GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, F.R.S., F.G.S., DIRECTOR.

REPORT OF PROGRESS

FOR

1878-79.

PUBLISHED BY AUTHORITY OF PARLIAMENT.

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1880

G. M. D., Photo. July 26, 1878.

HOUSES, CARVED POSTS, AND CANOES, SKIDEGATE VILLAGE.

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1878-9.

To the Right Honorable

Sir John A. Macdonald, P.C., K.C.B.,

Minister of the Interior.

Sir,—I have the honour to transmit herewith the annual reports and maps relating to the operations of the Geological Corps.

You will observe that it has been considered advisable to postpone the publication of the detailed reports of some of the explorations made during the season of 1879, in order that the observations in the respective areas, may be extended and made more complete, the results fully studied and condensed, and unnecessary repetition of details avoided.

I have the honor to be,

Sir,

Your obedient servant,

ALFRED R. C. SELWYN.

Montral, May, 1880.

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I.

SUMMARY REPORT

OF THE

OPERATIONS OF THE GEOLOGICAL CORPS,

TO 31ST DECEMBER, 1879.

BY

ALFRED R. C. SELWYN, F.R.S., F.G.S.,

DIRECTOR OF THE GEOLOGICAL AND NATURAL HISTORY SURVEYS OF CANADA.

The field operations of the Geological Survey during the past year have, as usual, extended east and west from ocean to ocean, and also from Manitoba to the western shores of Hudson's Bay. The results, though valuable and interesting, are not in many respects as satisfactory or complete as they might be were the efforts of the very limited available staff of explorers more concentrated.

In the early part of the season much of my own time, and later a portion of Mr. Whiteaves' time, was occupied in connection with the publication of the Reports for 1877-78, forming a volume of 500 pages, with numerous illustrations, views, maps, sections and woodcuts. This was issued in October, and has since been distributed. The total cost of the paper, printing and lithographic work for the English edition, 3,500 copies, has been $5,240.27, and for the French edition, 400 copies, $2,278.05.

Districts examined.

The districts in which geological explorations and surveys have been made during the past summer are as follows:—

1. British Columbia.
2. The North-West Territories.
3. Quebec.
4. New Brunswick.
5. Nova Scotia.

Explorations of Dr. G. M. Dawson in British Columbia.

In British Columbia and in the Rocky Mountain region to the eastward, Dr. G. M. Dawson worked in conjunction with an exploratory party of the Canadian Pacific Railway Survey, for the purpose of ascertaining the main geological features of the country traversed and its prospective value for agricultural or pastoral occupation. This exploration occupied seven months, and involved a journey by rail and steamboat of 6,160 miles, and by pack-train, canoe and waggon of about 2,380 miles. The region to which attention was more especially directed lay between the mouth of the Skeena River on the Pacific Coast and Edmonton on the Saskatchewan River, including also Pine River Pass and its approaches and the fertile country north and south of Peace River.

Extent of country to be traversed.

The vast extent of country to be traversed left but little time for the examination of geological details, and caused the exploration to assume, to a great extent, the character of a rapid reconnaisance of the physical and economic features of the country. A general geological section has, however, been obtained from the Skeena River to the Peace River country east of the Rocky Mountains, also much new geographical and general information respecting the climate and natural resources of the region, including meteorological observations and illustrative photographs.

Preliminary Report.

The work of 1879 having been carried on in connection with the Canadian Pacific Railway Survey, a preliminary report of its results has been prepared at the request of Mr. Sandford Fleming, Engineer-in-Chief, and is published as Appendix No. 7 of the Railway Report. This deals chiefly with the climate and agricultural value of the region traversed, but includes also general notes on its geological features and minerals of economic importance. A detailed report, in which the geological structure of the country is treated of at greater length, and which will be accompanied by a map, is now in course of preparation.

Explorations of Dr. Bell, Nelson River basin

Dr. R. Bell, assisted by Mr. Cochrane, was occupied in completing and extending the work of the previous season in the region to the north and north-west of Lake Winnipeg. Track surveys and geological examinations were made extending over a total distance of 1,700 miles, including the following rivers and lakes:—

Nelson River Basin and Lake Winnipeg.

1. The east side of Lake Winnipeg, from Dog's Head to the mouth of Red River.
2. The Nelson River, from Goose-hunting River to the point reached from the sea in 1878, including Split Lake and Gull Lake.
3. Grass River and lakes upon its course, from the mouth to the head of the east branch.
4. The western channels of Sipi-wesk Lake and the channels leading to and from Duck Lake.

5. Channels of Nelson River intersecting the eastern part of Ross Island, over fifty miles long.
6. All the channels between Great and Little Playgreen Lakes.
7. Jackfish River, from Rossville Mission to above the first rapids.
8. Canoe route from Knee Lake to God's Lake, including God's Lake.
9. Canoe route between Oxford House and Island Lake, including Island Lake.
10. Canoe route from Split Lake to Little Churchill River.

Churchill River and Hudson's Bay.

11. The Little Churchill River, for about one hundred miles, to its junction with the Great Churchill River.
12. The Great Churchill River, from the above-named junction to the sea.
13. The coast of Hudson's Bay, for a few miles on either side of Fort Churchill.

Besides the track surveys above mentioned, considerable stretches of the previous season's work were re-surveyed to check distances and obtain greater accuracy of detail.

Observations were frequently taken for latitude and magnetic variation, and at a few points for longitude. The daily barometer and thermometer readings were registered, and the temperature of rivers and lakes taken. About fifty photographs were secured to illustrate the most interesting features of the regions explored, and a number of specimens collected.

The general aspect of the whole region is level, and the prevailing soil a light colored clay.

Soil and climate of the region.

As far north as Sipi-wesk Lake, on the Nelson River, and Knee Lake, on the boat route from Lake Winnipeg to Hudson's Bay, both soil and climate appear sufficiently good to maintain a population entirely dependent on agriculture.

Explorations and Surveys in the Province of Quebec.

The examinations and surveys in the Province of Quebec during the past season have extended over a very large area on both sides of the St. Lawrence. Besides attending to the general work of the survey and museum, a considerable part of my own time during the summer was devoted to the investigation commenced in 1877, and reported on last year, in connection with the determination of the geological structure and age of the several formations constituting the Quebec group, the observations made with this object in view having during the season extended over about 2,500 square miles from Quebec and the Valley of the Chaudiere River to the Vermont boundary. There a meeting was arranged with Professor Hitchcock, the State Geologist of New Hampshire, in order to investigate together and discuss on the ground the points upon which diverse opinions have hitherto prevailed, but which it is hoped will now be, so far as Canada and the immediate adjoining territories are concerned, brought into agreement.

In the counties of Argenteuil, Terrebonne, Montcalm, Joliette and Berthier about 1,700 square miles have been examined in detail by Messrs. Vennor and Ord, particular attention having been paid to ascertaining the distribution of the Laurentian crystalline limestone bands and serpentines, with which most of the economic minerals of the region, iron ore, plumbago, phosphate, mica and asbestos are associated.

On the south side of the St. Lawrence Mr. A. Webster has examined an area of about 1,700 square miles, lying, for the most part, within the great gold-bearing belt on the head waters of the Chaudiere, the St. Francis and the Salmon Rivers, including the country around Lakes Aylmer, St. Francis and Megantic.

Mr. Richardson's attention has been devoted to making certain measurements and examinations between River du Loup, the Temiscouata road and the Trois Pistoles River, which were required to fix the out-crops and define the limits of the various formations. This work should now be extended north-eastward to Gaspe, including a detailed exploration of the Schickschock Mountains.

Work in New Brunswick by Messrs. Bailey Matthew and Ells.

The progress of the work in New Brunswick has been satisfactory, examinations and surveys having been made in central and southern New Brunswick, in Carleton and York counties, by Messrs. Bailey, Matthew and Broad of about 1,500 square miles, including 600 miles of measurement by odometer and pacing; and in northern New Brunswick, by Mr. Ells, in the counties of Northumberland, Restigouche and Gloucester, including the coast of the Baie des Chaleurs from Bathurst to Campbeltown. Some interesting photographic illustrations of the country have been secured, and about 1,000 miles of track surveys have been made.

Explorations by Mr. Fletcher in Cape Breton Island.

In Cape Breton an area of about 500 square miles, lying between River Inhabitants Basin on the south and Whykokamagh on the north, has been closely surveyed by Mr. Fletcher, all roads, brooks and tracks having been measured by odometer, with the view of constructing an accurate and detailed map of this important mineral district, in which deposits of coal, petroleum, gypsum, marble and other valuable minerals have been found, and give promise of becoming economically available.

Some of the detailed reports of these explorations are now submitted. The field-notes and the measurements of the others have been worked up and plotted, but it is deemed advisable to defer their publication for further and more extended observations in the respective areas. The general report on the geology of southern New Brunswick, by Messrs. Bailey, Matthew and Ells, contains a brief summary of the earlier reports on this region, and it expresses the present views of the authors respecting the distribution, structure and relation of the several groups of strata, the subject being further illustrated by the geologically colored maps and sections, with descriptive notes, which accompany the report.

In this report and in the accompanying maps, the term Silurian is restricted to those formations which have hitherto been designated Upper and Middle Silurian, embracing the Lower Helderberg, Onondaga, Guelph, Niagara, Clinton, Medina and Oneida groups. Use of the terms Silurian, Cambro-Silurian and Cambrian.

The term Cambro-silurian is used for the formations constituting the Trenton group, viz., Bird's Eye, Black River and Trenton limestones, Utica slates, Loraine or Hudson River shales; while in the term Cambrian are included the Chazy, Calciferous, Quebec group, Potsdam, St. John and Menevian groups, down to the summit of the Huronian.

It having, in many cases, been found impossible to identify, trace out and define the limits of the above-named sub-divisions, it has become necessary to adopt the more comprehensive nomenclature, and at the same time to define its precise signification as now used, and as it is proposed henceforth to use it in the reports and maps of the Canadian Geological Survey.

In the palaeontological and natural history branch Mr. Whiteaves, assisted by Mr. Foord, has accomplished a large amount of valuable work, some of the details of which appear in the accompanying reports. This work also includes the examination of numerous and large collections from all parts of the Dominion, amounting probably to more than 7,000 specimens, and the determination and naming of a number of the species, also the commencement of the descriptions and figures of the fossils from the coal-bearing rocks of the Queen Charlotte Islands for the third part of the first volume of "Mesozoic Fossils," and the selecting, naming, labelling and cataloguing of twelve collections of characteristic Canadian fossils, which have been presented to various educational institutions in the Dominion. Palæontological branch.

In addition to making collections in the field during the summer, Messrs. Weston and Willimott have been occupied in arranging the specimens in the Museum, and in preparing others for exhibition and distribution. Mr. Weston has made and mounted for microscopic examination upwards of one hundred and fifty slices of rocks, and has also made colored drawings of a number of them under the camera in the microscope. Work of Messrs. Weston and Willimott.

Twenty-eight collections of Canadian rocks and minerals, containing Distribution of specimens.

together about 2,477 specimens, have been selected, labelled and catalogued, by Mr. Willimott, for distribution to educational institutions in all parts of the Dominion; and considerable progress has been made in a systematic numbering of the Museum collection, with a view to the preparation of a complete descriptive catalogue.

Catalogue of the Museum.

Chemical branch.

Since the date of my last report the chemical branch of the survey has, I regret to say, lost the able and faithful services of Dr. B. J. Harrington, he having, owing to increasing collegiate duties, felt compelled to resign his position on the survey. The work is, however, now most efficiently and zealously conducted by Mr. Christian Hoffmann, assisted since September by Mr. Frank Adams. It has included analysis of coals, kaolin, fire clay and several other minerals of economic importance or scientific interest, also determinations of iron, copper, manganese, lead, gold, silver, nickel and cobalt in ores, either collected by the survey or sent from various parts of the Dominion for examination and report. The details of some of this work will be found in Mr. Hoffmann's report.

Distribution of publications.

About 200 books, pamphlets and maps have been presented to the library during the year in return for the publications of the survey, of which about 1,139 copies have been distributed, besides 1,600 sent to Ottawa for distribution.

Visitors to the Museum.

One thousand six hundred and three names have been registered in the visitors' book from 1st January to 31st December, 1879.

In some of the maps published with the present report, geological notes, signs and lettering appear in red, and in future it is proposed, in order to facilitate the study and use of the maps, published by the Survey, to use black for the topography only, while red, green and blue lettering will be used for geological, botanical and zoological notes respectively.

MONTREAL, January 1st, 1880.

ADDITIONS TO THE LIBRARY,

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Royal Society of London:—

Proceedings............................ Volume XXVII, Numbers 185-189
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Museum of Practical Geology and Geological Survey, London:—

A Catalogue of the Library................. Compiled by WHITE and NEWTON

Journal of the Iron and Steel Institute, London:—

Proceedings.. Number 2, 1878
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Manchester Geological Society;—

Transactions.. Volume XV, Parts 1-9

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Proceedings.................................. Volume IX, Session 1877-8

Institution of Engineers and Ship Builders in Scotland:—

Transactions ....Twenty Second Series 1878-9

Glasgow University:—

Calendar for the year.. 1879-80

Royal Irish Academy, Dublin:—

Transactions.. Volume XV

Geological Survey of Hokkaido, Japan, By BENJAMIN SMITH LYMAN, Geologist and Mining Engineer:—

Report on the Second Year's Progress of the Survey of the Oil Lands of Japan. By BENJAMIN SMITH LYMAN.

Report of Progress..for 1878-79

Four Sheets of Maps.

Geological Survey of India:—

Palæontologia Indica.......................... Volume I Series IV, Part 3
" " .... Series II-3
" " .... " IV-2
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Records .... " X, " 3-4
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A Manual of the Geology of India.—Part 1-2. By H. B. MEDLICOTT, M.A., and W. T. BLANFORD, A.R.S.M., F.R.S. :—
Contents and Index of the first ten volumes of the Records of the Geological Survey of India, 1868 to 1877.

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Report of Progress, By the Secretary for Mines, with Reports on the Geology, Mineralogy and Physical Structure of various parts of the Colony. Number V.

Mining Surveyors and Registrars, Victoria, Australia :—
Reports 1878
Report of the Chief Inspector of Mines..1878
Mineral Statistics of Victoria..1878

JOHN RAE, A.M., Commissioner of Railways :—
Railways ef New South Wales : Report on their construction and working for 1876.

New Zealand Institute :—JAMES HECTOR, M.D., F.R.S. :—
Transactions and Proceedings..Volume X–XI
Reports of Geological Explorations during 1877-8, with Maps and Sections.
" " " " 1878-9, " " "
Meteorological Report, 1877, including Returns for 1875-6, and Averages for previous years.
Thirteenth Annual Report on the Colonial Museum and Laboratory, 1878-78.
Fourteenth " " " " " 1879-79.

United States Geological Survey of the Territories :—Dr. F. V. HAYDEN, U.S. Geologist :—
Tenth Annual Report of the United States Geological and Geographical Survey of the Territories embracing Colorado and parts of adjacent Territories, 1876. By F. V. HAYDEN.
Birds of the Colorado Valley a Repository of Scientific and popular information concerning North American Ornithology. By ELLIOT COWES :—
Illustrations of Cretaceous and Tertiary Plants of the Western Territories of the United States.
Bulletin..Volume IV, Number 4
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United States Geographical and Geological Survey of the Rocky Mountain Region. J. N. POWELL, in charge :—
Report on the Geography of the Henry Mountains. By G. K. GILBERT.

United States Geological Exploration of the Fortieth Parallel. CLARENCE KING, Geologist in charge :—
Systematic Geology..............................Volume I, By CLARENCE KING.

Mining Industry.......................... Volume III, By JAMES D. HAGUE
With Geological Contributions. By CLARENCE KING.

United States Geographical Surveys west of the One Hundredth Meridian. First Lieut. GEO. M. WHEELER, in charge :—

Vol. II.—Astronomy and Barometric Hypsometry.

Vol. IV.—Palæontology. By CHARLES A. WHITE, M.D.

Vol. VI.—Botany. By I. T. ROTHROCK.

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Geological Survey of Pennsylvania :—Prof. J. P. LESLEY, State Geologist :—

Report of Progress. The Brown Hematite Deposits of the Siluro-Cambrian Limestones of Lehigh County, 1875-6. By FREDERICK PRIME, JR.

Report of Progress. In the Juniata District on the Fossil Iron Ore Beds of Middle Pennsylvania, 1874-5. By JOHN H. DEWEES.

Report of Progress. In Indiana County, 1877. By W. G. PLATT.

Report of Progress. The Northern Townships of Butler County, 1875. By H. MARTYN CHANCE.

Report of Progress. In Bradford and Tiôga Counties, 1874-8. By SHERWOOD, PLATT and FULTON.

Report of Progress. Atlas to the Coal Flora of Pennsylvania and of the Carboniferous Formation throughout the United States. B. LEO. LESQUEREUX.

Second Report of Progress in the Laboratory at Harrisburg. By ANDREW S. McCREATH.

Catalogue of the Geological Museum. By CHARLES E. HALL.

New York State Museum of Natural History, JAMES HALL, LL.D., Director :—

Twenty-Seventh Annual Report of the University, 1875.				
Twenty-Ninth	"	"	"	1876.
Thirtieth	"	"	"	1877.

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Fifty-Eighth Annual Report of the Trustees, 1875.				
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The Smithsonian Institution, Washington :—

Documents relative to its origin and History. By WILLIAM J. RHEES.

United States Coast Survey, Washington :—

Report of Progress of the Survey.......................... 2 Vols., 1874-75

Geological Survey of New Jersey.—GEORGE H. COOKE, State Geologist :—

Annual Report for the year.. 1878

Museum of Geology and Archæology of the College of New Jersey :—

Topographic, Hypsometric and Meteorologic Report of the Princeton Scientific Expedition, number 2, By LIBBEY F. and W. W. McDONALD.

Boston Society of Natural History :—

Proceedings.. Volume XX, Part 1–2

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Proceedings, New Series, Vol. VI. Whole Series, Vol. XIV. From May, 1878 to May, 1879.

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Report of Progress for 1877 and 1878.

Harvard College, Cambridge, Mass., U. S. :—
The Auriferous Gravels of the Sierra of California. By J. D. Whitney.
Annual Report of the Curator of Harvard College for 1878-79.
Bulletin..Volume V, Numbers 8-10

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Bulletin..Volume X, 1878
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American Philosophical Society, Philadelphia :—
Proceedings..Volume XVII, Numbers 102-4

Engineers Club of Philadelphia :—E. Bellin, Editor :—
Proceedings..Volume I, Numbers 1-4

American Institute of Mining Engineers, Easton, Pa. :—
Transactions.. 4 Volumes, 4-7

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Report embracing the results of Investigations made during portions of the years 1855-56 and 57..Volume 1 2, Part 1 and
Geology and Palæontology..By Hall and Whitney

Prof. N. H. Winchell, M.A., State Geologist of Minnesota :—
Bulletin of the Minnesota Academy of Natural Sciences for 1877.
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Atlas accompanying Reports on Upper Peninsula, 1869-1873. Twenty-five Sheets. By Julius Bien.

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History and Methods of Palæontological Discovery.

Nova Scotian Institute of Natural Sciences :—
Proceedings and Transactions..Volume IV, Part III
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Department of Mines, Nova Scotia :—
Report for the year.. 1879

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Annual Report of the Minister of Public Works for the Fiscal Year 1st July, 1877, to 30th June, 1878.

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Census of Canada..Volume V

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ANDFORD FLEMING, Engineer-in-Chief of the Canada Pacific Railway :—
Report in reference to the Canada Pacific Railway 1879

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Bulletin .... Tome 1, Numbers 1–7
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Brachiopodes .... Volume V

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Illustrated by reference to other Provinces of Australia. By the Rev. W. B. CLARKE, M.A., F.R.S., F.G.S., F.R.G.S.

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Report of the Commission for 1875–6. Part IV. Propogation of Food Fishes. Presented by J. F. WHITEAVES, F.G.S.

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Udsigt Over det Sydlige Norges Geologi. 1 vol., 4°, 262 pp.
Om Stratifikationens Spor, and 3 sheets maps.

Société Malacologique de Belgique, Bruxelles :—
Procès-Verbaux des Séances. 34 Nos., 1877–8.

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Israel C. Russell :—
The Physical History of the Triassic Formation of New Jersey and the Conne ticut Valley.

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The Prairie Lands of Canada.

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Notes on some North American Pyrrhotites and other Minerals containin Nickel.
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Remarks upon The Laramie Group.

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Second Annual Announcement, 1879–80.

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Fourteenth Annual Catalogue of the Officers and Students, with a Statement o the Courses of Instruction, 1878–1879.

George J. Brush and Edward S. Dana :—
On the Mineral Locality in Fairfield County, Connecticut, with a descriptio of two additional new species.

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Mining on the North Shore Lake Superior.

S. A. Miller :
Remarks upon the Kaskaskia Group, and Descriptions of new species of Fossils from Pulaski County, Kentucky.

A. Miller and C. B. Dyer :—
Contributions to Palæontology No. 2.

Univerisite Laval, Quebec :—
Report 1879–80

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Annales de Chimie et de Physique, Paris.
Annales des Mines ou Recueil des Mémoires sur l'Exploitation des Mines, Paris.
American Journal of Science and Arts, New Haven, Conn.
Chemical News, London.
American Manufacturer and Iron World.
Comptes Rendus, Paris.
Canadian Naturalist, Montreal.
Canadian Patent Office Magazine, Montreal.
Engineering and Mining Journal, New York.
English Mechanic, London.
Jahresbericht; ALEXANDER NAUMANN
Geological Magazine, London.
Elsner's Chemische-Technische Mittheilungen.
Journal of Chemical Society, London.
Iron: The Journal of Science, Metals, Manufactures, London.
Les Mondes, Revue Hebdomadaire des Sciences, Paris.
Mining Journal, London.
Nature, London.
Popular Science Review, London.
Philosophical Magazine, London.
Proceedings of the Academy of Natural Science, Philadelphia.
Quarterly Journal of Science, London.
Quarterly Journal of the Geological Society, London.
Revue Universelle, Paris.
The Iron Age, New York.
The Zoologist, London.
Van Nostrand's Eclectic Engineering Magazine, New York.

GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, F.R.S., F.G.S., DIRECTOR.

REPORT

ON THE

QUEEN CHARLOTTE ISLANDS

1878

BY

GEORGE M. DAWSON, D.S., A.R.S.M., F.G.S.

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To Alfred R. C. Selwyn, Esq., F.R.S., F.G.S.,

Director of the Geological Survey of Canada.

Sir,—I beg to present herewith a report on the exploration of 1878 in the Queen Charlotte Islands, bearing principally on the geology and geography of the islands, but including as appendices reports on the Haida Indians and on the zoological and botanical collections made, with a table of meteorological observations and notes on the latitudes and longitudes of places. In Appendix C, Mr. J. F. Whiteaves has embodied the result of an examination of some of the marine invertebrates. The Survey is indebted to Mr. S. I. Smith of Yale College, and to Prof. J. Macoun of Belleville, for their gratuitous services in preparing reports on the crustacea and plants respectively.

I have the honour to be,

Sir,

Your obedient servant,

GEORGE M. DAWSON.

Montreal, May 1, 1880.

REPORT

ON THE

QUEEN CHARLOTTE ISLANDS,

BY

GEORGE M. DAWSON, D.S., A.R.S.M., F.G.S.

The present report treats almost exclusively of the Queen Charlotte Islands, to which the greater part of the time employed in exploration during the summer of 1878 was devoted. Some difficulty was experienced in obtaining a suitable craft for the passage from Victoria to the Islands—a distance of between 400 and 500 miles—and for the succeeding exploratory work. It was not till the 27th of May that I, and my assistant, Mr. Rankine Dawson, were able to leave Victoria in the little schooner *Wanderer*. Our schooner was of about twenty tons burden, and the crew consisted of three men, besides ourselves. She was provisioned and fitted out for the entire summer on leaving, as it was improbable that we should be able to renew our supplies except by leaving the region to be examined, and at the expense of considerable time. Our force was occasionally supplemented during the summer by one or two natives with local knowledge. Calms, head winds and currents met with in the channels between Vancouver Island and the mainland rendered our progress to the north-westward very slow. We, however, reached Houston Stewart Channel, in the southern part of the Queen Charlotte Islands, on the 12th of June, and from that date to the end of August was occupied in the exploration of the islands. On the return voyage a preliminary examination was made of the coal measures of Quatsino Sound, and those lying between Beaver Harbor and the Nimpkish River, on Vancouver Island. This part of the season's operations is not here reported on. A visit was also made to the Baynes Sound coal-bearing region, at the request of some gentlemen interested in it, and Victoria was reached on the evening of the 17th of October. Some observations made on the superficial

Equipment and voyage to the Islands.

Explorations on Vancouver Island.

deposits of the mainland and in the vicinity of Vancouver Island are included in this report with those bearing on the Queen Charlotte Islands, for the purpose of rendering these more complete.

Bad weather. The weather during a great part of our stay in the Queen Charlotte Islands was very unfavourable, being stormy and calm by turns, and exceedingly wet. This involved much discomfort and some delay, and combined with the unexpectedly intricate character of the south-eastern part of the islands, which occupied much time, rendered it impossible to extend the systematic exploration to the west coast.

Results of the season's work. The exploration, though particularly devoted to the geological features of the country, necessarily involved the maintenance of a careful running survey, checked by observations for latitude taken as frequently as the weather and other circumstances admitted. Meteorological observations were carried on with as much regularity as possible during the entire season. A number of plants were collected and preserved. These have since been forwarded to Prof. Macoun, who has kindly furnished a list of them. Some time was also devoted to dredging, and a large quantity of material obtained in this way or collected along the shores has been handed to Mr. Whiteaves for examination. Sixty-three photographs were taken on prepared dry plates, most of which have proved satisfactory on development. They illustrate points of geological and picturesque interest, and also the peculiar carvings and architectural devices of the Haidas. These had not before been photographed, and owing to the rapid progress of decay it will be impossible to obtain satisfactory illustrations of them in a few years time.

Position, Discovery and Early History of the Islands.

Position of the Islands. The Queen Charlotte Islands, so named by Dixon in 1787, form a compact archipelago, separated by wide water-ways from the islands which fringe the shore of the mainland of British Columbia to the west and the coast of the southern extremity of Alaska to the north. Dixon Entrance or Sound, to the north, has an average breadth of thirty-three miles. Like most places on this coast, it has been several times re-named. The name Perez Inlet was given to it by Bodega in 1775, and it has also appeared on maps as Douglas Entrance, Granitza Sound and Kygahne Strait. The water between the Queen Charlotte Islands and those fringing the mainland to the west has been named on some charts, rather inappropriately and in quite modern times, Hecate Strait. It has a rudely triangular form, with a width at the south, between Cape St. James, and Day Point, Milbank Sound, of eighty-eight miles; at the north, between Rose Point and Stephen's Island, twenty-seven miles, this being the shortest traverse from any part of the Queen Charlotte Islands to those adjacent to the mainland.

General character of the Islands.

The islands may be regarded as a partly submerged mountain range, being a continuation north-westward of that of Vancouver Island and the high region of the Olympian Mountains of the north-western angle of Washington Territory. There is, however, a wide attachment of low level land, forming the whole north-eastern part of Graham Island. A line drawn from the southern extremity of the islands to their north-western point has a bearing of N. 25° W.,* and this may be taken as representing the direction of the mountain axis. The islands are included in north latitude between 54° 15′ and 51° 55′, in west longitude between 131° 2′ and 133° 5′. The extreme length, from point to point, is one hundred and fifty-six miles;† the greatest width, in a direction at right angles to the length, fifty-two miles. It is impossible to form even an approximately correct estimate of the area of the islands, owing to the uncertainty which still obtains as to the true position in longitude of the west coast. The islands forming the main chain, and representing the mountain axis are, from south to north, Prevost, Moresby, Graham and North Islands. The first was named after Captain (now Admiral) Prevost. North Island, so called by Dixon in 1787, was named Isle de Langara by Caamano. Prevost Island has a length of eleven and a half miles; though I believe that the extremity of the land forming Cape St. James is separated from Prevost Island proper by a narrow channel. Moresby Island is seventy-two miles long, but the explorations now reported on have resulted, by the tracing out of the channels on its east coast, in leaving it a mere skeleton. Graham Island has a length of sixty-seven miles, with the width above assigned as the maximum of the group. North Island is about five miles in extreme length. The separation of the larger islands may be said to be accidental, as it does not depend on any fundamental structural feature, but on the casual inosculation of inlets or fiords which characterize both the eastern and western coasts.

Coast line.

From the southern extremity of the islands to Cumshewa Inlet, in latitude 53°, the east coast is dissected with inlets, which generally have bold rocky shores, and either end blindly among the mountains or inosculate laterally with others, cutting out large islands. The inlets in their main directions conform to two principal bearings, being either nearly parallel with or transverse to the direction of the main mountain axis. They are generally deep, and northward to the latitude of Laskeek the sea to the eastward is so also. Beyond

* This and other bearings throughout the report are given with reference to the true meridian.

† Distances in this and the succeeding descriptive portion of the report are stated in nautical miles.

this place banks begin to appear, and the northern part of Hecate Strait is comparatively quite shoal. Channels similar to those penetrating the mountain axis further south are represented in Graham Island by the expansions of Masset Inlet and its associated lakes, and by Naden Harbor. In the case of Masset Inlet, however, a wide border of low land cuts the inlets off from direct communication with the sea to the east. This has been brought about in the manner explained in a subsequent division of this report which treats of the superficial geology. The highest and most rugged part of the mountain axis of the islands is found in latitude 52° 30′, where many peaks bear considerable patches of perennial snow, and rise to altitudes probably surpassing 5,000 feet. Southward, high mountains are again found opposite Burnaby Island, but toward Cape St. James the land gradually falls. About Houston Stewart Channel none of the summits probably surpass 2000 feet. Northward, about the heads of Cumshewa and Skidegate Inlets, and on Louise Island, the land is very rugged, with many summits exceeding 3000 and 4000 feet. Beyond Skidegate, however, in connection with the appearance of the Tertiary formation, the surface becomes much less mountainous, and though the axis of the islands is still well marked, the mountains about the head of Masset Inlet appear seldom much to surpass 1000 feet in height, and near North Island low hills only occur. Graham Island may, in fact, be divided into two differently characterized regions by a line drawn from Image Point, Skidegate Inlet, to Jal-un River, on the north coast. To the south-westward of this line is a country hilly and even mountainous, but so far as observed almost always densely forest-clad, with trees which attain large dimensions where not too much exposed. North-eastward lies a low, flat or gently undulating country, which seldom exceeds 300 feet in elevation. This country is also densely wooded, the trees often attaining magnificent dimensions.

Mountains and lowlands.

The west coast of the islands was examined in a few places only; a concise description of it is, however, given by Vancouver, who coasted along it in September, 1793, from North Island southward. As little can yet be added to this, it may be quoted entire.*

Vancouver's description of the west coast.

"From this point, which I have called Point North, we found the general trending of these shores first take a direction S. 14 W.,† twenty-two miles to a projecting land, appearing like two islands, the west extremity of which I named Point Frederick [Frederick Island], and then S. 17 E., twenty-six miles to a high, steep, cliffy hill, named by Mr. Dixon Hippa Island; this ended in a low projecting point to

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* A Voyage of Discovery to the N. Pacific Ocean, &c. London, 1801. Vol. IV., p. 283 *et seq.*

† Printed N. 14 W., by an accidental error.

the north-eastward, off which lie some breakers, though at no great distance. The coast to the N.N.E. and S.E. of Hippa Island appeared to be much broken, particularly to the south-eastward, where a very extensive sound takes an easterly direction, named by Mr. Dixon Rennell's Sound; its entrance, by our observations, is in latitude 53° 28′, longitude 127° 21′. Having reached this extent about dark, we hauled our wind, and plied under an easy sail to preserve our station until the next morning. At the dawn of the following day, Wednesday, the 25th, we continued along the coast, composed of steep, mountainous precipices, divided from each other by the water; these seemed to have gradually increased in height from Point North, from whence along the shores to this extent were some scattered islets and rocks at a small distance from the land. Our progress was slow, the wind being light, accompanied with pleasant weather. At noon, in the observed latitude of 53° 2′, longitude 227° 22′, Hippa Island by compass bore N. 42 W., and a conspicuous projecting point near the southern-most land in sight, which I named Cape Henry, S. 82 E.; these forming the outline of the coast, lie from each other S. 32 E. and N. 32 W., 15½ leagues apart. This cape, situated in latitude 52° 53′, longitude 227° 45½′, forms the south point of a deep bay or sound, its shores apparently much broken; to this I gave the name of Englefield Bay, in honor of my much esteemed friend, Sir Henry Englefield. [Since partly surveyed]. Its north point of entrance, lying from Cape Henry N. 27 W., at the distance of seven leagues, I named Point Buck, which also forms the south point of entrance into a sound falling deep back to the eastward, named by me Cartwright's Sound. Its north point of entrance, which, likewise after my very particular friend and physician, I named Point Hunter, lies from Point Buck N. 25 W., distant ten miles, and a little within this line of direction is an island near the northern shore.

Vancouver's description of the west coast.

"From Cape Henry, which we passed in the afternoon, at a distance of four or five miles, the shores, so far as we had reached by sunset, seemed to be compact, and to take a more easterly direction. The southern-most land in sight bore by compass S. 72 E., the nearest shore N.N.E. five miles, and the northern-most land in sight N. 33 W. During the night the wind was light and variable, by which means our distance from the coast was increased greatly beyond what I had intended. At daylight on Thursday, the 26th, the land near the south extremity of Queen Charlotte's Islands, which is named by Mr. Dixon Cape St. James, was seen bearing by compass S. 87 E., the northern-most land in sight N. 68 W., and the nearest shore N. 11 W., four or five leagues distant.

"With a favorable though light breeze, our course was directed along the shore, but at too great a distance to admit of our making any particular or exact delineation of it; nor is the sketch we were enabled to obtain of these islands to be considered as correct, or to be depended upon, because their numerous divisions would have demanded a survey that would have occupied infinitely more time than we had now to bestow. Our examination was wholly confined to the general direction of the shores, and to ascertain the position of their conspicuous projecting points. Towards Cape St. James the land was very moderately elevated, but, like that on the northern part of the islands, it rose gradually to rugged and uneven mountains, which occupied the centre of the country, descending towards its extremities to a less height, and is of a more uniform appearance."

On the discovery and earlier voyages to these islands and adjacent regions, a few notes may be given, forming an interesting page in the history of our knowledge of the West Coast of America.

Voyage of Juan De Fuca.

In 1592 the Viceroy of Mexico fitted out a caravel and pinnace to discover the 'Straits of Anian.' The origin of the name Anian appears to be obscure, but it was used to designate a supposed northern passage between the Atlantic and Pacific Oceans. The conduct of the expedition was entrusted to a Greek pilot, Apostolos Valerianos, commonly called Juan de Fuca. The story of this navigator, which need not here be quoted, has been doubted, and no record of his voyage can be found among the Spanish archives of the period, which have now come to light; but the accordance of his statement of the occurrence of an important opening in the coast of the continent in a latitude approximately given, with the fact of the existence of the strait afterwards in 1788 called by his name by Meares, establishes a strong presumption in favor of his veracity. De Fuca may therefore be supposed to have been the first to discover any part of the territory now forming the Province of British Columbia.

Narrative of De Fonte's voyage.

It is related that in 1639 the Court of Spain, having intelligence of some expeditions attempted in that year by the people of Boston, New England, Bartholemew De Fonte was appointed to command a squadron fitted out at Callao, in Peru, to oppose them.* His vessels were named the *Holy Ghost*, *Saint Lucia*, *Rosary* and *King Philip*. The details of his voyage are circumstantially given, but it is unnecessary to quote them. Leaving Callao in 1640, he sailed northward along the Pacific Coast, and entered what he called the Archipelago of St. Lazarus on the 14th of June. This is said to be situated in 53° N. latitude, and through it he sailed 260 leagues in intricate channels among islands, making some very extraordinary geographical dis-

* Observations on the Passage between the Atlantic and Pacific Oceans, &c. W. Goldson, Portsmouth, 1793.

coveries. It is customary to suppose that the account of this voyage is a mere fiction, and it may be so, but it is worth pointing out that it shows some signs of being at least founded on fact, though the distances and other circumstances are evidently grossly exaggerated, whether by De Fonte himself or some compiler of the account of the voyage. The latitude given—for which somewhat wide limits of error must be allowed—runs nearly through the centre of the Queen Charlotte Islands. Such a navigation as De Fonte describes, among islands, may have been made anywhere on this part of the West Coast. His statement does not seem to imply that the 260 leagues was made in any one direction, if any value be set on these figures. Subsequent writers interested in making out a case for the North-west Passage, have fitted in De Fonte's descriptions with the view of making them reach as far as possible across the continent.* The very statement of the existence of an extensive archipelago in this latitude should go some way in proving the partial authenticity of the narrative, as the character of that part of the West Coast then known was quite opposed to such an idea. In a 'river' up which he sailed he says there was a fall of water till half flood, but that an hour and a quarter before high water the flood begins to set strongly into a 'lake.' Such places are not uncommon among the intricate fiords of this coast. One between the two expansions of Masset Inlet would almost precisely answer the description. One of his officers, Bernardo, is said to have examined a certain river with three Indian boats, each made of a tree 50 or 60 feet long, accompanied by two Jesuits, 20 of his own people, and 36 natives. In size, number of persons which they are fitted to contain, and mode of construction from a single tree, these exactly correspond to the fine canoes which the Indians of this part of the coast actually make. Lastly, as Goldson points out, the names Conibasset, Conasset, Arenna Mynhasset closely resemble some found on the coast. This resemblance is more, however, with the names ending in *at* or *aht* of the Indians of the west coast of Vancouver Island and Cape Flattery or Classet.

Its supposed mendacity.

Reasons for attaching some importance to the narrative.

In response to a request by Mr. J. F. Whiteaves, when engaged in working out the collections of fossils obtained by Mr. J. Richardson in the Queen Charlotte Islands in 1872, Mr. W. H. Dall, well known by his researches on the West Coast, furnished a memorandum on the earlier voyagers to the Queen Charlotte Islands.† This I have made the basis of the following chronological record of discoveries up to the time of Vancouver, amplifying it considerably, and making a few corrections.

Information supplied by W. H. Dall.

* This may be seen in a Map by Mr. De l'Isle, 1752, and in the Map accompanying Goldson's volume.

† Published in Vol. I, Part 1, Mesozoic Fossils, 1876.

Voyage of Perez.

On the 25th of January, 1774, Ensign Juan Perez, previously employed in the Manilla trade, sailed in the corvette *Santiago*, from San Blas, touching at Monterey, California, from which he sailed June 6th, on an exploring expedition to the north, accompanied by Pilot Estevan Martinez, and Rev. Fathers Pena and Crespi, chaplains. The first land seen, July 18, 1774, was that of the Queen Charlotte Islands, in latitude 54°, to the north point of which Perez gave the name of Co. de S. Margarita [North Cape of Vancouver], and to the high mountains, Sierra de San Cristoval. Finding no anchorage, they turned southward without landing, and on the 9th of August anchored in a port stated to be in latitude 49½°, and probably Nootka Sound. This he called Port San Lorenzo. The authorities for this voyage are the narratives of Perez, observations of Martinez, and the journal of Friar Pena, MSS. copies of which were obtained from the Imperial Archives of Madrid, by the United States Government, in 1840. An account was also published in 1802, in the introduction to the voyages of the *Sutil* and *Mexicana*. This was the first voyage *actually known* to have been made northwards by the Spaniards after 1603.

Bodega and Maurelle.

Immediately after the return of Perez, Viceroy Bucarelli ordered another expedition to examine the coast as far as latitude 65°. Captain Bruno Heceta, in charge of the *Santiago*, with Perez as ensign, and the schooner *Sonora* in charge of Juan de Ayola, with Maurelle as pilot, in company with the schooner *San Carlos*, sailed from San Blas, March 15, 1775. The captain of the *San Carlos* became insane before they were out of sight of land, and Ayola was detached to take his place, and stopped at Monterey, while Lieutenant Francisco de la Bodega y Quadra took his place in charge of the *Sonora*. Most accounts are erroneous in stating that Ayola accompanied the expedition northwards. The schooner was attacked by the natives near Destruction Island, north of Cape Mendocino; and being very unwilling to proceed, Heceta, in the *Santiago* (with Perez), seized the opportunity to return to Monterey. Bodega and Maurelle, in the schooner *Sonora*, however, kept on their way. They saw Mount Edgecumbe about the middle of August, and afterwards landed in Port Remedios (the Bay of Islands of Cook), and, sailing down the coast, named the strait north of Queen Charlotte Islands, Perez Inlet [now Dixon's Sound], and coasted along the shores of the said islands at a considerable distance, without examining the capes and bays. They then returned to Monterey, doing a little surveying on the Oregon and Californian coasts by the way.

Cook.

These expeditions of the Spaniards in the North Pacific were singularly barren of geographical results. What information was obtained was, moreover, carefully concealed. When Cook, therefore, began the exploration of this part of the coast of America, he was absolutely without authentic reports of its nature. His instructions, based on the fact that Hearne had found the extent of the American continent to be very great northward, were to begin a search for a passage to Hudson's Bay north of the 65th degree. He did not visit the Queen Charlotte Islands. He left King George's Sound (Nootka) for the north in April, 1778, but owing to stormy weather did not sight the land again till he reached latitude 55° 20′.

In 1786, La Perouse coasted along the shore of the Queen Charlotte Islands, and was the first to suggest their separation from the mainland. (Arteaga and Bodega, in 1779, did not visit them.) He named (on his chart), in the north part, Baie de Clonard; a bay in the south part, Baie de la Touche; the south cape, Cape Hector, and some small islands off it, Isles Kerouart. He sailed to the eastward sufficiently to satisfy himself that a deep inlet extended between the islands and the mainland. His Isles Fleurieu are on the main coast, south and east of the Queen Charlotte Islands, and are the Princess Royal Islands of Duncan. He gave no name to the Queen Charlotte Islands. La Perouse.

In 1786, Captains Lowrie and Guise, in the *Captain Cook* and *Experiment*, fitted out in Bombay, visited, in the course of a trading voyage, the Queen Charlotte Islands. They have left no information on record in regard to it, but as they are said to have sailed in a direct course from Queen Charlotte Sound (which they named) to Prince William's Sound, it appears not unlikely that they passed inside the Queen Charlotte Islands. In the same year, Captain Hanna,* in the *Sea Otter*, from Macao, is stated to have traced the coast northward from Nootka to nearly the 53rd degree of latitude, and probably visited the Queen Charlotte Islands. In September, 1786, Captains Portlock and Dixon, in the *King George* and *Queen Charlotte*, made the land of the west coast of the islands, near Hippa Island, but finding "no harbor nor the least sign of any inhabitants," bore up and stood to the southward. Vessels visiting the Islands in 1786.

In 1787, Dixon, in the *Queen Charlotte* spent more than a month on the coast of the islands (July 1st to August 3rd). He gave the name to the islands which they still bear, naming also Dixon's Entrance, North Island, Cloak Bay, Hippa Island, Rennell's Sound, Cape St. James and Ibbitson's Sound. With the exception of the last, which is now called Houston Stewart Channel, all these names still hold. Dixon did not land anywhere, but the anonymous narrator of his voyage devotes 29 pages of his volume to the proceedings on the coast of the Account of the Islands by Dixon.

* Captain Hanna appears to have been the first to engage in the fur trade on the coast of what is now British Columbia. He sailed from China in a brig of about 60 tons, reaching King George's Sound (Nootka) in August, 1785, and sold his cargo in Canton the following year for $20,600. Captain Cook had indicated Nootka as the best place known to him for the trade.

Views published by Dixon.

Queen Charlotte Islands. Many interesting details concerning the inhabitants are given, and though the map accompanying his volume is rough, his numerous bearings have been of essential value in fixing the position on the chart of the yet unsurveyed west coast. He also gives a view of Hippa Island (p. 205), sketches of Cape St. James and the island now called Frederick Island (p. 214), an excellent plate of a Haida woman with labret (p. 226), and illustrations of a wooden dish, labret and spoon (pp. 188, 208). On the 2nd of July he attempted to enter Cloak Bay and Parry Passage, between North and Graham Islands, but was prevented from doing so by the strength of the tide. Captain Dixon subsequently sailed southward along the whole west coast, coming in with the land by day and standing off at night. On July 25th (St. James' Day) he rounded the south point, with the

Land proved to be insular.

intention of circumnavigating the islands, but owing to light variable winds, turned back, after having cruised northward on the east coast to a latitude given as 52° 59′, but which may probably have been about half-way between Cumshewa and Skidegate Inlets.* In this position, high land was in view to the north-west, nearly 30 leagues distant, which was identified as that seen when near the north end of the islands, proving to Dixon's satisfaction that the land he had been coasting along for nearly a month was a group of islands. Dixon surmised that the land was not continuous from meeting some of the same people on both sides. During this visit to the Queen Charlotte Islands, 1821 sea otter skins were purchased, which at the prices then current in Canton must have been worth about $90,000. Dixon met, on his return, off

Colnett and Duncan.

the entrance to Nootka, Captains Colnett and Duncan, in the *Prince of Wales* and *Princess Royal*, which had been fitted out in London by the same company of adventurers that Dixon himself was connected with. On August 9th, 1787, they parted company, Dixon steering for the Sandwich Islands, Colnett and Duncan for the Queen Charlotte Islands. In 1788, Duncan sailed through the strait between the islands and the mainland, which we do not know to have been done previously. He also named the Fleurieu Islands (of La Perouse) the *Princess Royal Islands*, after his vessel. In August of the same year, Captain

Douglas.

Douglas, in the *Iphigenia*, fitted out in China, coasted along part of the north shore of the islands, rounding Rose Point, and naming it. He then sailed southward, between the islands and mainland. In 1789,

Gray.

Captain Robert Gray, of the sloop *Washington*, of Boston, visited the east coast of the Queen Charlotte Islands. He appears to have left Nootka for the north in April. Gray called the islands Washington

* There is some uncertainty in Dixon's latitudes about the south part of the islands. The latitude given would place him opposite Cumshewa Inlet; the position assigned is obtained by adding 10′, this being the correction found necessary by Vancouver for Dixon's position of Cape St. James. (Vancouver, Vol. IV., p. 287).

Island, being ignorant of Dixon's name, and apparently of the fact that there were several large islands.* The *North West America*, a schooner of about 40 tons, built by Meares, at Nootka, in 1788, commanded by Robert Funter, left Nootka shortly after the *Washington*, and had returned to that place from a trading voyage in the Queen Charlotte Islands on the 9th of June, 1789, when she was seized by the Spaniards. As in his instructions to Captain William Douglas, commanding the *Iphigenia*, and also in charge of the *N. W. America*, Meares (Sept., 20, 1788,) specially directs that in the following summer the *N. W. America* should examine and trade along the east shore of the Queen Charlotte Islands (which he calls the Great Island). It is probable that the coast was visited early in 1788 by Funter. Douglas, in the *Iphigenia*, quitted Nootka on June 3rd of the same year, sailed northward between Queen Charlotte Islands and the mainland, and afterwards visited the north coast of Graham Island, naming the entrance to Masset Inlet M'Intire's Bay, the passage between North and Graham Islands, (now called Parry Passage), Cox's Channel, and a cove in the south side of North Island Beal's Harbour. Douglas stayed about a week in Parry Passage. His people are the first white men absolutely known to have landed on the Queen Charlotte Islands (p. 266), and in his narrative published by Meares, he gives some interesting particulars of his intercourse with the natives. Douglas and Funter.

On the 29th of June, 1791, Joseph Ingraham, in the brig *Hope*, of Boston, anchored in a harbour on the south-west† side of the Queen Charlotte Islands, which he called Magee's Sound, after one of the owners of his vessel. About these islands and the coast of the continent immediately adjacent to them he remained during the entire summer, and having collected a large cargo of furs, sailed for Canton in the autumn. He appears to have named two places on the north coast Hancock's River‡ and Craft's Sound, now called Masset and Virago Sound. Ingraham.

The *Columbia*, Captain Gray, made a second voyage from Boston in 1790-91, and was occupied trading on the east coast of the Queen Charlotte Islands in August and September, 1791. Gray fell in with the *Hope* in this vicinity on July 23rd. He wintered at Clayoquot, Vancouver Island, and built a small vessel there, the *Adventure*.

On August 22, 1791, Captain Etienne Marchand, in the French ship *Solide*, which had visited Sitka Sound, made the entrance of Cloak Marchand.

* It has been stated that Gray first identified North Island, and traversed Parry Passage. North Island is, however, shown with some accuracy on Dixon's map, published in 1788, and it is further improbable that Gray reached this place, as Douglas, coming a few weeks after the time of his supposed visit, found the natives with plenty of furs to trade.

† Greenhow. North West Coast of America, 1840, p. 120.

‡ Perhaps, however, named after the *Hancock*, Captain Crowell, of Boston, in the fur trade in 1791.

Bay, between North and Graham Islands. While the vessel stood off and on, a boat party entered and explored the bay and adjacent Parry Passage (or Cox's Channel). The first chart in detail published of any of the Queen Charlotte Islands harbors, was that prepared by Marchand's party. It is said, however, that Ingram inserted plans of several harbours in a manuscript journal of his voyage. The *Solide* subsequently visited the west coast of Graham Island for some distance to the southward, and then departed for Barclay Sound.

Caamano. In 1792, the Spanish corvette *Aransasu*, Lieutenant Jacinto Caamano, in company with the sloops *Sutil* and *Mexicana*, sailed from San Blas to Nootka. Thence the two last-named vessels departed for the Strait of Juan de Fuca, while Caamano, sailing northward, explored various parts of the coast to the 56th parallel of latitude, including the north shore of the Queen Charlotte Islands, where he applied the name Isle de Langara to North Island, and those of Estrada and Mazaredo to Masset and Virago Sounds.

Gray's mate, Haswell, in the *Adventure*, and afterwards Gray himself, in the *Coulmbia*, also returned to the Queen Charlotte Islands to trade in this year.

Vancouver. In 1792, Captain George Vancouver, in His Majesty's sloop *Discovery* and armed tender *Chatham*, arrived on the west coast, and began the series of explorations and surveys which occupied parts of three years, and resulted in the correct delineation of the main features of the coast from the 30th parallel northward, and westward to Cook's Inlet and Kadiak. In July, 1793, he sailed northward between the Queen Charlotte Islands and the mainland, sighting them several times from a distance. In September, 1793, he was again in the vicinity of the Queen Charlotte Islands, and in coasting down the west shore, correctly outlined it. He gives some observations on its character and bearings from point to point, which have already been quoted. He named at this time Point North, Point Frederick (Frederic Island), Englefield Bay, Cape Henry, Point Buck, Cartwright's Sound and Point Hunter.

In August, 1794, Vancouver again passed southward along the west coast of the Queen Charlotte Islands, but, owing to thick weather, scarcely saw them, and was not able to add to his notes of a former year.

Number of vessels in the fur trade. It would be uninteresting, even were it possible, to follow the various traders who must have visited the Queen Charlotte Islands after this time. It is more than probable, indeed, that many vessels resorted to the islands during the later years included in the above record, for Vancouver gives a list of no less than twenty-one which were engaged in the fur trade between the north-west coast of America and China in

1792. Little or nothing was added to our knowledge of the islands after these earlier voyages till they were visited in recent years by several vessels of the Royal Navy, and sketch-plans made of some of the harbours. The fur trade declining rapidly, attention appears to have completely withdrawn from the islands until 1852, when the Hudson Bay Company dispatched a party of men in the brig *Una*, Captain Mitchell, to discover the locality from which several specimens of gold had been brought by Indians. This was found to be in Port Kuper, or Gold Harbour, on the west coast. The gold was found in a small irregular vein, which was soon proved to run out in every direction. The quantity of gold obtained by the expedition was considerable, but has been variously stated. The enterprise was soon abandoned, but the discovery for a time created quite a *furore*—the first gold excitement of British Columbia—and the locality was visited by a number of miners, but with no further success. In July, 1859, Mr. Downie, with a party of twenty-seven, provisioned for three months. started for Port Kuper, or Gold Harbour, reaching it on August 6th, They discovered a few specks of gold, but no paying vein. Mr. Downie appears to have been the first to discover the coal in Skidegate Inlet. About this time a Captain Torrens also went with a party to prospect on the Queen Charlotte Islands, and narrowly escaped massacre by the Skidegate Indians. The Haidas have always borne a bad character, and have plundered coasters on one or more occasions, detaining a portion of the crew as slaves. Fear of the possible behaviour of the Indians has frequently deterred private individuals from visiting the islands.

Discovery of Gold.

Discovery of Coal.

In 1852, H. M. S. *Thetis* visited Port Kuper, the sketch of this port being made by G. Moore, master. The sketch of the entrance to Cumshewa Inlet is by Captain T. Sinclair of the Hudson Bay Company. In 1853, H.M.S. *Virago* visited Virago Sound, the entrance to Masset Inlet and Houston Stewart Channel. A sketch of Virago Sound was made by G. H. Inskip, master; of Masset by H. N. Knox, mate; of Houston Stewart Channel by Messrs. Inskip, Gordon, and Knox. The sketch of Parry Passage, though not directly attributed to the officers of the *Virago*, was also doubtless made at this time. H. M. S. *Alert* visited Virago Sound and Houston Stewart Channel in 1860, making some additions to the previous sketches of these places, and a line of soundings off the east coast of Graham Island, from near Cape Fife to Skidegate, and thence to Cumshewa. In 1862, H. M. S. *Hecate* visited Skincuttle, to prevent violence being done to the miners then engaged there, and made a line of soundings from that place to Bonilla Island. In March, 1864, the same vessel visited Houston Stewart Channel, making some additions to the sketch. Skidegate Inlet was (in part) carefully surveyed by D. Pender, Master, R. N., 1866.

Dates of Surveys and Sketches.

Visit of Mr. Richardson.

In 1872, Mr. James Richardson, of the Geological Survey of Canada, at the request of gentlemen interested in opening a coal mine at Skidegate, spent nearly two weeks in that inlet. The account of his investigations is published in the Report of Progress for 1872-73, and the fossils collected by him form the subject of Mr. Whiteaves' memoir, already referred to, of a short report by Mr. Billings*, and a note by Principal Dawson†.

Charts and Plans.

The best chart which I was able to obtain of the Queen Charlotte Islands is that of the Admiralty, bearing corrections up to 1862, and numbered 2430, on a scale of fifteen miles to one inch. This is said to be based chiefly on Vancouver's survey of 1792, corrected by a Russian chart of 1849, and by Mr. Inskip in 1854. It is nothing more than a very rough sketch of the main outlines of the islands. A considerable portion of the east coast is represented on the Admiralty charts 1923 A. and 1923 B., published subsequent to December, 1874, but is little altered from the last. Of Skidegate Inlet there is a nearly complete and accurate plan (No. 48), on a scale of one mile to an inch. There is also a sheet of plans of harbors (No. 2168), printed subsequent to 1864, giving moderately correct sketches of Houston Stewart Channel, Virago Sound, and the entrance to Masset Sound; very imperfect ones of Cumshewa Inlet and Parry Passage. A small book of sailing directions for the islands, by G. Inskip, was also issued by the Admiralty in 1853, but has apparently been recalled or allowed to become out of print, as I have been unable to procure a copy. Some directions for navigators are, however, to be found in Imray's *North Pacific Pilot*, 1870, Vol. I., probably derived from the last mentioned work. In giving a description of the islands, the east coast is followed from the south northwards, and such notes as may be useful to vessels visiting the coast, whether the result of personal observations or derived from the *Pilot*, are inserted.

General Description of the Islands.

Southern extremity of the Islands.

The southern extremity of the land of the Queen Charlotte Islands, is a chain of rocky islets and rocks called Isles Kerouart by La Perouse, which runs off from Cape St. James three and a half miles, in a south-south-easterly direction, corresponding with that of the mountainous axis of the group. Sunken rocks must exist still further from the land in the same line, as Vancouver notes that Gray, of the *Columbia*, stated that his vessel struck and received some material damage, on a rock lying at a much greater distance (Vol. IV. p. 287.) Dixon gives a fairly

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* Report of Progress, 1872-73, p. 71. † Ibid, p. 66.

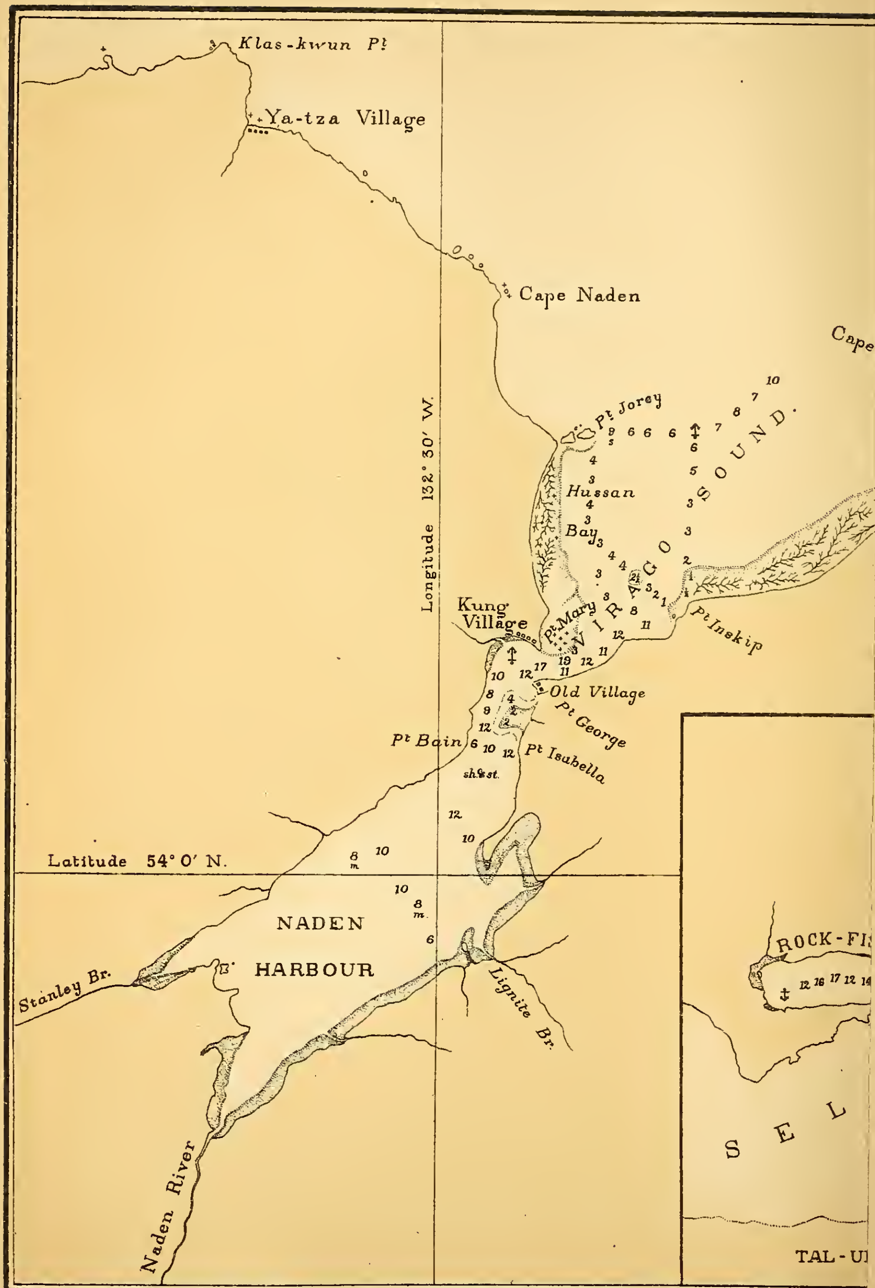
GEOLOGICAL SURVEY OF CANADA.

DRAWN BY MESSRS. BOVEY & DAWSON.

THE BURLAND LITHOGRAPHIC CO MONTREAL

SKETCHES OF HARBOURS, QUEEN CHARLOTTE ISLANDS, 1878.

SCALE: 2 Nautical miles to 1 inch.



DRAWN BY MESSRS. BOVEY & DAWSON.

SKE

accurate view of the rocks.* As seen by myself at a distance of some miles to the north-east, they appear to form three groups, the first lying close to Cape St. James, consisting of two large rocks, the second of one large and several smaller rocks, and the third and furthest southward, of two or three rocks of some size and a number of lesser ones. These little islets are very remarkable in appearance, standing boldly up with rounded tops and vertical cliffs on all sides. Even the smaller rocks have the same pillar-like form, so frequently found where a rocky coast is exposed to the full sweep of a great ocean. They serve as secure breeding places for innumerable gulls, puffins and other sea-birds. The southern point of Cape St. James is a vertical cliff about equal in height to the larger of the islands lying off it. The land gradually rises northward, till about Houston Stewart Channel it has in many places a probable elevation of 2000 feet. Cape St. James appears to be the southern extremity of an island about one mile in diameter, which has heretofore been drawn as forming a part of Prevost Island. The narrow channel which separates it from the latter runs west-south-westward. The east coast of this and Prevost Island to *East Point*† is bold, and frequently formed by a cliff facing the sea. This part of Prevost Island is indented by two bays or inlets, the southern apparently inconsiderable, the northern probably three or four miles in depth.

Isles Kerouart.

East coast Prevost Island.

From East Point the shore runs north-westward seven and a quarter miles to Moore Head, at the south-east entrance of Houston Stewart Channel. The shore is much broken, being penetrated by several inlets which run back among the high hills. Several small islands lie off it, of which one is bold, densely tree-clad, and has a height of about 150 feet. Houston Stewart Channel runs west two and a half miles, and then turning abruptly, south-west three miles. From the knee thus formed Rose Harbour, an inlet nearly three miles long, runs northward. Like the main channel, it has a width of about three-quarters of a mile. Its western side, especially to the north, is bordered by high hills, while to the north-east it is separated by a narrow neck of low wooded land from *South Cove* of *Carpenter Bay*. A stream which has been called Sedmond River on the chart, enters at its head from the west. At the west entrance to Houston Stewart Channel lies Anthony Island, on which the Indian village generally known as *Ninstints* is situated, and a number of smaller islets. No villages exist in other parts of the inlet. Those marked on the chart have been temporary houses, most of which have now disappeared. In the neighborhood of Houston Stewart Channel the hills or mountains everywhere rise steeply from

Houston Stewart Channel.

Ninstints.

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* A Voyage Round the World, but more particularly to the North-west Coast of America, by Captain George Dixon. London, 1789, p. 214.

† Names printed in *italics* in this portion of the report are these given by myself, or in use by the Indians, but which have not previously been published.

the shore, and there is no arable land, scarcely indeed any soil properly so called. The trees, from the exposed position of this part of the islands are rather stunted, and show much dead wood. They grasp the almost naked rocks. A strong tide runs through the channel, the flood setting eastward from the Pacific, while the ebb flows in the opposite direction. This is very favourable to the existence of certain forms of marine life, and the rocks are alive with sea-urchins, star-fish, acorn-shells, mussels, chitons, holothurians, &c. The bottom was found on dredging to consist of gravel and shelly sand, except in the sheltered bays, where it is mud.

Zoological fecundity.

Soundings and shoals.

At about four miles from the eastern entrance to Houston Stewart Channel the depth is said to be 90 fathoms, which gradually shoals to 20 fathoms within a mile of it. The soundings then become very irregular, ranging from 30 to 7 fathoms. In the channel the depth varies from 11 to 20 fathoms. Within the entrance point on the north side there is a snug bay bordered by a sandy beach. There is also good anchorage for a small craft east of Ellen Island of the chart. Care must be exercised in sailing up the channel, as there are several rocks which contract the available width. Rose Harbour is secure and capacious, with anchorage at from 6 to 15 fathoms, but with kelp and shoal water along its eastern shore. The basin at its head is full of little islands and rocks, and should not be entered. Imray gives the following directions for entering Houston Stewart Channel from the eastward. When abreast Cape St. James, the vessel should close the land to 1½ miles, and coast along till the entrance opens out. After passing a convenient distance southward of the largest or outer island (Anthony Island), off the southern end of which an extensive ledge of rocks extends south-westward, the channel will show itself. A bare flat rock about 50 feet high, which should be kept on the port hand, is a good guide.

Danger Rocks.

Off the point, between the east entrance of Houston Stewart Channel and Carpenter Bay, to the north, are the North and South Danger Rocks. These are low rocky islets, but are said to be surrounded by sunken rocks. In entering Houston Stewart Channel from the northward they should be given a wide berth. The point above mentioned is low and densely wooded. At a little cove on its north side, protected by rocks and full of kelp, is an Indian house, which appears to be occupied at some seasons. Carpenter Bay, between *Iron Point* on its north-western and *Islet Point* on its south-eastern side, is a little over two miles wide, and runs westward about five miles. On its south side are two small bays, the western of which has already been mentioned under the name of South Cove, as approaching near to the head of Rose Harbour. In its head is good anchorage for a small schooner

Carpenter Bay.

in from 6 to 10 fathoms. It is not quite land locked, but sheltered from the only direction otherwise exposed by a little rocky reef which runs out from its east side. The bay ends westward in a narrow arm, which receives two streams of some size. It resembles the head of Rose Harbour in being filled with little rocky islands and rocks, and though well sheltered would be unsafe even for small craft. The general aspect of this inlet and the country surrounding it is like that of Houston Stewart Channel. Thickly wooded mountains rise everywhere from the water's edge to heights frequently exceeding 1000, but rarely if ever more than 2000 feet. The shore is generally rocky, with deep water off it, and beaches are infrequent and not extensive. The timber being of small stature and gnarled is not of any great prospective value, and agricultural land does not exist. There were many seals here at the time of our visit (June 17th), playing in the water or lying on the rocks. Some mothers carried their young on their backs, the two heads coming up together in a most amusing manner.

Seals.

Collison Bay, lying between the last and Skincuttle Inlet, is about a mile and three-quarters wide, with a probable depth of two miles. It runs up into a narrow arm, which was not examined. Several small islands and rocks lie in its mouth, and it does not appear to be serviceable as a harbour.

Collison Bay.

Skincuttle Inlet is five and a half miles deep, with a width between its entrance points of four miles. A number of smaller inlets and coves open from it. The north side of the inlet is formed by Burnaby Island, and from the north-west angle Burnaby Strait runs northward to *Juan Perez Sound*, and separates Burnaby Island from the east shore of Moresby Island. In 1863-64, Skincuttle Inlet was the scene of the exploits of a certain Mr. Francis Poole, calling himself a civil and mining engineer. He subsequently published a volume called "Queen Charlotte Islands,"* which is chiefly remarkable for the exaggerated character of the accounts it contains. Mr. Poole gives a rough sketch map of Skincuttle, on which he has named most of the features. I have retained his names in so far as I have been able to recognize the localities to which they are intended to apply.

Skincuttle Inlet.

The shores of Skincuttle Inlet resemble those of other parts of the islands already described, being in general bold, and rising at once from the water's edge either to low hills or mountains of some height. The inlet appears to be continued westward by low land, but owing to the fact that the mountains were perpetually covered with mist during our stay in this place, it is possible that there are hills of some height at a little distance from the shore. Near the north-western angle of

* London, 1872.

the inlet the mountains rise steeply to a height of 3000 feet or more, being the highest yet met with in proceeding northward. The surface of the country is forest-clad, but as before noticed many of the trees are dead at the tops. When sheltered flat land occurs, however, they are well grown and healthy looking. The Spruce (*Abies Menziesii*), Hemlock (*Abies Mertensiana*) and Cedar (*Thuja gigantea*) are the most abundant, the latter chiefly near the shore. Alders (*Alnus Oregona*) and Crab-apples (*Pyrus rivularis*) form small groves near the beach where the land is low. In the narrower passages where no heavy seas can enter, the trees seem almost to root in the beach, and their branches hang down so as even to dip into the water at high tide. Where a narrow beach occurs in these sheltered localities, vividly green grass spreads down till it meets the yellow tangle which grows up as far as the tide ever reaches. Owing to the dampness of the climate, a few days exposure at neap tides does not seem to injure the sea-weed. Ferns also grow abundantly on the trunks and even on the boughs of the trees, both living and dead, and green moss forms great club-like masses on projecting branches. Large trunks, overthrown and dead, become at once perfect gardens of moss young trees and bushes, though lying high above the ground supported on piles of yet earlier windfall. Similar features characterize the forest bordering the shores elsewhere throughout the whole southern portion of the Queen Charlotte Islands, and—it is unnecessary to add—render locomotion in any other way than by boats or canoes along the shore nearly impossible.

Timber.

Luxuriant vegetation.

Islands.

The entrance to Skincuttle Inlet is south of a chain of islands which may be called the *Copper Islands*, and lie east-north-east and west-south-west. It is a mile and a half wide, but should be used with caution, as there is reason to believe that a rock, sometimes bare, lies in it. The passage to the north of the Copper Islands is contracted, and with one or more rocks in its narrowest part. The first opening on the south side of the inlet, and best anchorage, is Harriet Harbour of Poole, of which a careful survey, with soundings, has been made. It is two miles east of the south entrance point of Skincuttle Inlet, and runs southward one mile. It should be entered by the channel on the west side of Harriet Island, which lies at its mouth. A vessel should be kept nearer the west side of the channel, (as several little rocks covered at high water lie along Harriet Island) and run some distance beyond the inner end of the island before bringing too, to avoid the shoal bank which lies off its point. The depth is about 8 fathoms, with good holding ground, and the harbour is well sheltered from most directions, though subject to heavy puffs from the valleys at its head when a southerly gale is blowing.

Harriet Harbour.

A mile and a half west of Harriet Harbour is Huston Bay of Poole

This is a wide inlet which runs southward about four miles, and then turns to the west, in which direction its extremity was not visited. High mountains rise from the shore near its head.

At the western end of Skincuttle Inlet are three indentations of the coast, of which the southern appears to be George Harbour of Poole. The northern, lying at the entrance of Burnaby Strait, may be called *Tangle Cove.* It is a well sheltered anchorage for a small schooner, but a shoal, the extent of which is unknown, lies off its mouth. The entrance is between a small island which lies at its south side and two other little islets to the north. In it lies a rock which uncovers at low water. The mountains at the head of Tangle Cove are steep, and probably reach 3000 feet in height. Part of their upper slopes are bare of trees, but apparently covered with peaty moss, where not composed of rock. Two and a half miles northward of Burnaby Strait is *Dolomite Narrows.* The strait is here not more than a quarter of a mile wide, and the channel is crooked, obstructed by rocks, and shoal, having from six to eight feet only of water at low tide. The current is not strong, however, and our schooner passed safely through, though it is not to be recommended as a passage for any craft larger than a boat or canoe. All parts of Burnaby Strait must, indeed, be navigated with great caution, as there are many rocks, and a large proportion of them are covered at high water. Just south of Dolomite Narrows, from the west side of the strait, opens *Bag Harbour*, expanding within to a basin nearly a mile in diameter. On the south shore of Burnaby Island, constituting the north side of Skincuttle Harbour, is a bay, with several small islands in front, which may be a good harbour, but was not examined. Further east, in the vicinity of the abandoned copper mine, Blue Jay and Kingfisher Harbours of Poole, are mere rocky coves, scarcely commodious for boats.

Dolomite Narrows.

Granite Point, on the north side of the entrance to Skincuttle, is a rather remarkable whitish crag, separated by a narrow neck of low land from the main shore. The east side of Burnaby Island from this place to Scudder Point—a distance of about five miles—was not examined. There is, however, a deep bay to the north of Granite Point, with a high island lying in its mouth. The Bolkus Islands form a chain about two miles long, lying east and west in the centre of Skincuttle Inlet. They are five in number, with many small rocks and reefs. The land is low, and on the western and largest of the islands the soil appears to be good, though now covered with dense forest.

Granite Point.

Burnaby Strait is nine miles in length, running northward six and a half miles beyond Dolomite Narrows, and gaining eventually an average width of a mile and a quarter. Nearly abreast Dolomite Narrows on Burnaby Island are two conspicuous mountains—*The Twins*—estimated

Burnaby Strait.

Burnaby Strait. at 1500 feet in height. One and a half miles north of the Narrows, *Island Bay*, two miles deep, runs westward. It is named from a number of small islands—about seventeen—which it contains, and may probably be too rocky for a safe harbour. Four miles north of the Narrows, a passage opens westward between the north shore of Burnaby Island and *Huxley Island.* On the west side of the northern entrance to Burnaby Strait is *Skaat Harbour.* This is a bay two and three-quarter miles wide, with a total depth of about three miles. In its mouth lies one large island—*Wanderer Island*—and several smaller ones. The harbour turns into a narrow inlet in its upper part, which was not visited, and terminates among high mountains forming a portion of the axial chain of the islands. Skaat Harbour was not sounded or carefully examined, but from the character of its shores would probably afford good anchorage, especially behind Wanderer Island, and if so, it is the best for large vessels in this vicinity. It lies near the seaward opening of Juan Perez Sound, *All Alone Stone* and *Monument Rock* forming good entrance marks to Burnaby Strait. The harbour will probably be found deepest on the Wanderer Island side, as there is an extensive field of kelp off the opposite shore. The entrance to Skaat Harbour on the southern side of Wanderer Island is very narrow. At the angle formed between it and the shore of Burnaby Strait are two small coves affording anchorage for a schooner, but with wide tide-flats at their heads, which a short distance below low-water mark fall away very rapidly into deep water. The eastern point of Wanderer Island, in line with that of Centre Island, leads over *Limestone Rock*, a mile to the southward of the latter. This is a dangerous reef, bare only at low water, but not extensive, though a second rock, dry at low water only, lies a short distance south-east of it.

Burnaby Island The north shore of Burnaby Island, five and three-quarter miles in length, lies east-north-east and west-south-west, and is nearly straight on the whole, though with a few shallow bays, one of which has been called *Section Cove,* and is again referred to in this report. *Alder Island* lies about the centre of this stretch of coast. It is about half a mile in diameter, nearly flat, and there is probably a good anchorage behind it, which should, however, be approached from the north, as the *Saw Reef* runs out from the shore of Burnaby Island to the eastward, and this part of the coast is, moreover, broken and rocky, with large fields of kelp extending off it.

From Scudder Point the shore trends somewhat west of south, allowing the outer of the Copper Islands to be seen. The hills on the north side of Burnaby Island are not high, being estimated at from 300 to 500 feet. A considerable width of low land stretches back from Scudder Point, covered with an open growth of large but gnarled spruces, the trunks of which are not simple, but fork upwards, as they are often found to do in exposed situations. Little beaches of coarse clean-washed gravel fill the spaces between the low shattered rock masses, which spread widely between high and low water marks, with evidence of the action of a heavy surf. In a cove on the north side is a strongly built but abandoned Indian house.

Huxley Island is about two miles in length, from north to south. It is very bold and remarkable, rising rapidly from the beach to a height probably exceeding 1000 feet. Abreast the north-west point of this island, in mid-channel, a cast of the dredge in 70 fathoms was obtained, the bottom being a fine sandy mud.

Juan Perez Sound has been so named in honour of the reputed discoverer of the Queen Charlotte Islands, who, though he appears rather to have had that honour thrust upon him than earned it by courage in his exploration, probably deserves some recognition.* This opening, between the north of Burnaby Island and *Ramsay Island*, has a width of eight miles. It runs north-westward, giving off a number of smaller inlets and bays, and is continued in a north-north-westward direction by *Darwin Sound*, by which it communicates with the upper ends of the long inlets which run westward from *Laskeek Bay*. From the centre of a line joining the outer entrance points, to the southern entrance of Darwin Sound, Juan Perez Sound is thirteen and a half miles in length. On its south-western side are *Werner Bay*, *Hutton Inlet* and *De la Beche Inlet*. These terminate in narrow channels or fiords, which run up among the axial mountains of Moresby Island, and owing to the short time at my disposal, and comparatively uninteresting character of the rock sections, were not examined to their heads. From Werner Bay two small inlets branch. Hutton Inlet appeared to be about three miles long; De la Beche Inlet nearly six miles, with a low valley, hemmed in by mountains on either side, running north-westward from its extremity. None of these openings seem to be at all well adapted for harbours, as the shores are bold and rocky, seldom showing beaches, and the water to all appearance too deep for anchorage. The *Bischoff Islands* are low, but like the rest of the country, densely wooded. There is a sheltered anchorage for small schooners between the two larger islands, but it must be entered from the westward, and with much caution, owing to the number of rocks and sunken reefs which surround it. *Sedgwick Bay*, about three miles deep, in the south shore of *Lyell Island*, was merely sketched from its entrance. It appears to be too much exposed for a harbour, as southerly winds draw directly up Juan Perez Sound.

Juan Perez Sound.

Inlets and Islands.

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* As already mentioned, Maurelle, in 1775, named the strait to the north of the islands after Perez, but his name has been superseded by Dixon's.

Islands, north of Juan Perez Sound.

The north-east side of Juan Perez Inlet is formed by a group of islands, of which Faraday, Murchison and Ramsay Islands are the largest. Ramsay Island is two and three-quarter miles in length, east and west. Bold hills rise in the centre of the island, which is densely wooded. Its south shore is high, with some rocky cliffs. Two small islets lie off the north-east shore, which is rugged and composed of solid rock. The north-west shore has several coves, but none suited for anchorage. Murchison Island is two and a half miles long; Faraday Island nearly two miles. Both are low. Between Ramsay and Murchison Islands is a little group composed of *Hot Spring Island*, *House Island* and a few more small islets and rocks. Between Hot Spring and House Islands is a good anchorage for small schooners, sheltered on all sides but the north. On the south side of Hot Spring Island is the spring from which it has been so named. Its situation is easily recognized by a patch of green mossy sward which can be seen from a considerable distance. Steam also generally hovers over it. The actual source of the water is not seen, but is probably not far from the inner edge of the mossy patch. The surface is composed of broken fragments, more or less completely concealed by bush and sod, and the water is first seen lower down, where it issues in a number of little streams over a considerable breadth, and flows out upon the beach. I had no thermometer reading sufficiently high to take the temperature of the warmest streams, in which the hand could scarcely be held with comfort. Other rills, probably coming less directly from the source, are comparatively cool. The water has a slight smell of sulphuretted hydrogen, and a barely perceptible saline taste. The stones over which it flows in some places show traces of a whitish deposit, and the streams and pools are choked with a slimy confervoid growth. On stripping off the sod of the portion of ground not covered by trees and bushes, the earth is found to be quite warm. The Indians bathe in a natural pool in which the waters of one of the streams collect; it is partly full of soft mud, but hard in the bottom.

Hot Spring.

Indian bath.

Running northward from the end of Murchison Island is a chain of small islands about four miles long, which may be named the *Tar Islands*, as the Indians report that on one of them bituminous matter is found oozing out among the stones on the beach. The southern island of the group—*Agglomerate Island*—has apparently been burnt over, and is covered with standing dead trees. It alone was visited, and owing to some confusion in the bearings taken for the purpose of fixing the others, their number and position as shown on the map is somewhat uncertain. Outside these islands lies a single low island with a few trees, which may be called *Tuft Island.*

Rocks dry at low water lie between Faraday and Murchison Islands, and there are several small rocky islets and low-water rocks in the vicinity of Hot Spring and House Islands. Vessels entering Juan Perez Sound had therefore better do so to the south of Ramsay Island, till the narrower channels have been carefully surveyed. No bottom was reached with 94 fathoms of line in the centre of the Sound south of Ramsay Island, nor in another place about a mile south-east of the extremity of Bischoff Islands. No other soundings were made here, but the water seems to be everywhere deep.

Lyell Island.

Lyell Island is about ten miles in extreme diameter in both east and west and north and south bearings. It is separated by Darwin Sound from the main coast of Moresby Island to the south-west, and is composed of high hilly land, generally rising at once from the shores to heights of from 600 to 900 feet, and attaining in a few instances toward the centre of the island a height probably exceeding 1000 feet. It is densely wooded, and where patches of low land exist bears some fine timber. Sedgwick Bay, already described, indents its southern shore, *A-tli* Inlet its northern. The east coast was not surveyed, and is merely sketched in on the map. Darwin Sound from its southern entrance, to *White Point* is eleven and a half miles in length, and lies north-north-west south-south-east. It is irregular in width, but is a fine navigable channel. In the south entrance no bottom was found with a 94-fathom line. In entering from the southward, *Shuttle Island* looks nearly round. The channel on its eastern side should be followed, as this seems to be quite free from impediments. Abreast the north end of Shuttle Island in this channel a cast at 18 fathoms was obtained. A mile beyond this point is an inconspicuous low rock in mid-channel, with a second bare only at low water a short distance to the north of it.

Tide.

The flood tide sets up Darwin Sound from the southward into the various inlets, and then eastward to the open sea again by *Richardson* and *Logan Inlets.* The ebb in like manner draws through from end to end in the opposite direction. The tidal current must run about two knots when strongest.

Bigsby Inlet.

The south-west side of the sound for four miles from the south entrance is rocky and broken, with several coves and little inlets. *Bigsby Inlet* then runs in two and a half miles west-north-westward. It is a gloomy chasm, scarcely half a mile in width, but surrounded by mountains higher than any yet seen, and probably not exceeded by any in the islands. These rise steeply from the water, sometimes attaining in the first instance a height of 3000 feet, and are in places nearly perpendicular, but are generally well wooded, the trees clinging in the crevices of the rocks. Further back, especially to the southward and westward, massive summits of bare granite rise to a height of 4000 to 5000 feet, with their upper gorges and shady hollows filled with drifted snow-fields. We were overtaken by evening in this inlet on July 2nd, and could scarcely find a strip of beach wide enough to spread our blankets down on for the night.

Shuttle Island, though low, is rocky. The channel to the west of it is probably deep enough for vessels of any class, but should not be used till it has been properly surveyed. There is a rock, covered at high water, on the west side of its northern entrance.

Echo Harbour.

A mile and a half further northward, and opposite the inner end of Richardson Inlet, is *Echo Harbour*. The entrance to this harbour looks like a shallow cove from outside. We entered it on July 4th in search of a place to anchor, and were surprised to find the passage into the harbour. It runs southward about a mile, and is surrounded by high hills which toward its head rise to rugged mountains. The outer part of the entrance is about 10 fathoms in depth; the sides then approach, leaving a channel scarcely 300 yards wide between abrupt rocky shores. In the harbour proper the depth is everywhere about 15 fathoms, decreasing gradually toward the head for a short distance, and then running steeply up to a flat which is partly dry at low water, and above high water mark forms a narrow grassy beach. The bottom is soft mud, and excellent holding ground. A very narrow passage leads westward from the bottom of the harbour into a wonderfully secluded little basin, scarcely a quarter of a mile in diameter. With the exception of a channel in the centre, this is nearly dry at low water. Into its head flows a large brook, coming from the mountains to the south-westward.

High mountains about Klun-kwoi Bay

Two miles northwest of the entrance to Echo Harbour, the shore line falls back to form *Klun-kwoi Bay*. This runs up in several arms, which were not minutely examined, among the bases of rugged snow-clad mountains, which rise very steeply from the shores, or at the sides of the narrow valleys by which the heads of the inlets are continued inland. The highest peaks probably exceed 5000 feet in altitude, and the desolate grandeur of the scenery of the region is almost oppressive. The axial mountains of Moresby Island form a high and partly snow-clad sierra from the north end of Juan Perez Sound to this place. They appear to culminate here, and are not such a prominent feature further southward. It is probably to this part of the range that Perez's name of *Sierra de San Cristoval* may be applied with greatest propriety.

Crescent Inlet.

Crescent Inlet may be considered as forming the extension northward of Darwin Sound. It turns gradually through nearly half a circle, from a north-north-west bearing to a direction nearly west-south-west, and is over four miles in length, though its actual extremity was not visited. It is a fiord, with steep mountainous and wooded sides, but it is probably not so deep as most similar inlets, as there are stretches of beach of some length. The mountains at its head are not so high as those in the last bay, and if Tasoo Harbour, on the west coast of Moresby's Island is correctly placed, the distance across to it from the head of this inlet cannot be great. I did not hear, however, that the Indians have any trail across from this place. The most conspicuous peak in the vicinity of Crescent Inlet is on its north side, at the angle of the bend. This mountain is about 3000 feet in height, with a sharp summit, which at some points of view appears to be tripple. It is partly bare and was named *Red Top.*

From the wide indentation of the coast which is named Laskeek Bay, four large inlets run westward, of these the two southern, which have been named Richardson and Logan Inlets, open into the head of Darwin Sound. Richardson Inlet is about ten miles in length, with an average length of about one and a half miles. Its southern side is formed by Lyell Island, its northern by *Kun-ga Tan-oo* and *Inner Islands,* from east to west. The inlet is straight with moderately bold shores, Kun-ga Island is over 1000 feet in height, forming a good mark at its entrance. There is a low rocky reef, however, some distance east of the outer point of Kun-ga, and a second off the south point of the same island. Near *Dog Island* there are several small islets and rocks. The channels between Kun-ga and Tan-oo and the latter and Inner Islands are probably deep, though the first should be navigated with caution, and care taken to avoid the east end of Tan-oo Island, as several rocks and patches with kelp lie off the Indian village there. About three and a half miles west of Dog Island, on the south side of Richardson Inlet, is a cove, where a small schooner can find a convenient anchorage,—probably the nearest stopping place to Laskeek village. There is a ruined Indian house in the cove. The western end of Richardson Inlet is contracted to a width of about a quarter of a mile, and obstructed by a small island and several rocks. The tide runs through the passage with considerable force, and it is unsuited as an approach to Echo Harbour, though the most direct way in from the sea. A-tli Inlet, about three miles deep, and with two main arms, was sketched from its outer points. It did not appear to be a good harbour. Waters opening from Laskeek Bay.

Logan Inlet is about seven miles in length, with a small bold rock, covered with trees—*Flower-pot Island*—in its mouth. One other small island lies close to the shore on its southern side, but it is otherwise free from obstructions, and constitutes a fine navigable channel, and the best approach to Echo Harbour. Vessels should enter to the north of Flower-pot Island, and keep on up the centre of the channel. Kun-ga Island, as already mentioned, is high, having been estimated at 1500 feet. *Ti-tul Island,* small and with low limestone cliffs, lies off its north point. Tan-oo and Inner Islands are also bold, rising to Logan Inlet.

rounded hills of a nearly uniform heighth of about 800 feet. They are not without some good gravelly beaches, though generally rocky.

Fine timber.

In the inlets and bays just described, in the vicinity of Lyell Island, there is a considerable quantity of fine timber, trees of great stature growing in all moderately level and sheltered places. The most abundant tree here, as elsewhere on the islands is *Abies Menziesii.* The 'yellow cedar,' *Cupressus Nutkatensis*, occurs rather sparingly toward the heads of the inlets. The *Laskeek* or *Klue* Indian village, is situated on the eastern extremity of Tan-oo Island. It is one of the most populous still remaining in the Queen Charlotte Islands.

Dana and Selwyn Inlets.

The two northern inlets from Laskeek Bay may be called *Dana* and *Selwyn Inlets.* In the mouth of Dana Inlet is a small, high, rocky island, of rounded form, which may be called *Helmet Island.* A second small island is near it, and from most points of view the channel between the two is not seen. Care must be taken to avoid mistaking this island for Flower-pot Island, in the mouth of Logan Inlet. Dana Inlet is six and a half miles long, and runs nearly due westward, with bold shores. At its extremity it turns northward, communicating by a narrow but apparently deep passage with Selwyn Inlet, and thus cutting off *Tal-un-kwan Island*, seven miles in length. The hills on this island are rounded and regular in form, and rise to elevations of from 800 to 900 feet. Selwyn Inlet runs westward, parallel to the last, for about seven miles, and then turning north-westward, runs for a like distance in that direction, giving off three arms, one of which forms at high-water a passage for canoes into the upper part of Cumshewa Inlet, and separates *Louise Island* from the main shore. A small island lies off the north entrance point, with a low rock off it. The remainder of the east-and-west reach of the inlet appears to be free from obstructions, with the exception of a small rock near the south shore. After giving the islets at the north entrance point a wide berth, a vessel should keep the north shore on board, til lin five miles the entrance of *Rock-fish Harbour* is reached. This harbour is formed by a book-shaped projection of low land, at the angle of Selwyn Inlet. It runs in westward for about a mile and a half, with a width of about half a mile, and an average depth of about fifteen fathoms. It is a secure and well-sheltered anchorage, more easily entered than Cumshewa Harbour. The west branch of Selwyn Inlet was estimated to run four miles west-south-westward, and cannot be more than nine or ten miles from the upper arms of Mitchell or Gold Harbour, of the west coast. A low valley was observed to run some distance westward from the head of this branch. Of the two remaining arms of Selwyn Inlet, one appears to end blindly in about two miles, the second running north-north-eastward, forms the communication with Cumshewa Inlet already alluded

Rock-fish Harbour.

to. These upper arms of the inlet a1e environed by high and rugged mountains, of which, however, owing to persistently wet weather, no good view was obtained. The passage to Cumshewa is narrow and walled in at both sides by mountains which rise very steeply from it. The land on Louise Island to the north of Rock-fish Harbour is also very high and bold. Like those before described, the shores of this inlet are densely wooded.

The positions of *Reef Island* and the *Low Islands* in Laskeek Bay have not been fixed with any accuracy, and they are merely sketched on the map. The first-named is steep along the water's edge, and a reef runs about half a mile southward from it.

From the mouth of Selwyn Inlet, the coast runs north-eastward for seven miles, with several small bays, fully open to the sea, and generally rocky. About mid-way a remarkable limestone point, named *Point Vertical*, from the attitude of the beds, projects. It is connected with the main shore by a narrow spit, on which stands an Indian house. North of it are two small islands,—*Limestone Islands*,—behind which the tide, running southward along the coast, forms a race at ebb. *Skedans Bay* is strewn with sunken rocks and fully open, and should on no account be entered by vessels. A large stream enters its head, which can be seen at some distance inland forming a high waterfall, and which, according to the Indians, flows out of a lake of some size high among the mountains. The Skedans village forms a semi-circle round the head of a small bay or cove—very rocky—which indents the south side of a narrow isthmus, connecting two remarkable nipple-shaped hills with the main shore. This peninsula is situated at the south entrance point to Cumshewa Inlet, and between it and the Skedans Islands lying off, the tide forms a race. The Skedans Islands form a mark in entering Cumshewa Inlet from the south, but are only sketched on the map. They are low and tree-clad.

Coast between Laskeek and Cumshewa.

Skedans village.

Cumshewa Harbour, of the Admiralty chart, is shown as about five miles in depth. This opening is in reality, however, a long inlet, running westward fifteen miles, and sending a prolongation southward to Selwyn Inlet. It differs in its somewhat greater width, and the low character of the land on its northern shore from the inlets to the south, and in fact marks the junction, on the east coast of the island, of the mountain region and flat country underlain by the comparatively undisturbed Cretaceous rocks. There is more beach along the shores than in the southern inlets, and wide tide-flats, indicating shoaler water, which is not only found in the inlet itself, but now extends far off the coast. The shores are quite bold, however, in some places toward the head of the inlet, and the water probably deep. The mountains south of the extremity of the inlet and on Louise Island are high and carry

Cumshewa Inlet.

snow in abundance, which doubtless lasts all summer. These appear about as high as any yet seen, from which it is evident that the axial range does not gradually die away northward, but is here suddenly interrupted. North of the extremity of the inlet, some miles back from the shore, rounded hills estimated at about 1000 feet are seen.

Entrance to Cumshewa Inlet.

Outside the mouth of Cumshewa Inlet, north of the Skedans Islands, the depth is pretty uniform at about twenty fathoms, with a shelly and gravelly bottom. An extensive reef lies nearly a mile off the northern entrance point of the inlet, in a south-easterly bearing, with a second, seen only at low-water, nearly half a mile further out in the same direction. A vessel coming from the north should, therefore, keep well off the shore till the Cumshewa rocks are passed, and then stand in to the entrance in a north-westerly course. Cumshewa Island, of the chart, is a small barren rock. *Kin-gui Island*, just within the north entrance point, on the north side of the inlet, bristles with dead trees, and can be recognized easily. About a mile further in is the narrow channel by which the inlet must be entered. This is about half a mile wide, lying between the north shore of the inlet, and northern edge of a very extensive shoal which runs out from the south shore, with a broadly triangular form. When the southern point of the peninsula which projects from the north shore of Cumshewa Inlet, bears N. 65° 30′ (S. 88° W. Mag.), the northern edge of the wide shoal is just cleared. The least depth in the channel is, according to the Admiralty sketch (No. 2168), seven to eight fathoms, but as the sketch is otherwise incorrect, too much confidence should not be placed in this measurement. A few patches of the shoal dry at low tide, but the greater part of its extent is indicated only by the kelp which grows thickly on it during the summer.

McKay's Cove.

Within the narrows, on the north shore, is a cove, where a small house for the purpose of trade with the natives was built some years ago, but is now abandoned. The tide-flats are wide, but off them a small schooner may find a pretty secure anchorage, though the tide—which runs strongly in the mouth of this inlet—sweeps round the cove.

Cumshewa village.

Cumshewa Indian village is situated on the north side of the inlet, the houses being arranged along the shore of a bay which faces south-eastward. A small rocky island which may be called *Village Island*, lies off it, and is connected with the main shore at low-tide.

The ruins of an abandoned village exist on the outer point near Cumshewa Island, but this one has probably never been of great importance.

Anchorage.

On the sketch of Cumshewa, published by the Admiralty, an anchorage with eleven and twelve fathoms of water is shown behind the

Peninsula. This is a mistake, as the bay there is quite shallow. The best anchorage for a large vessel is probably to be found on the south side, nearly opposite the Peninsula, and abreast a stretch of low land, at the entrance of a large stream.

Coast between Cumshewa and Skidegate.

From the entrance to Cumshewa Inlet, the coast runs north-north-westward to Spit Point, at the south side of Skidegate Inlet, a distance of sixteen miles. It is indented by two considerable bays, the northern of which may be called *Copper Bay*, from the fact that some work has been done here at one time in examining a deposit of copper ore. The land is low, and very different in appearance from that of the coast southward. In a few places it rises at the shore to a height of about 200 feet, and generally attains this elevation at some distance inland. The projecting points are generally low and flat, formed of gravel deposits, elsewhere referred to as probably indicating a slight elevation of the land. In correspondence with the change in the character of the land, the beach becomes flat, and shoal water extends far off shore. Near Cumshewa the beaches are almost entirely composed of boulders, but show more gravel and sand toward Skidegate, though plentifully strewn with erratics, especially near the projecting points. The surface of the country is densely wooded with trees of large size. Spit Point is low, and composed of sand deposits, which extending northward form the bar or shoal which stretches across the entrance to Skidegate Inlet.

Entrance to Skidegate.

The country on the north side of the entrance to Skidegate is also low. The shoal just referred to runs across from Spit Point toward Lawn Hill, which may be considered as marking the outer north point of the inlet. The ship entrance is from the north, with a least depth of 11 fathoms. The bar may also be crossed, however, with $3\frac{1}{2}$ fathoms of water south of the Bar Rocks, opposite Dead Tree Point. As Skidegate Inlet has been surveyed and a reliable map is published by the Admiralty (No. 48), it will be unnecessary to add further remarks as to its navigation. The bar is remarkable in sloping off very gradually seaward, while toward the inlet it dips steeply down into water of 20 or 30 fathoms.

Skidegate Inlet

Skidegate Inlet runs west-south-westward. At about eight miles from the bar it is contracted to a width of about a mile and a half between Image Point and that on the north-east side of Alliford Bay. Within this it opens widely, forming two great expansions, which are separated by Maude Island. The eastern part of the northern expansion is called Bear Skin Bay on the chart, while its western extremity, turning north-westward, forms Long Arm; the total length of the Inlet from the bar to the head of Long Arm being about twenty-one miles. The deposit of coal which has been mined is situated in the angle east of Long Arm, and was reached by a small railway from Anchor Cove. Many islands, of which the largest is named Lina Island on the chart, are scattered in the northern expansion of the inlet. The southern expansion may be called *South Bay.* It holds one large island—South Island—and at its western side passes into a narrow water which becomes *Skidegate Channel,* and communicates westward with the ocean.

Mountains rising towards axis of Islands.

From the east shore of the islands the country rises gradually till at the narrow portion of the inlet, at Image Point, hills exceeding 1000 feet in altitude border it on both sides. Further westward the mountains increase in height and become more rugged, till the mountainous axis of the islands is reached. This crosses the inlet at Long Arm, and shows several summits between 3000 and 4000 feet high, some of which carry a little snow all summer on their shady sides. Their outlines are not remarkably rugged. On the eastern flanks of the range the mountains in several places show long slopes with steep escarpments and other peculiarities of form usually found where they are composed of massive tilted strata. These are in this instance those of the coal-bearing Cretaceous series. Westward of the axis the mountains are again lower, with rounded forms.

Slate Chuck Brook and route to Masset.

Many small streams flow into Skidegate Inlet, but none deserving to be called rivers. The most considerable is that which has been called the Slate Chuck on the chart. It reaches the inlet about a mile north of Anchor Cove, coming from a wide and low valley which runs north-westward into the mountain range, and is nearly parallel to that occupied by Long Arm. Slate Chuck Brook is so called from the fact, mentioned by Mr. Richardson,* that from a quarry a few miles up its course the Indians obtain the dark shaly material from which they make carvings. The Indians now appear to know little about the upper part of the Slate Chuck, but say that it comes from a large lake, from the other end of which (or near it) flows a stream which reaches the head of Masset Inlet. In former years this route was occasionally used, part of the distance being accomplished in canoe and part on foot through the woods. Of late years it is supposed to have become impassable from windfall due to fires. The Ya-koun River was pointed out to me in Masset Inlet as that by which part of the journey was made. The distance in a straight line between tide-water at the two points indicated is about twenty-five geographical miles, or twenty-eight and a half statute miles.

The shores of Skidegate Inlet are not so bold as those of the fiords to the south, and are generally fringed with a beach of greater or less

* Report of Progress, 1872-3, p. 61.

width. The surrounding country is densely wooded, and in the valleys or where the land forms a flat border near the sea, timber of magnificent growth is found. In the cove at Image Point some rude buildings have been erected in connection with the dog-fish fishery, in which two persons were engaged at the time of our visit. Half a mile inland a few trees have been felled for the purpose of obtaining wood for barrels, and a little opening made which enables one to form some idea of the straightness and size of the trees composing the forest. These are chiefly Menzies spruce (*Abies Menziesii*), and yield a clean white wood of moderately fine grain, and apparently well suited for the manufacture of lumber. Fine timber.

The Skidegate Indian village is nearly half a mile in length, consisting of a row of houses, with the usual carved posts, fronting on Village Bay of the chart. A second village is situated on the east end of Maude Island. This is quite new, having been formed by the Kuper Inlet (or 'Gold Harbour') Indians within a few years. Indian villages.

From South Bay, Skidegate Channel runs nearly due westward fifteen miles to the Pacific. Six miles from its western opening it bifurcates, one arm running probably about west-south-westward, and forming an island of the region between it and the main channel. About mid-way from South Bay to the west coast, *North Arm* runs northward about two and a half miles. From South Bay to *Log Point*—eight and a half miles—the channel is quite contracted, but two parts of it are particularly so, and may be called the *East* and *West Narrows*. The first includes three miles of the channel, which does not average over a quarter of a mile in width, and in one place is contracted to about 200 feet. At high tide this has the appearance of being a deep open channel with a few small rocky islands and rocks only, but at low water it becomes almost dry for long stretches, with a small and tortuous water-way between gravelly banks. The West Narrows is at Log Point, is much shorter than the last, and probably not less than two cables in width where least. It is very shoal, however, over a great part of its width, with several rocks in the centre near the deepest channel. The tides from the east and west meet about the East Narrows. The current runs through the channel with great force, probably at the rate of five knots in several places. A small schooner might be brought through Skidegate Channel, passing the narrows at slack water of high tide. She could not be taken through both narrows, however, at one tide, as the slack water lasts for a very short time. The channel can only be considered navigable for boats and canoes. Skidegate Channel. East and West Narrows.

At Log Point the channel suddenly becomes about a mile wide, and continues to widen slightly till it opens to the ocean, affording no

West entrance of Channel.

sheltered anchorage. Two miles west of Log Point, the south-western branch of the channel runs off, going first southward for about a mile. At this point it is blocked by the delta of a brook of some size, which enters from the south-east. A bank has been formed here, which dries for a width of at least a quarter of a mile at low water, and even at high tide cannot have more than four feet of water on it. This passage is therefore only adapted for canoes or boats, and is used by the Indians when travelling between Skidegate and Port Kuper. A vessel entering the north arm of Skidegate Channel from the west might probably find a secure anchorage in the entrance to the south-west arm just mentioned.

Character of the country.

The central portion of Skidegate Channel, though narrow, occupies the middle of a valley of some width, and is bordered generally on both sides by low wooded land, sloping gradually up to the foot of the mountains, which rise to elevations between 1000 and 1500 feet. This is also the case with the arm which projects northward, and a transverse low valley connects this with that occupied by the Long Arm. Beyond Log Point the channel assumes the general character of the inlets of the west coast. The shores become steep and rocky, with little or no beach. The trees covering the hills become scrubby in appearance, and are mingled with much dead wood. Scarcely any soil clothes the slopes, and entensive patches of bare rock become evident among the foliage. The higher mountains are from 1500 to 2000 feet in height. Their summits are frequently bare, and show the characteristically green tint due to a sphagneous covering of moss, and small bushes, as distinguished from the usual sombre hue of the conifers. The 'yellow cedar' (*Cupressus Nutkatensis*) becomes abundant toward the west coast, but is generally of no great size.

Skidegate to Rose Point.

The distance from Lawn Hill at the entrance to Skidegate, to Rose Point is forty-six miles. The coast in some respects resembles that between Cumshewa and Skidegate, and is straight and open, with no harbour, and scarcely even a creek or protected cove for canoes or boats for long distances. The beach is gravelly, and sometimes coarsely stony, to the *Tl-ell River*. Beyond this it becomes sandy, and though not without some gravel, continues to hold this character to Rose Point. Lawn Hill is evidently formed by an outcrop of Tertiary volcanic rocks elsewhere described. For many miles northward, banks of clays and sands are found along the shore, and for about seventeen miles northward from the Tl-ell River these frequently rise into cliffs fifty to one hundred feet in height. These are generally wearing away under the action of the waves, and trees and stumps may be noticed in various stages of descent to the beach. In some places dense woods of fine upright clear trees are thus exposed in section, and there must be much fine spruce timber on the wide low country which stretches back from the shore toward Masset Inlet. Very frequently the timber seen on the immediate verge of the cliffs and along the shore is of an inferior quality, owing to its exposed position. The soil where shown in the cliffs is generally quite sandy, or peaty in hollow places in which water has collected. Sand hills, or elevations resembling such, are seen in some places in section in the cliffs, and it is likely that further inland where these are not found the soil has a better character, though the fact that the upper layers of the drift deposits are of sand and gravel renders it probable that it is generally light. Soil.

North of the range of cliffs the shore is almost everywhere bordered by sand hills, which are covered with coarse grass, beach-pea and other similar plants, and would afford fine grazing for cattle. Behind these are woods, in some places burnt and the trees generally undersized and scrubby. This part of the coast is also characterized by lagoons, and is evidently making, by the banking up of the sand under the action of the sea. The largest of the lagoons opens at Cape Fife of the chart, running southward some miles, and according to the Indians communicating with a second further inland. The mouth of this forms a safe harbour for boats or canoes at high tide, but is nearly dry at low water. Sand hills and lagoons.

The Tl-ell River just alluded to reaches the sea ten and a half miles north of Boulder Point, at the entrance to Skidegate. It is a stream of some size. For about three miles above its mouth it runs nearly parallel to the shore, about half a mile back, and separated by a low swampy strip of land of that breadth only from the sea. This land is of comparatively modern formation, being composed of sand and gravel banked up by the action of the waves. It is partly open and in part covered with spruce trees of no great size. A ruined Indian house, which must have been very large, stands about three miles south of the mouth of the river, and near this the Indians say it formerly debouched. This is probably correct, though it can scarcely have been during the existence of the building of which traces are now seen. The water of this river is of a dark coffee or amber colour, and a similar tint distinguishes that of all streams of the northern low part of the islands. In the bay to the north of Cape Ball an Indian village, of which some of the houses are still standing, was formerly situated. The Indians report that at very low tides patches of hard clay appear a long way off Cape Ball. They relate further that many years ago a vessel went ashore on these shoals, and got off only by throwing overboard many things, of which one was a brass cannon. On some parts of the shore near Cape Fife magnetic iron sand is abundant, and in this numerous 'colours' of gold can easily be found. Tl-ell River. Ruined house. Deserted village. Gold.

Rose Point. Rose Point was so named by Douglas in 1788, but is known to the Haidas as *Nai-koon*, or long nose. It is a remarkable promontory, dependant apparently on no geological feature, but caused merely by the meeting of the currents and waves from the southward and westward round the corner of the island. The inner part of Rose Point, near Cape Fife, does not differ from the low wooded coast to the south, though according to Indian accounts there are inland a great number of lakes and swamps, which may probably be lagoons like those just referred to, but have become completely land-locked and hold fresh water. Further out, where the point is narrower and more exposed, it is clothed with small stunted woods, which in turn give place to rolling grass-covered sand-hills. Beyond this the narrow gravelly point is covered above high-water mark with heaps of drifting sand, and great quantities of bleached timber, logs and stumps piled promiscuously together. The apex of the point is a narrow steep-sided gravelly bank, which runs out for a long distance at low water. Two small vessels belonging to the Hudson Bay Company have been lost on this point, which being so low is very dangerous in dark or thick weather, and, in the absence of a survey of the extension of the banks off it, should be given a wide berth.

Dangerous banks.

Rose Point to Masset.

From Rose Point to Masset the minor indentations of the shore are so slight that it may be described as forming one grand crescentic bay twenty-one miles in width. With the exception of a few small rocky points the beach is smooth and regular, and almost altogether composed of sand, though in some places coarse gravel occurs, and in its steep slope above the ordinary high-water mark, evidences the action at some times of a very heavy sea. Low sand-hills generally form a border to the woods, which densely cover the land, and grow in dark groves, with comparatively little underbush in many places, but generally rather scrubby. The trees are chiefly *Abies Menziesii*. The water is shoal far off the shore, especially on approaching Masset, where kelp forms wide fields at a great distance from the beach. Eight miles from Rose Point is the *Hi-ellen River*, a stream of some size, which is frequented by great numbers of salmon in the autumn. Its mouth forms a good boat harbour. On its east bank are the ruins of an Indian village, on its west *Tow Hill*, an eminence remarkable in this low country, faces the sea with a cliff composed of columnar volcanic rocks of Tertiary age. A mile and a half west of the Hi-ellen River are several rude houses, inhabited by the Masset Indians during a portion of the summer while they are engaged in curing halibut and making dog-fish oil. It is uncertain whether Tow Hill or a broad low elevation which lies a short distance inland near Cape Fife is the Nagdon (evidently a corruption of Nai-koon) Hill of the chart. From

Salmon river.

Fishing village.

a distance of ten or fifteen miles northward the two appear to lie together in the axis of Rose Point.

The north shore of Graham Island near Masset is generally low, with shoal water extending far off, though at a distance of about twelve miles from shore, in Dixon Entrance, the depth is about 100 fathoms. At Masset, instead of the wide open bays generally met with, we find a funnel-shaped entrance leading to the narrow waters of Masset Sound. Masset requires to be approached with great caution by vessels, as, according to the sketch published by the Admiralty, a bar with only about 3 fathoms of water stretches across between the outer points. On the map accompanying this report the bar is indicated according to the sketch referred to, which may be approximately correct only. Inside the bar the depth increases to 9 and 11 fathoms, and anchorage in 10 fathoms is found in a bay on the east side, opposite the chief Indian village. The strength of the tide, however, renders this a poor stopping place. Owing to the great expansion of the upper part of Masset Inlet, the current continues to run up the sound, opposite Masset, for about two and a half hours after the water is falling by the shore, while the ebb runs out for about three hours after the tide has begun to rise on the beach. Approaches to Masset.

The village just mentioned is called *Ut-te-was*, and here is situated a Hudson Bay post—the only one on the Islands—and a station of the Church Missionary Society, in charge at the time of our visit, in August, 1878, of Rev. Mr. Collison. The station has now been established for two years. About a mile south of this place, also on the east shore, is a second village, and on the opposite side a third. Though all these are now decaying and with comparatively few inhabitants, Masset must at one time have been a very populous place. Mission station.

The land in the vicinity of Masset is all low, no hills being visible. It is generally densely timbered with fine spruce trees, but there are reports of 'prairies' in the interior, which may not improbably be swamps. Three miles up the sound a lagoon or arm runs off on the east side. At this place the land pretty suddenly attains an elevation of 100 feet or more, spreading back in a flat or gently undulating plain at this level. Where seen in the banks this is formed of drift deposits. Clays and gravels below, hard-bedded sands above. Nearly opposite this place, on the west side is *Maast Island*, which appears to have given its name to the entire inlet. It lies across a bay, which seems at first sight to offer better anchorage than that already referred to. The island is, however, low and sandy, and a great part of the bay or passage behind it is dry at low water. The length of Masset Sound from its seaward entrance to the point at which it expands widely is nineteen miles. It is about a mile in average width, and though Country about Masset. Masset Sound.

slightly tortuous, preserves nearly the parallelism of its sides. The depth, ascertained in a few places, varies from 10 to 12 fathoms. A number of little streams enter at the sides, most of which, according to Indian reports, have their sources in small lakes. Four and a half miles from the southern or inner end of the sound, where its trend is nearly south-west and north-east, a narrow passage runs off nearly due southward, joining the expanded portion of Masset Inlet, and forming a large island, the general altitude of which is somewhat less than that of most of the surrounding country. This passage is partly dry at low water, but is occasionally used by the Indians in canoes.

Great expansion.

At its southern end, the narrow part of the inlet—which has been called the sound—expands suddenly to a great sheet of inland water, which with an extreme east and west length of seventeen miles, has a breadth where widest of five and a half miles. This, to the northward and eastward is bounded by continuous low wooded land, probably based throughout on drift deposits like those seen in Masset Sound and on the east coast of the island; to the west and south by hills, rising to mountains in the distance. Even these, however, are comparatively rounded in form, and probably never exceed 1500 feet in height. The northern and southern shores are of even contour, and often bordered by wide shoals covered with boulders. The western half of the expansion is studded with islands, and it is rather irregular in outline, forming four large bays or inlets with intervening mountainous points. The shores are here steep, with narrow bouldery beaches sloping down at once into deep water. About the heads of the inlets, and near the mouths of streams only, are small areas of flat ground found. Of these inlets that which reaches furthest southward is called by the Indians *Tin-in-ow-e.*

Tsoo-skatli.

On the south side of this great expansion, five miles from its eastern extremity, is a narrow passage, the mouth of which is partly blocked by islands, but which leads into a second great expansion called by the Indians *Tsoo-skatli*, or 'the belly of the rapid.' The largest of the islands in this passage is called *Slip-a-ti-a.* A small one to the east of it (and connected with it at low tide) *Chītz.* A third, to the south of the first and in the middle of the passage, *Hlout.* Kelp grows abundantly in the channels on both sides of the islands, which cannot therefore be very deep. The tide runs through them with great velocity, especially at ebb, when in the western channel it forms a true rapid, with much white water. The upper expansion, or Tsoo-skatli, is nine and a half miles in length, and much less in width than the first. Its eastern side, as in the first, is formed of low land, while its south-western extremity is a long fiord-like inlet. In this upper expansion there are many islands, the largest of which (*Has-keious Island*) is nearly a mile

Second expansion.

in diameter and about 200 feet high. The eastern portion of the south shore is rocky, and, sloping very gradually down below the water-level, gives rise to a complication of small islets and rocks. On the east side of Tsoo-skatli, two and a half miles from its extremity, is a rather remarkable hill, (*Tow-us-tas-in*) with a steep cliff on one side, to which the Indians have attached a curious story. The north-eastern part of Tsoo skatli has a depth of from 10 to 16 fathoms. The depth of the north-western part, about the centre between the large island and the mainland, was ascertained in one place to be 23 fathoms. That of the south-western arm is probably considerably greater.

Many streams flow into these upper expansions of Masset Inlet, of which several well deserve to be called rivers. The largest is probably that which is known as *Ya-koun*, and enters the south-eastern corner of the northern expansion of the inlet, in the bottom of a shoal bay. About the mouth of the river are large sandy flats, dry at low tide. It was formerly navigable for small canoes a long way up, and is reported to head in a large lake which, probably, like the expansions of Masset Inlet, lies along the junction of the hilly and low countries. This is the stream mentioned on a former page as forming a portion of the disused route from Masset to Skidegate. According to one account, the distance to be traversed on foot, after proceeding up the river as far as possible, is about half a day's journey. A trail from near the mouth of this river also formerly led eastward to the old Indian village near Cape Ball; but owing to heavy windfall caused by fire, both this and the navigation of the river have been given up. On the west side of the bay at the mouth of this river are a few small houses, which are inhabited during the salmon fishing season.

Old routes to Skidegate and Cape Ball.

The *Ma-min River* joins the Tsoo-skatli expansion at its east end, and has a wide delta-flat about its mouth. It is navigable by small canoes for several miles, but is much obstructed by logs. It probably rises in a lake among the mountains to the south-west. The *A-wun River*, joining the first expansion of the inlet from the south, some miles west of the entrance to Tsoo-skatli, was not particularly examined, and may not be large. It is said to rise in a lake. The *Ain River*, entering the same expansion from the north-west, is an important stream. There are several Indian houses which are occupied in summer about its mouth, and two about half a mile up its course. It is said to flow out of a very large fresh-water lake of the same name, the river itself being short. The lake is filled with islands, and is a favourite berrying place in the autumn. In winter it is frozen completely over.

Entering rivers

The rise and fall of the spring tides at the entrance of Masset Sound was estimated at about fourteen feet, but owing to the length of the narrow sound, the first expansion has a tide of from eight to ten feet

Irregularities of tides.

only, and the second or Tsoo-skatli still less, about six feet. On August 13th it was high water at the entrance of Masset Sound at 1h. 15m. P.M., while in the narrow entrance to Tsoo-skatli, twenty-three and a half miles distant, the flood had just caused a reversal of the current at 0h. 20m.

Masset to Virago Sound.

The coast between Masset and Virago Sounds is everywhere low, and differs from that east of Masset in being rocky or covered with boulders. No wide sandy bays occur. The points are generally of low rocks, dark in colour and of Tertiary age. The water is shoal far off shore, with wide fields of kelp. The trees along the shore are not of great size, and are interspersed with occasional open grassy spaees.

Naden Harbour

Virago Sound, constituting the entrance to *Naden Harbour*, is situated in the bottom of a deep bay, in whieh, aceording to the Admiralty sketch, the water averages about 4 fathoms in depth. The shoalest water lies a little outside the narrow sound, and is 3¼ fathoms. In the sound the water is from 8 to 15 fathoms. The sound is less than two miles in length, and leads into a spaeious harbour about four miles in greatest length, and two in width, with an average depth of 8 to 10 fathoms. Low land densely wooded with spruce (*A. Menziesii*) and hemloek (*A. Mertensiana*) of fine growth borders the whole harbour. Roek appears on the shore only near the bottom of the harbour and at the *Kung* Indian village, in the sound. The south-eastern shore of the harbour is low, with wide tide-flats, the north-western comparatively bold. On the sketch of the harbour which accompanies the report, the soundings in the bay and sound, with the outlines of the shoals, are adapted from the Admiralty sketch before referred to. Owing to the inaeeuraeies in form of the older plan, the ehannel may not be quite correetly laid down, and should be navigated with caution.

Naden River.

The *Naden River* enters the harbour at its south-east corner, and is probably the largest river on the Queen Charlotte Islands. It flows from a large lake, which aceording to the Indian accounts must be ten miles or more in diameter. A canoe ean be poled up the river in about half a day to the lake, but the stream has lately become encumbered with many fallen trees. We rowed nearly two miles up the river in a large boat at high tide. Its general course is a few degrees west of south, and with the exception of a few swampy flats, its banks are densely wooded. Several smaller streams enter the harbour; one, in the south-west corner, is called *Te-ka* by the Indians, on the Admiralty sketch Stanley River.

Sites for saw-mills.

Before many years extensive saw-mills will doubtless be established on Naden Harbour. It is well situated for the export of lumber. The quality of the spruce timber is exeellent, and besides the immediate shores of the harbour, logs might probably be run down the Naden River from the lake above.

The Kung Indian village stands on the margin of a crescentic sandy beach on the west side of Virago Sound, facing southward. It is now being abandoned for the new *Ya-tza* village to the north-west. Opposite the Kung village is a good anchorage. Indian villages.

From Naden Point, on the west side of the bay of Virago Sound, the general trend of the shore-line is west-north-westward for about seventeen miles to Knox Cape, forming the north-western extreme of Graham Island. The shore and country behind it are generally low, though with some rocky cliffs of no great height. The points are rocky, but wide gravelly or sandy bays intervene. Some rocks occur at a little distance off shore, but there is no appearance of a wide shoal belt like that found east of Masset. *Klas-kwun Point* is a remarkable promontory, rising in the centre to a hill about 200 feet in height, which, owing to the flat character of other parts of the shore, is visible for a long distance. In a rocky bay to the east of the point, and quite open to the north-eastward, is the new Ya-tza Indian village. Half-way from Klas-kwun Point to the east entrance to Parry Passage is the *Jal-un River*. This stream is of no great size, but its mouth, in the bottom of a little bay, forms an excellent canoe or boat harbour at high water, and appears to be a favourite camping place of travelling Indians. Three miles further westward is a small promontory, on the east side of which is another excellent boat harbour. To the west is a wide bay, which may be called *Pillar Bay*, from a very remarkable rock which stands in it. This is a columnar mass of sandstone and conglomerate, about twenty-five feet in diameter and ninety-five feet high. The summit is sloping and covered with some small bushes. It is separated by water from the main shore at high tide, but rises from a sandy and stony flat at low water. The Haida name of this remarkable object is *Hla-tad-zo-wōh*. Klas-kwun Point. Jal-un River. Pillar Bay.

Parry Passage, so named after the late Sir E. Parry, separates North Island from Graham Island. The passage proper is about two miles in length, with an average width of three-quarters of a mile, and opens westward into Cloak Bay of Dixon. Off the point on the south of the eastern entrance is a low rock, with a second reef covered at high water a little further out, rendering it necessary to enter with a south-westerly course. Lucy Island, on the north shore of the passage, is separated from the south shore of North Island by a narrow channel, on the north shore of which is a small Indian village, which was in former years a place of importance, and is evidently that called Tar-tanne by Douglas. A reef runs off the east end of Lucy Island, and a wide shoal with kelp stretches eastward from the shore of the southern extremity of North Island. Between these the channel extends with 8 to 11 fathoms of water. Abreast the Indian village the depth in the Parry Passage.

Indian villages. channel is 6 fathoms. Two deserted Indian villages (*Käk-oh* and *Kioo-sta*) lie on the south side of Parry Passage, near its west entrance. The water is here shoal and rocky for some distance off shore, and off the entrance point a sandstone reef runs northward half-way across the passage. On the north side, west of Lucy Island, is a deep cove, with high banks and cliffs surrounding it. This is doubtless that referred to as Henslung in Imray's Pilot, and said to be a good anchorage. Bruin Bay, abreast of Lucy Island on the south side of the channel, may also be used as an anchorage. It is, however, rather open to the north-east, and is not sheltered from the tide, which forms a race in Parry Passage. The flood runs eastward, leaving the east end of the passage with a north-easterly direction. The ebb runs in the opposite direction, and sets round the point west of Henslung with great force. Cloak Bay forms the western entrance to Parry Passage, lying between the south-west shore of North Island and Cape Knox. It is about two and a half miles wide, with a similar depth. Some rocks on which the sea breaks only in heavy weather lie some distance off the North Island shore, and there are also a couple of remarkable pointed islands on this side. The east side of North Island affords no good anchorage. Cape Knox is a long narrow tongue of land, on which are a few low hills. It appears to be formed throughout of the same hard intrusive rock as Lucy Island, and may be considered as representing a gigantic dyke of this material running in an east and west direction. Its south side is bold, and off it lie several rocks, the farthest out at a distance of about three and a half miles off the cape. On these the swell of the Pacific never ceases to break with great fury. A rough trail about a mile in length leads from the Kioo-sta Indian village across the neck of land at the base of the promontory of Cape Knox to *Lepas Bay* on the open west coast. From the point to the south of the bay a considerable range of the coast to the south-westward can be seen. It is rough, with cliffs and pinnacles of rock, and breakers extend far off the coast.

Cape Knox.

Lepas Bay.

North Island. North Island is entirely composed of low land, no point probably reaching a height of 300 feet. It is densely wooded. The land to the south of Parry Passage is similar in character. From Lucy Island, at the western extremity of North Island, hills of some height are seen coming out to the coast nearly abreast of Frederick Island, about fifteen miles to the south-westward. From this point of view Frederick Island is well open from the main shore, a fact showing the inaccuracy of the outline of the islands as represented on the Admiralty chart (No. 2430.)

According to the notes given in Imray's Pilot, before referred to, the west coast, from Parry Passage to Frederick Island, appears to afford

PLATE II.

G. M. D., Photo. Aug. 24 1878.

PILLAR ROCK PILLAR BAY, GRAHAM ISLAND.

no shelter, consisting of several open bays with outlying rocks. Hippa Island is said to be high and bold seaward, and the portion of the coast in its vicinity more broken than that to the north, and with deeper inlets and apparently fewer rocks lying off. A large high island is said to be situated on the north side of the entrance to Skidegate Channel, while another island, much smaller and peaked, stands out clear of the land at about three or four miles further northward. Kuper or Kennedy Island has a channel on each side leading into Mitchell or Gold Harbour. The north or Inskip Channel is eight and a half miles long by about half a mile wide. A little without its entrance are some small islands, but no difficulty is found in discovering the passage in. No bottom was obtained in the channel at 60 fathoms, but a cast was obtained at the entrance at 35 fathoms on a halibut bank. On the north side, about three and a half miles up the channel is a deep opening, and where Inskip and Moore Channels meet are two additional openings to harbours, with some small islands lying near them. West Coast. Inskip Channel

Moore Channel, on the south side of Kuper Island, was surveyed by H.M.S. Thetis in 1852, at the time that large numbers of adventurers from California and elsewhere had collected in the vicinity in search of gold. The channel is five miles long, by half a mile wide, with bold high shores, covered with trees. No bottom was obtained at 70 fathoms in mid-channel. On the north side, just without the entrance are some small rocky islands named the Moresby Islands, and on the south side a few rocks close inshore. Mitchell or Gold Harbour is about two and a half miles deep by half a mile wide, and is surrounded by precipitous and densely wooded hills 700 to 800 feet in height. At its head is Thetis Cove, with a sandy beach and stream of water. At one and three-quarter miles up is Sansum Island, with ruins of huts. The anchorage lies inside this, in Thetis Cove. Keeping Sansum Island on the port hand, the passage is a cable wide, with deep water. The cove is quite land-locked, but squalls, with rain, come over the hills with considerable violence. Half a mile from the mouth of the harbour, on the starboard side going in, is Thorn Rock, with three feet at low water. It lies about a cable-length from the shore, and on the opposite side, not quite so far from the land, is a second rock. With a fair wind, and the ship kept in mid-channel, nothing is to be feared. One mile westward of Mitchell Harbour, and on the same side of Moore Channel, is the entrance to Douglas Harbour, which appears to be very similar to Mitchell Harbour, and is separated from it only by the Josling Peninsula. Moore Channel Gold Harbour.

The land being very high on both sides of the channels leading into these harbours, the wind is either right in or out: winds with any westing blowing in, those north easting, out. A sailing vessel leaving

Moore Channel with a south-easterly wind should keep well over to Hewlett Bay, so as to pass clear of the Moresby Islands, as the wind is very unsteady till clear of the high land.

Cape Henry, three miles south of the entrance to Moore's Channel, ends in a steep slope, with a hillock at its extremity. Eighteen miles

Tasoo Harbour. further south is the entrance to Tasoo Harbour. The intervening coast is high, and rises abruptly from the sea. The entrance to Tasoo Harbour is said to be short and narrow, the harbour itself large and deep. Anchorage is found near some small islands on the port hand going in. From Tasoo Harbour to Houston Stuart Channel is very bold. There are several openings which are reported by the Indians to lead to good harbours. Louscoone, at the west entrance to Houston Stuart Channel, is said to be a good harbour similar to Rose Harbour.

The time and means at my disposal did not enable me to make a survey or geological examination of the west coast of the islands, which would require to be carried on during the early summer, which appears to be the least boisterous portion of the year. It is a very dangerous lee shore for sailing craft, and would, I believe, be most easily dealt with in one of the canoes of the country, manned by a good Indian crew.

Tidal currents. Strong tidal currents prevail in the waters surrounding the Queen Charlotte Islands. The tide from the southward and that which has passed round the north end of the island meet between Rose Point and Cape Ball. The flood runs northward along the southern part of the east coast, and eastward in Dixon's Entrance.

Great abundance of fine timber. The well-known Douglas fir does not occur in the Queen Charlotte Islands, finding its northern limit on the outer coast at the north end of Vancouver Island. The forest is chiefly composed of Menzies spruce (*Abies Menziesii*), the western cedar (*Thuja gigantea*) and the western hemlock (*Abies Mertensiana*). The yellow cedar or cypress (*Cupressus Nutkatensis*) also occurs, though seldom in large groves, and generally scattered over the more barren and rocky portions of the hill slopes. Of the trees above mentioned, Menzies spruce, the cedar and the cypress are the most valuable for lumber, and though the first-named is not considered equal to the Douglas fir for most purposes, it must ere long become valuable, and can be obtained of excellent quality and in almost inexhaustible quantity in these islands. Skidegate Inlet would be convenient in many respects as a site for saw-mills, but Naden Harbour or Masset are better situated for the purpose, affording easy access to a large area of wooded country.

Humid climate The great growth of the trees and the comparative immunity of the woodland from forest fires depend principally on the damp character of the climate of the islands, which is also evidenced in many other ways. The heaviest rainfall is, however, local, taking place on the western mountainous axis, where the westerly winds surcharged with moisture first meet an impediment in their flow, and are thrown up into the cooler regions of the atmosphere. It may often be noted that while heavy rain is falling on the mountains the sky is comparatively clear over the strait to the eastward. From this circumstance the triangular area of low land forming the north-eastern part of Graham Island is not subject to an extremely heavy rainfall, and would appear to be well suited to agriculture but for the dense forest covering, which at the present time it will not pay to remove. The Hudson Bay Company have a post at Masset, where, for some years, cattle have been kept, or rather have kept themselves, grazing on the open sand-hills in the vicinity of the coast, and requiring no attention summer or winter. Between Masset and Skidegate a considerable number of animals might live in this way, and it has been proposed to winter mules and horses from the mines of Cassiar in this country. In winter the rainfall in the islands is generally very heavy, with persistently overcast sky, and gales more frequent and violent than those experienced on the coast to the southward. No observations on the total annual precipitation exist. Snow occasionally falls in winter to a considerably depth, but does not lie long, except in the mountains. In the winter of 1877-78 no snow fell on the low lands.

Heavy local rainfall.

Grazing lands.

Snow.

The general remarks on winds given for the coast to the southward in the Vancouver Island Pilot (page 4) apply almost equally well to those of the Queen Charlotte Islands, so far as the observations made in their vicinity show. It would appear from the direction of the wind and behaviour of the barometer that most of the storm centres pass eastward to the north of the islands, and it is probable that the sea to the northward is more tempestuous than in their vicinity. Fogs do not seem to occur with such great frequency as in the southern part of the Strait of Georgia.

Storms and fogs

The temperature of the surface of the sea was frequently observed where local circumstances did not appear to interfere with it. The temperature at the bottom could not be determined owing to the non-arrival of the thermometer ordered for that purpose. Between Victoria and Milbank Sound, by the inner channels, the temperatures taken every evening from May 28th to June 9th give an average of 54°.1 Fahrenheit. From June 10th to August 28th, forty-two observations on different days, all in the vicinity of the Queen Charlotte Islands, give a mean temperature of 53°.8. This may be taken as representing pretty accurately the average temperature of the surface water during the three summer months—June, July and August. Seven observations in the channels between Port Simpson and Milbank Sound, between

Average temperature of the sea.

August 29th and September 12th, give a mean of 54°.5. Fifteen observations between the last mentioned date and October 17th, taken about the north end of Vancouver Island, and by the inner channels to Victoria, give a mean of 50°.7 degrees. Mud brought up in the dredge from one hundred fathoms, in Dixon Entrance, had a temperature of 47°.

Fishing banks. The natives of the Queen Charlotte Islands, as described elsewhere, live almost entirely on fish, more especially on the halibut. To the north of a line drawn from the entrance of Skincuttle Inlet north-eastward across Hecate Strait, the depth of the water never exceeds 100 fathoms, and is generally very much less. A similar shallow area, with a probable width of ten or twelve miles, borders Graham Island to the north, and it is also probably comparatively shoal for some distance off Halibut. the west coast of the northern part of the same island. These banks, swept by strong tidal currents, with the shore line of the inlets and fiords, constitute the feeding grounds of the halibut and other fishes, and by their exceptional extension account for the great abundance of fish to be found in the vicinity of the islands. The halibut is doubtless the most important, and though it has not yet been found marketable either salted or canned, if means were adopted whereby it might be carried in a fresh state to the southern markets, an extensive fishery Dog-fish. might be maintained. The dog-fish (*Acanthus Sukelyi*), found in great abundance, is taken for the manufacture of oil, and a small establishment was at work in this business at Skidegate at the time of my visit, besides the less systematic operations of the Indians. Salmon. Salmon of two or more species run up most of the streams in large numbers, especially in the autumn. They are taken by the natives in wiers and by spearing, but as none of the rivers are large, the opportunities for establishing canneries are not so good as in other parts of Herring. the Province. Herring are very abundant in some places, especially in the vicinity of Skidegate, at certain seasons. A species of pollock or coal-fish is caught in large numbers on certain parts of the west and north coasts of the islands. It is prized by the Indians as a source of edible oil which some tribes use instead of that of the oolachen from Flat-fish. the Nasse River. The last-named fish does not occur in the vicinity of the islands. Flounders and plaice abound in some localities. A true Cod. cod, probably of the same species as that for which vessels sail from San Francisco to the Okhotsk Sea, is found, but is not sought after by the Indians, though it may occur abundantly on certain banks at some Mackerel. seasons. The same remark applies to the mackerel, of which a species is found. Smaller fish, such as the various species of rock-cod and the shell-fish, which form an important item in the native dietary, it is unnecessary to particularize. With the exception of minerals of economic value, more fully treated of in a subsequent part of this report, it would appear that the fisheries and forests of the Queen Charlotte Islands will constitute their chief claim to attention, till such time as the demand for arable land leads to the utilization of that portion of the surface which is fit for farming. Economic importance.

Geological Observations.

General Remarks on the Rocks of the Queen Charlotte Islands.

The mountainous axis of the Queen Charlotte Islands from Cape St. James to Skidegate Channel, and probably still further northward as far as Hippa Island, is composed of a mass of much disturbed, and in some places highly altered rocks, which have at first sight an appearance of great antiquity, but are found on closer inspection to owe this appearance to the inclusion of great masses of easily altered contemporaneous volcanic materials, and to the fact that they have been subjected to an extreme of flexure and disturbance which very frequently takes the character of actual fracture and displacement, as has been observed elsewhere on the Pacific coast. To work out the intricacies of these older rocks, which may be looked on as the nucleus of the islands, would be a work of time and would involve much patient labour. Composition of mountainous axis.

In a preceding report on British Columbia it has been found necessary to include for the present the Palæozoic and Triassic rocks under a single heading.* They lie together unconformably beneath well characterized Cretaceous beds, but are so much involved that no attempt has been made to separate them except locally. In the southern part of the interior of British Columbia both Carboniferous and Triassic fossils have been found among these older rocks, but no forms of greater antiquity. In the Queen Charlotte Islands, now reported on, fossils have been discovered in the rocks unconformably underlying the Cretaceous in a number of places. These serve to characterize a certain zone of argillites and limestones, which is frequently repeated in sections along different parts of the coast, as distinctively Triassic; and show it to represent the so-called Alpine Trias which is so largely developed in California and Nevada. No forms distinctively Carboniferous or Palæozoic have yet been discovered, but from the intimate association of Carboniferous and Triassic rocks in the southern interior of the Province, and more particularly from the occurrence of a great mass of rocks largely volcanic in origin and believed to be Carboniferous in age, in the southern part of Vancouver,—which forms part of the same axis of elevation with the Palæozoic and Triassic rocks. Triassic fossils. Possible occurrences of Carboniferous rocks.

* Report of Progress, 1877-78.

Queen Charlotte Islands,—it is highly probable that rocks of this age may come to the surface in some places. Mr. Whiteaves, who has examined the fossils, does not find any clearly Triassic forms among those from Rose Harbour, the old copper mine in Skincuttle Inlet, and the south end of South Island in Skidegate Inlet. The limestones of these localities may therefore possibly be of Carboniferous age, and if so a large portion of the associated rocks of volcanic origin must be attributed to the same period. As it is at present impossible to unravel the structural complexity of the sub-Cretaceous rocks of the islands, it has been thought best to colour them together on the map as Triassic, in correspondence with their characteristic fossils.

Triassic fossils from Vancouver Island.

Though no report is here made on observations in the northern part of Vancouver Island, it may be mentioned, that Triassic forms identical with those from one of the localities on Houston Stewart Channel, have been obtained on Forward Inlet and Browning Creek, Quatsino Sound.

Contemporaneous volcanic matter.

Any unconformity which may have existed between different beds of this sub-Cretaceous mass of rocks, may now be masked by their complete folding and the great disturbance and fracture to which they have been subjected. The occurrence of great masses of contemporaneous volcanic material during both the Triassic and Carboniferous periods, in British Columbia, has been demonstrated in former reports; and in the event of the lower and possibly Carboniferous rocks proving to be really Triassic, their general character would accord closely enough with that of those known elsewhere.

Rocks of Logan Inlet and vicinity.

The rocks characteristically represented on Logan Inlet, and extending northward and southward from it in a narrow trough, are evidently newer than the greater part of the series of the islands, and their lithological resemblance to those contained in the Cretaceous coal-bearing series of Skidegate is so great that it is not improbable that they may be of the same age. As no beds holding Cretaceous fossils have been found in association with these rocks, it has been thought best to include them for purposes of description with those mentioned above. The area which they occupy is, however, distinguished on the map from that of the older rocks, in so far as my observations enable me to define it.

Disturbance closing Triassic

After the deposition of the rocks coloured as Triassic, and before the newer series with which the coal is associated began to be formed, a period of some disturbance must have intervened, to which a great part of the granitoid intrusive rocks of the region are possibly referable. Portions of these older rocks were raised above the sea level at this time, and the deposition of the Cretaceous coal-bearing rocks was inaugurated. This did not proceed uninterruptedly, however, for we have evidence of the occurrence of a period of great volcanic activity, which led to the intercalation of several thousand feet of almost unmixed volcanic products. Following this, without any marked unconformity was a tranquil period, during which a great thickness of shales and shaly sandstones was deposited, and in connection with the earliest beds of which the Skidegate coal was formed. The overlying conglomerates probably evidence a period of depression, after which, and closing as far as we know the record of the Cretaceous period in this region, an upper series of shales and sandstones was produced in a shallow and quiet sea. The great period of disturbance and mountain formation for the region now supervened, and the only record we have of the time elapsing between the Cretaceous and later Tertiary is in the flexure, crumpling and fracture of the beds.

Cretaceous rocks.

Period of great disturbance.

It would seem that during the portion of the Tertiary period represented by the rocks of the north-eastern portion of Graham Island, the general relative level of sea and land has not been far different from that now obtaining. Wide areas, probably including much swampy land, were covered with a dense vegetation which in favourable circumstances gave rise to lignite deposits. There may have been several minor alterations of level, of one of which we have evidence at Skon-un Point, in the stratum with marine shells which overlies the lignites. The records of the period are closed by the great volcanic flows which were probably supplied by a number of different centres of eruption, the approximate positions of some of which are shown by the coarse agglomerate beds.

Conditions during Tertiary period.

Notes on the Map.

The older rocks of the islands, coloured as Triassic, are placed in this division on the evidence and with the reservations above detailed. Those coloured as Cretaceous constitute the coal-bearing series of Skidegate, and have sometimes been referred to the Jurassic period, though Mr. Whiteaves, on more detailed examination of the fauna, is inclined to place them in the Cretaceous. The Tertiary rocks are chiefly volcanic, and are supposed to stretch below the low north-eastern part of Graham Island, beneath the drift covering. The fossils discovered are not sufficient clearly to prove their Miocene age, but they are classed provisionally as Miocene, as they represent, with little doubt, rocks which have been attributed to this period on other parts of the West Coast. It should also be remembered, in consulting the map, that while the divisions are drawn with sufficient accuracy on those parts of the coast which have been surveyed and examined, the continuation of the lines inland is based on the attitudes of the rocks and physical character of the country alone, and that

Map.

the colouring of the regions of the West Coast which have not been visited is hypothetical only.

TABULAR VIEW OF FORMATIONS REPRESENTED IN THE QUEEN CHARLOTTE ISLANDS.

Post-Pliocene.	Sands and gravels. Plastic and boulder clays, gravel beds, &c.
Unconformity, with evidence of some flexure and disturbance of Tertiary beds.	
Tertiary, probably Miocene.	Volcanic rocks of the north part of Graham Island. Sandstones, with marine fossils and lignites of Skun-un Point. Shales, clays and lignites of Ma-min River and Chin-oo-kun-dl Creek.
Complete unconformity, with evidence of great disturbance. Chief period of mountain making.	
Cretaceous.	A. Upper shales and sandstones. B. Coarse conglomerates. C. Lower shales and sandstones. D. Agglomerates. E. Lower sandstones.
Unconformity, but without evidence of great disturbance.	
Triassic, but possibly passing below into Carboniferous.	Agglomerates and ash rocks of Logan Inlet, &c. (These possibly represent Subdivision D., *supra.*) Flaggy calcareous argillites and thin limestones. Massive limestones. Massive dioritic and felspathic volcanic accumulations, probably including minor limestone beds, occasionally schistose.

Triassic.

The rocks seen in the shores of Houston Stewart Channel are everywhere very much disturbed, shattered by faults and traversed by innumerable dykes. This region lies in the line of the mountainous axis of the islands, and though no extensive granitic masses appear here, the intensity of the force brought to bear on this region is well exemplified. About the middle of the south-west reach of the channel, in a bay on the south-east side, are extensive exposures of limestones and flaggy argillites, with general westerly dips. The limestones are generally in thin beds, bluish-black on fresh fracture, and frequently fœtid when struck. They are cherty, and contain blackish rounded masses or root-like concretions of silica, and blend with the shales or flaggy argillites, which appear to occupy a superior position. The argillites are calcareous throughout, and generally each bed is a few inches thick, though in some cases finely shaly. Fossils were found in abundance in some of the shaly layers and in the limestones. Mr. J. F. Whiteaves enumerates the following species from this locality. They are evidently synchronous with the so-called Alpine Trias of Nevada:— Houston Stewart Channel. Triassic fossils.

1. *Amplexus (?), sp. nov.*
2. *Monotis subcircularis*, Gabb.
3. *Halobia Lommeli*, Wiss.
4. *Sphæra Whitneyi (?)*, Meek.
5. *Arcestes Gabbii*, Meek.
6. and 7. Fragments of two species of Ammonitoid shells, one of which appears to be new. They probably belong to different genera.
8. *Belemnites, sp. nov.*

Felspathic dykes, generally of pale greenish-grey colour, traverse the rocks in all directions, and stand out like ruined walls when the softer beds have been weathered away from them. These so complicate the section as to render accurate measurement impossible, but there is probably 500 feet or more in thickness of the limestones and argillites. Dykes.

At the point on the east side of the entrance to Rose Harbour, large masses of limestone, similar to the more compact layers of that above described, again appear. They are nearly vertical in attitude, with a strike of about N. 26° E., but are traversed by a great number of dykes and intrusive masses of felspathic rock. A few fossils, among which are fragments of gasteropoda, apparently of the genera *Murchisonia, Naticopsis* and *Macrocheilus*, were here again found. Chert is abundant. Following the strike of the limestone in this place, and closely associated with it, are igneous rocks, apparently contemporaneous. The most abundant is dark blackish-green, spotted, and may be called a diabase, though it is difficult from its decomposed character to determine the several ingredients. In it are masses, irregular in form and perhaps concretionary, of paler felspathic material, which project on weathered surfaces and assume a brown sub-metallic polish.

Supposed arrangement of beds.

It would be hazardous to attempt to delineate the course of the beds in the Houston Stewart region on the information obtained. It may be, however, that the limestone just described represents the continuation of that on the opposite side of the channel, which may run with its associated argillites up the centre of Rose Harbour, and so through to South Cove in Carpenter Bay, where the argillites are again found. In this case the limestone exposures near the mouth of the Sedmond River, at the head of Rose Harbour, would represent the same bed on the opposite side of a narrow synclinal occupied by argillites. The fossils obtained in this place, however, differ from those of the first-mentioned locality in facies. Mr. Whiteaves recognizes in the limestone imperfect casts of lamellibranchiata and gasteropoda, which seem to belong to the following genera:—

Fossils from Rose Harbour.

1. *Pecten*, or *Aviculopecten*, one species.
2. *Cardiomorpha* (?), two species. One with radiating ribs, like *C. radiata*, DeKoninck; the other with smooth surface.
3. *Loxonema* (or *Murchisonia*), one species.
4. *Macrocheilus*, near *M. canaliculatus*, McCoy.
5. *Euomphalus*, *sp. nov.* (?)

These fossils resemble those from the point at the east side of the entrance to Rose Harbour, and can scarcely be newer than the Triassic formation or older than the Carboniferous.

Igneous rocks.

The rocks seen elsewhere in Rose Harbour are igneous, massive, and may either be contemporaneous with the limestones and argillites or of subsequent origin. At the west entrance point occurs a grey felspathic amygdaloid, the cavities in which have been lined with a chloritic mineral and then filled with quartz, with in some cases a little copper pyrites. From this point to Fanny Point, at the seaward opening of the inlet, its north-west side appears to be entirely composed of greenish felspathic or dioritic rocks, probably bedded but much altered.

From the eastern opening of Houston Stewart Channel the north-east side of Prevost Island is composed, where examined, for seven miles, of greenish rocks, apparently for the most part dioritic and probably bedded, with general north-westerly and south-easterly strikes. These are supposed to underlie the limestones above described. Small quartz veins with a little copper pyrites were observed at one place. At Forsyth Point, on the north side of Houston Stewart Channel at its east entrance, the rock is a massive granitoid diorite or hornblendic granite, containing fragments of darker rocks like those elsewhere forming a part of the stratified series, and traversed by dark greenish dykes of porphyritic felspathic rock. At Point Langford contorted fragments of much hardened argillites rest in a grey-green felspathic and porphyritic matrix. From this point round the promontory to Islet Point, forming the southern entrance point of Carpenter Bay, the widest expanses are of blackish and greenish argillites, much altered, disturbed and traversed by dykes, but nevertheless in a few places holding impressions of a many-whorled, strongly-ribbed ammonitoid shell, perhaps a species of *Clydonites*. The ribs bear a single row of nodes or spines near the periphery. This is very different to either of the Ammonitoid shells from Houston Stewart Inlet. East of Islet Point these rocks seem to form a broad curve with general north-easterly dips at moderate angles, the highest rock seen being a massive grey-green porphyritic material like a much altered agglomerate.

Eastern part of Houston Stewart Channel.

The rocks in Carpenter Bay are so much disturbed that there is little chance of getting any general idea of their arrangement. They are, however, doubtless of the same age with those of Houston Stewart. Argillites are largely represented, but are everywhere cut up and interfered with by dykes, so much so that in some places fragments only of the sedimentary rocks remain, contorted or steeply tilted. Other areas are characterized by greenish-grey felspathic diorites, of fine grain and often epidotic. It is difficult to say whether these are altered volcanic beds or intrusive masses. At Iron Point, on the north side of the entrance to the bay, are considerable exposures of hard greyish felspathic sandstones, which occasionally become conglomeritic and hold blackish shaly fragments. The dips are undulating, and the formation at this place on the whole nearly flat. Pyrites in small concretionary masses is found in the sandstones, and causes them to assume on weathering a rusty appearance. They are also very hard and somewhat peculiar in appearance, leading at first to the belief that they might be in part of volcanic origin. This, however, is not the case. Under the microscope they are found to consist chiefly of quartz, particles of dark argillites, and a pale fine-grained laminated rock which may be a quartzite.

Rocks of Carpenter Bay.

In Skincuttle Inlet limestones are well represented, and would afford a means of tracing out in detail the structure of the rocks, were sufficient time devoted to this purpose. On the east side of the entrance to Harriet Harbour, flaggy limestones, with some much altered argillites,

Skincuttle Inlet.

Limestone bands.

are found dipping north-westward at an angle of 50°. This appears, however, to be an abnormal attitude due to local disturbance, for what is apparently the same zone of limestone runs south-westward to the inner end of Harriet Island, and bending sharply round this, again appears on the point at the west side of the harbour, and is here well shown, dipping south-westward at an angle of 45°. The limestone is grey and cryptocrystalline, and holds cherty concretions together with siliceous veins which stand out on weathered surfaces. The thickness of the bed is considerable, but is not completely shown. It is underlain by a peculiar material, which appears to be a felspathic ash rock containing a large proportion of calcareous matter. It is grey in colour, speckled by the mixture of light and dark fragments, and shot through with iron pyrites in small concretions and veins. The Bolkus Islands, lying opposite the mouth of Harriet Harbour, in the centre of the inlet, are for the most part composed of similar limestone to that just described. In the bay on the east side of the largest or western island, this is found to overlie a grey rock which evidently represents that described as occupying a similar position in relation to the limestone at Harriet Harbour. It here, however, simulates an amygdaloid in appearance, but is probably similar in origin to the last. The calcareous matter with iron pyrites has formed rounded concretionary masses. This in turn rests upon a massive green amygdaloid of basic character. The thickness of the overlying limestone as shown on this island is at least 1500 feet. It includes some layers of flaggy limestone, and of a dark grey rock of fine grain which may be called an impure limestone, and has probably been a highly calcareous mud. There can be little doubt but that the limestones of the Bolkus Islands represent those of Harriet Harbour and vicinity, being the north side of an anticlinal fold, the axis of which runs westward up the main channel. It is further probable that the same band, leaving the east end of the Bolkus Islands, runs across to the west end of the Copper Islands, and that the bend thus made corresponds with that shown on the southern side of the supposed anticlinal, in Harriet Harbour. The limestone now described is also probably the same with that found in Houston Stewart Inlet.

Calcareous ash rock.

Possible arrangement of rocks.

Copper Islands.

The Copper Islands are largely composed of grey sub-cystalline limestones, closely associated, and in some cases interbedded, with greenish dioritic rocks, which are often compact, but occasionally evident altered amygdaloids. The general strike is nearly east and west, with prevailing northerly dips at angles of about 30°. In the dioritic rocks, copper ore, in the form of small irregular strings and concretionary masses of copper pyrites, occurs in many places. These weather conspicuously green, and prove the cupriferous character of

Copper ore.

this part of the formation, though no deposits of workable dimensions were observed. Well-defined veins of quartz and calcite traverse the islands in several places with general north-westerly and south-easterly bearings, but were not found to contain any copper.

Peculiar weathering of limestones.

The action of the weather on the limestone exposed between low-water mark and the edge of the woods causes them to assume a rough, pitted surface, on which hollows are separated by steep, sharp-edged ridges and brittle points, sustained generally by some siliceous or other impurity in the stone. Where a hollow is formed which will contain sea or rain-water, it may be noticed that its sides are eaten into along a line corresponding with the height at which the water overflows, a circumstance, no doubt depending on the absorption by the surface of the water, thus for a time stagnant, of carbonic acid from the atmosphere. The peculiarly rough character of these limestone surfaces is, no doubt, due in part to the constitution of the rock, but also to the great rain-fall and persistent cloudiness of the region.

Obscure fossils.

Limestones characterize the shores of the point on the north side of the inlet, opposite the inner end of the Copper Islands, dipping westward on its eastern shore, and in association with argillites northward on its southern. These are somewhat different in appearance from those above described, and it is not known whether they represent a broken portion of the westward continuation of the Copper Islands belt or a second limestone zone of a different horizon.

The fossils obtained here are described by Mr. Whiteaves as.—

1. Casts of a large *Murchisonia* or *Loxonema*, the whorls of which are rather longer than wide.

2. Casts of a discoidal spiral shell, which are so badly preserved that it is impossible to tell whether they should be referred to the Cephalopoda or Gasteropoda.

Copper mine.

On the north side of a small cove on the east side of the point, the greatest amount of exploratory work in connection with the attempt at copper mining, referred to on a former page (p. 17 B.), has been carried on. One small shaft, probably of inconsiderable depth, is on a hard, irregular vein of qurrtz, which appears to hold a trace of copper only on one side. In a second locality a horizontal opening has first been made in the face of a low cliff, not far above high-water mark, and from this a shaft has been sunk. The shaft is now inaccessible, and the whole of the material excavated has been carried away by the sea, so that no idea of its depth or the quality of ore obtained in its bottom can be formed. There is no true vein here, but magnetic iron ore, with a little copper pyrites, forms bunches of irregular form penetrating the country rock at the sides of a compact greenish dyke, which has a general course of N. 34° W. The dyke traverses the limestone of the region, which is here nearly flat, and also an asscoiated and probably contemporaneous dioritic mass. It is probably to intersect this dyke that the shaft has been sunk, but there is now no appearance on the surface which would justify extensive exploration. This is the opening named ' main shaft' on the sketch of the inlet by Poole.

Huston Inlet.

Limestone appears at the points on both sides of Huston Inlet. It is also found on the sonth-west side of the inlet at several points, in association with massive contemporaneous green volcanic rocks, of which one—at the point at the knee of the inlet—is a well characterized amygdaloid. It is not improbable that the anticlinal axis, already mentioned as running east and west south of the Bolkus Islands, turns abruptly at the west end of the inlet to a southerly course, running into George Bay, and thence west of, but nearly parallel to, Huston Inlet. Huston Inlet would then mark the run of one band of the limestone and of the flaggy, calcareous argillites already more than once referred to. At Boulder Island, near the entrance to the inlet, several hundred feet in thickness of blackish argillites, with calcareous concretions and sandstones, and thin limestones, occur, and may represent this band, though it is perhaps more probable that they belong to a small outlier of the overlying Cretaceous coal-bearing series, which appears in the form of sandstone and conglomerate beds at low angles on the south-western point of the Bolkus Islands.

Probable Cretaceous outliers.

Iron ore.

At the east side of the entrance to Harriet Harbour Mr. Poole has marked a deposit of magnetite on his sketch. This occurs on the beach in the form of an irregular mass, which measures on the surface sixty-seven feet across. It is contained in a body of fine grained greenish trappean rock, which is intrusive in the limestones and associated beds. In some places large blocks of nearly pure magnetite may be obtained, while in others it is much mixed with quartz, and contains also a considerable proportion of iron pyrites in irregular bunches and strings. This in decomposing gives the whole mass a reddish colour, and from its intimate association with the magnetite might to some extent injure the quality of the ore. On laying down the course of the dyke at Mr. Poole's ' main shaft,' on the north side of Skincuttle Inlet, it is found to very nearly strike that associated with this deposit, which also appears to have a north-west and south-east course. It is therefore highly probable that both represent portions of the same intrusion. That the iron ore runs southward beyond the locality where it was seen in place in Harriet Harbour is shown by the fact that loose masses of it are found on the south end of Harriet Island. These must have been carried thither from some place higher up the valley, in common with other boulders, during the glacial period.

The ore is a remarbably pure coarsely crystalline magnetite. Specimens of an average character examined by Mr. C. Hoffmann were found to contain 58·06 per cent. of metallic iron, while a fragment exceptionally rich yielded 69·88 per cent. Analysis.

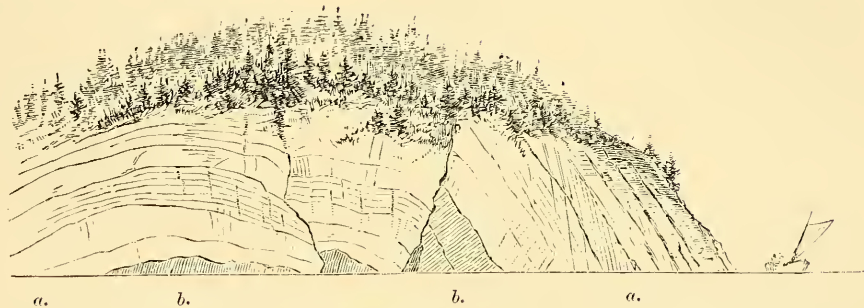
The extremity of Granite Point is composed of a grey coarse-grained syenitic rock, which is evidently intrusive, but the precise relations of which to the neighbouring beds is obscure. Granite Point

In Burnaby Strait green rocks, often evident volcanic breccias, preponderate, and are indeed almost exclusively represented. They are generally massive, showing no distinct bedding, but everywhere jointed and fissured. These are supposed to belong to the great igneous series which underlies the massive limestones. Irregular veins of red-weathering dolerite are abundant in this vicinity. Both points of the eastern bay on the north shore of Burnaby Island are composed of similar massive greenish rocks, but on the east side of the next bay—called Section Cove on the map—limestones appear resting on them, and striking north-westward from the south-east point of Huxley Island and a small islet lying off it. Burnaby Strait.

The rocks in Section Cove were examined with some care and measured by pacing. Their arrangement is represented on the section. (Fig. 2). The line of junction of the green rocks with the limestone is confused by innumerable small faults and fractures. The lower part of the limestone is massive and cherty in places, but it soon becomes flaggy, and contains in some layers abundance of fossils, chiefly belonging to the two following Triassic species.— Section Cove. Triassic fossils.

1. *Monotis subcircularis*, Gabb.
2. *Halobia Lommeli*, Wiss.

After about 350 feet of pretty pure limestone, the beds are concealed for some distance, and when again seen are largely made up of calcareous flaggy argillites, nearly black in colour. These with occasional beds of pure limestone form the whole upper part of the series, to a large felspathic mass on the east side of the bay which appears to be intrusive, and beyond which the beds are so much confused and broken that no estimate of their thickness could be formed. Further on, several additional intrusive felspathic masses occur. They are grey, porphyritic, resemble some of those of Houston Stewart Channel, and are probably of the same age. The thickness of the limestones and flaggy argillites of the lower part of the series which maintain a sufficient regularity to admit of accurate measurement is about 1733 feet. They are generally in a nearly vertical attitude. Argillites and limestones.



FIG, 1. POINT NORTH OF LIMESTONE ISLANDS SHOWING BROKEN AND FAULTED CONDITION OF STRATA.

a. Limestone, b. Contemporaneous volcanic beds.

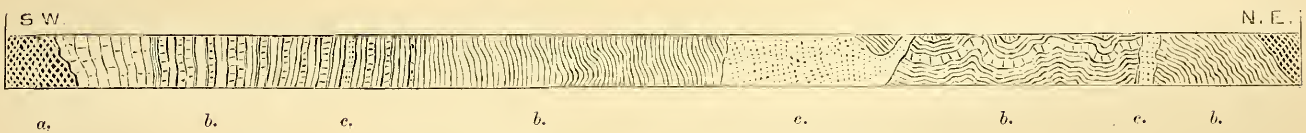


FIG. 2. SECTION OF TRIASSIC ROCKS, SECTION COVE, BURNABY ISLAND.

a. Contemporaneous volcanic matter. b. Limestones and argillites. c. Dykes and intrusions,

Scale, ten inches to one mile.

From the bay opposite Alder Island, the whole north shore of Burnaby Island appears to be formed of greyish dioritic rocks, which occasionally become granitoid, and are composed of two varieties of felspar and pale or dark green hornblende. These are doubtless intrusive, and subsequent in date to the bedded materials. They resemble the granitoid rock of Granite Point, at the north side of Skincuttle Inlet, but this is more highly crystalline and somewhat paler in tint. Dioritic rocks.

From the northern entrance of Burnaby Strait, along the south-west side of Juan Perez Inlet, and on both sides of Darwin Sound, the rocks continue in general appearance like those of Burnaby Strait, but are in the main more felspathic, and in places become schistose, and bear an older appearance. The zone above indicated is probably in fact that of the outcrop of the oldest part of the rock series recognised in the Queen Charlotte Islands, though it does not seem possible to separate it from the rocks before described by any well-marked line. It remains, indeed, doubtful whether the rocks of this region appear in a long, irregular anticlinal or merely form the disturbed edge of a series with general north-easterly dips. The former, however, appears to be the more probable suppostion. In Werner Bay, the rocks seem to be chiefly felspathic, in some places thin-bedded, but are associated with greenish bedded diorites, much resembling those of the Victoria series of the south of Vancouver Island. On the west side of Hutton Inlet, near its entrance, rocks apparently of dioritic composition, but in some places evidently fragmental, and frequently schistose, are interbedded with limestones, which are occasionally converted into white marble. Crinoidal joints were observed on one weathered surface. Greenish and greyish-green rocks, chiefly felspathic in composition but passing, in some cases, into more or less perfectly characterized diorites, continue along the shore to the vicinity of Bigsby Inlet. The southern entrance front of this inlet is composed of similar rocks, but the greater part of its south shore and the mountains rising beyond it are granitic. Where examined, the granite is coarse, and consists of white felspar, hornblend and mica, with little quartz. It forms, without doubt, an extensive mass, and does not pass by gradual stages into the rocks before described. The north shore of Bigsby Inlet is composed of hard grey-green rocks, chiefly felspathic in composition, and in some places evident amygdaloids. Near the north entrance point of the inlet, weathered surfaces of these assume a very peculiar appearance, presenting botryoidal forms, which are involved among themselves in such a way as to preclude the possibility of their being fragments. They appear, indeed, to represent the surface of an old lava flow, which has now again been brought to view by the removal of the superincumbent strata. The appearance of these rocks is much like that of those of the

Outcrop of older rocks.

Fossils.

Rocks of Bigsby Inlet.

Shuttle Island. entrance to Rose Harbour. The rocks of Shuttle Island are generally more or less schistose, and in some places are very markedly so. They are greyish and greenish in colour, and felspathic or dioritic in composition. In one place on the east side a pale grey talcose shist occurs, and the schists are interbedded with limestone or coarse marble in thin layers at the southern extremity of the island. This horizon is almost certainly the same with that of the entrance to Hutton Inlet, above described. Similar felspathic and dioritic rocks, though not so distinctly schistose, form the west side of Lyell Island, with the exception of False Bay, where flaggy, blackish argillites appear, and run south-eastward in a low country toward Sedgwick Bay.

Crescent Inlet. The anticlinal of Darwin Sound probably runs up Crescent Inlet to the north, turning westward with its extremity. In Klun-kwoi Bay the rocks so far as seen are rather dioritic than felspathic, and in some places evident amygdaloids. Argillites appear on both sides of Crescent Inlet. In one place on the south-west shore these were found to be fossiliferous, containing fragments of moulds of an ammonitoid shell of the same species as those from Houston Stewart Inlet, also a small *Pecten* or *Aviculopecten.*

Conglomerate layer. A band of black calcareous argillites with flaggy limestones, in all about 30 feet in thickness and dipping N. 80° W. $<$ 50°, was here also observed to be intercalated between two masses of conglomerate made up of fragments of crystalline rocks, with limestone and pieces of argillite like the surrounding beds. The lower conglomerate is sharply bounded above by the base of the argillites; the upper rests on a broken and disturbed surface of the argillites, evidencing some unconformity by erosion. This little section is rather puzzling, but appears to represent on the whole a conglomeritic mass forming a portion of the great argillite band. White Point, at the east side of the entrance to Crescent Inlet, is composed of pale felspathic rocks, which are probably intrusive.

Area of newer volcanic rocks. To the north-east of the belt of rocks just described, which characterizes the south-west side of Juan Perez Inlet and Darwin Sound, is an extensive area differing in general lithological character from most of the rocks previously met with, and probably representing a higher part of the series. This area, which seems to be a broad synclinal, though complicated by many minor irregularities and folds, has a length of about thirty-one miles in a north-west and south-east direction, with a probable average width of five to six miles. It embraces a great part, at least, of Ramsay and adjacent islands, and of Lyell Island, composes Tan-oo Island and the narrow promontory separating Logan and Dana Inlets, and appears to characterize the greater part of the shores of Selwyn Inlet. The synclinal then seems to turn westward, and was not further seen. The rocks are best displayed on the north side of Logan Inlet. Near the base of Red Top Mountain, on the north side of Crescent Inlet, flaggy argillites appear, much broken and traversed by dykes, but with general low north-easterly dips. They run south-eastward, through low ground, behind the felspathic rocks of White Point, and come out on the shore of Logan Inlet near its west end. These argillites probably represent those frequently before mentioned. They are found on the opposite side of Crescent Inlet, apparently forming the other slope of an anticlinal, which is no doubt the continuation northward of that already mentioned in Darwin Sound. A few fossils (mentioned on p. 58 B.) were obtained from them here, and they were also found to be fossiliferous in the small island near the entrance to Echo Harbour, where *Monotis subcircularis* was recognised. The width of the north shore of Logan Inlet occupied by the argillite band is a mile and a half or more, but the shore is rather low, and the section is not continuous. The argillites are then overlain in apparent conformity by flaggy grey sandstones, chiefly felspathic in composition. These are followed in turn by coarse conglomerates with well rounded fragments, which appear to be chiefly or entirely of crystalline rocks, unlike those of this part of the series. If no faults not recognized affect the strata, the conglomerate must have a thickness of several hundred feet at least. To the conglomerates follow the great overlying series of agglomerate and ash rocks, the distribution of which has been outlined above. These occupy the shore of Logan Inlet for about five miles eastward, but are cut off near the outer point by a mass of coarse grey granitoid diorite with epidote. The agglomerates are occasionally coarse, but usually fine-grained, and graduate into ash rocks, which again pass into a compact material which may be called a felsite, and may in some cases represent former flows of molten matter. The rocks are not highly crystalline, but generally dull and fine-grained on fracture, and pale in colour. The prevalent tints are greys and light grey-greens, and these characterize equally the fragments and matrix of the agglomerates, between which there is frequently very little lithological diversity. The beds are everywhere considerably disturbed, but the north side of Logan Inlet would probably be the best locality in which to make a measured section of the strata. The total thickness of the volcanic series overlying the argillites and conglomerates can scarcely, however, be less than 5000 or 6000 feet.

Fossiliferous argillites.

Felspathic sandstones.

Conglomerates.

Agglomerates and ash rocks.

Thickness.

The greater part of the rocks of Ramsay, Murchison, Faraday and the Tar Islands are supposed to belong to this overlying volcanic series. Well bedded and fine-grained pale felspathic sandstones, probably representing those immediately overlying the argillites at the west end of Logan Inlet, are found on the western ends of the three first-mentioned islands. On the shore of Murchison Island these are intimately associated with hardened blackish argillites, the section being, however, hopelessly confused by the presence of a number of fine-grained pale felspathic and porphyritic dykes. The mass of the argillites probably runs down the north-east side of Juan Perez Inlet, but beneath the water. About the middle of the north-west side of Ramsay Island, rocks differing somewhat from those generally found in the series appear. They form the entire north-eastern part of the island, the eastern part of Murchison Island, and probably the whole of the Tar Islands. These rocks are somewhat more basic, and though tilted in some places at high angles, of less altered appearance than those of Logan Inlet. They include a great thickness of rough agglomerate which has evidently been formed in the immediate vicinity of volcanic vents, as some of the included masses are over four feet in diameter. These frequently project on surfaces exposed along the shores by reason of the comparatively soft character of the matrix. The matrix and its included fragments are apparently similar in character. A microscopic section of one of the latter proved it to be a dolerite which with a dark finely granular ground-mass is rendered porphyritic by felspar and pyroxene crystals, which are frequently more or less perfectly stellar aggregations. The rock has not suffered much change, the minerals being clear and sharp.

Outlying islands.

Coarse agglomerate.

Dolerite.

A bed apparently of porphyritic dolerite forming a small island off the east shore of Ramsay island is nearly vertical and has a rude columnar structure. The Tar Islands appear to mark the outcrop of the most massive agglomerate bed. It is reported that on one of them bitumen oozes out in small quantities among pebbles on the beach. Agglomerates of a similar character are found on the east side of the entrance to A-tli Inlet, on the north shore of Lyell Island.

Bitumen.

At the north entrance of the narrow passage inside Tal-un-kwan Island detached masses of agglomerate and conglomerate are abundant, and though the rocks were not seen in place, they probably represent the northern continuation of the conglomerate described as lying at the base of the upper igneous series on Logan Inlet. The promontory south of Rock-fish Harbour is composed of much hardened and well bedded felspathic rocks, occasionally agglomerates, nearly vertical, and with a general east and west strike. Similar rocks appear to characterize both shores of Selwyn Inlet up to the long western arm, where the trough formed by these newer volcanic rocks runs inland to the westward. The northern shore of this arm is composed, however, of argillites, with some conglomerate, the latter probably representing the horizon already several times referred to, and indicating that this

Rocks of Selwyn Inlet.

zone, though probably most closely connected with the flaggy argillites, is persistent near the base of the overlying volcanic series, and that if there be any unconformity between the two it must be slight.

To the east of this area of volcanic rocks newer than those of the southern extremity of the islands, Kun-ga Island yet remains to be noticed. The inner or west end of the island is composed of hard greenish dioritic rocks like those elsewhere found below the massive limestone. The small island named Ti-tul, which lies off the north shore of Kun-ga, is composed of limestone, which also forms the north point of Kun-ga, and runs across it in a south-south-easterly direction. To the east of the limestone, and apparently following it conformably, with general eastward dips at high angles, or nearly in a vertical position, is a great series of flaggy blackish argillites, thin limestones and argillaceous sandstones. A few fossils, similar to those of the first-mentioned locality in Houston Stewart Channel, and of Triassic age, were obtained. If the upper volcanic series described in preceding paragraphs rests conformably above the argillites and associated rocks, it must be supposed either that a fault separates these rocks from those of the east end of Tan-oo Island, or that the limestones and argillites are folded over an anticlinal axis running north-north-east and south-south-west through the western part of Kun-ga Island, and that their westward-dipping portion is concealed below the water between the two islands.

Kun-ga Island.

Limestone.

Fossils.

At the north entrance point of Selwyn Inlet, massive limestones are again found, and on the coast between this point and the bottom of Skedans Bay, limestones and argillites are the most abundant rocks, the part of the series characterized by these materials being apparently several times repeated by folds. Point Vertical is a remarkably bold spur between two bays, composed of massive beds of limestone nearly on edge, and aggregating at least 400 feet in thickness. The limestone is grey, with the stratification well marked by layers charged with black cherty concretions, and by the solvent action of the water along certain planes. Some layers have a curious concretionary structure. They are traversed in all directions by little siliceous veins as thin as paper, the polygonal forms included between which have a superinduced concentric structure. North of Point Vertical are two islands which may be called Limestone Islands. On the inner of these the massive cherty limestone, with a dip of N. 16° E. < 40, is seen to lie directly upon an igneous material, resembling that found in a similar position in Skincuttle, and consisting of a fragmental grey felspathic rock holding pyritous and calcareous concretions. The adhesion of the limestone to the igneous series is thus conclusively shown by its conformable superposition on igneous rocks of precisely the same character

Limestones of Point Vertical.

Limestone and contemporaneous igneous beds.

Argillites and limestones conformable.

in widely separated localities. In exposures just outside the south point of Skedans Bay, the conformable junction with the limestones of the blackish flaggy argillites is also shown, confirming the opinion of their relation formed from the inspection of other localities. The rocks are much broken by dioritic intrusions, but the limestones, becoming thin-bedded towards the top, are distinctly interleaved with the argillites. The south-east side of Skedans Bay is composed of limestone, of the usual character, with general north-easterly dips. At the bottom of the bay this is followed, in ascending order, by the argillites, and to the north these are seen overlapped by agglomerate beds, which are supposed to belong to the series (Subdivision D.) attached to the Cretaceous coal measures. The first point south of Point Vertical shows similar rocks to these last mentioned, which may there form a small outlyer, and are certainly newer looking than any others of the vicinity.

Overlap of Cretaceous agglomerates,

Persistent limestone band

Nearly in the line of strike of the limestone of the south side of Skedans Bay, westward, on the south side of the West Arm of Cumshewa Inlet, at a distance of sixteen miles, similar limestone is again found; while argillites occur on the south-east side of the South Arm, holding *Monotis subcircularis.* The general line of strike thus indicated is confirmed by the parallelism to it of that of the rocks of Selwyn Inlet, and it is further probable that the limestone and argillites found west of Log Point, on the south shore of Skidegate Inlet, belong also to the same line of outcrop, which in this case can be traced in a general direction of N. 67° W for a total distance of thirty-three miles. The general strike of the older rocks sweeps round to this bearing from one of N. 35° West, which is the more usual in the southern portion of the islands.

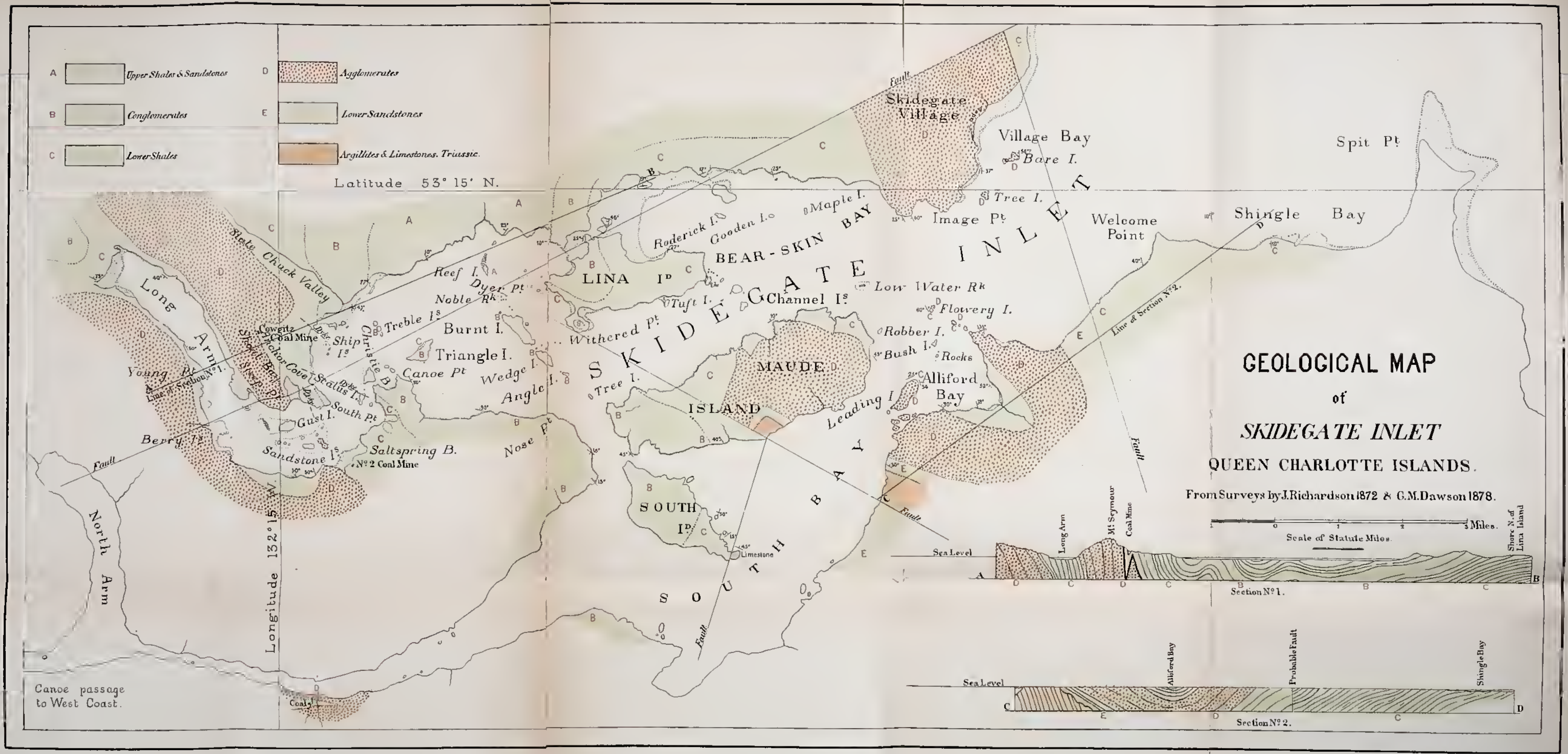
Change in strike.

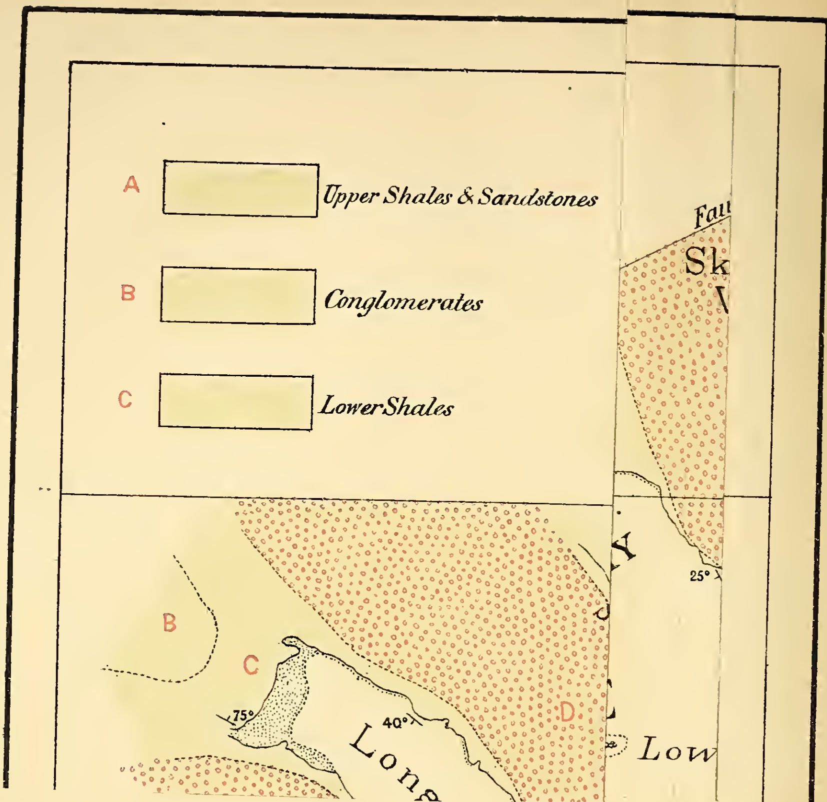
With the exception of the limestones and argillites above referred to, the rocks observed in the western part of Skidegate Channel are entirely igneous, dioritic or felspathic. The argillites hold *Monotis subcircularis* in great abundance. The existence in Skidegate Inlet of several small projections of the older rocks among those of the Cretaceous coal-bearing series, has already been referred to. Of these the most interesting is a mass of limestone forming the south-eastern point of South Island, which yielded a few fossils, on which Mr. Whiteaves furnishes the following note.—

Fossils from South Island.

1. A small oval, *Terebratula*-like shell. Sections of some of these specimens have been made, but the interior of each was found to be full of crystalline calcite, and no information as to the structural character could be obtained. It is not certain, therefore, to what family this shell should be referred.

2. *Euomphalus sp. indt.*


A Upper Shales & Sandstones
B Conglomerates
C Lower Shales
D Agglomerates
E Lower Sandstones
Argillites & Limestones. Triassic.
Latitude 53° 15′ N.
Longitude 132° 15′ W.
GEOLOGICAL MAP
of
SKIDEGATE INLET
QUEEN CHARLOTTE ISLANDS.
From Surveys by J. Richardson 1872 & G.M. Dawson 1878.
Scale of Statute Miles.
Miles.
SKIDEGATE INLET
Skidegate Village
Village Bay
Bare I.
Spit Pt
Shingle Bay
Welcome Point
Tree I.
Image Pt
Maple I.
Gooden I.
Roderick I.
BEAR-SKIN BAY
LINA ID
Low Water Rk
Channel Is
Flowery I.
Robber I.
Bush I.
Rocks
Alliford Bay
MAUDE ISLAND
Leading I.
SOUTH BAY
SOUTH ID
Limestone
Tuft I.
Withered Pt
Tree I.
Angle I.
Wedge I.
Nose Pt
Reef I.
Dyer Pt
Noble Rk
Treble Is
Burnt I.
Triangle I.
Canoe Pt
Christie B.
Ship Is
Slate Chuck Valley
Long Arm
Cowgitz Coal Mine
Anchor Cove
Shoal Bay
Young Pt
Line of Section No 1.
Berry Is
Gust I.
Sandstone Is
Saltspring B.
No 2 Coal Mine
South Pt
Fault
Line of Section No 2.
North Arm
Canoe passage to West Coast.
Coal
Sea Level
Long Arm
Mt Seymour
Coal Mine
Shore N. of Lina Island
Section No 1.
Alliford Bay
Probable Fault
Shingle Bay
Section No 2.
THE BURLAND LITHOGRAPHIC CO MONTREAL


A
Upper Shales & Sandstones
B
Conglomerates
C
Lower Shales
B
C
D
75°
40°
25°
Long
Low
Sk

Patches of the flaggy argillites also occur on the south side of Maude Island, and on the south-east shore of South Bay.

Cretaceous Coal-bearing Rocks.

Skidegate Inlet.

Surveys by Mr. Richardson.

In 1872, Mr. James Richardson, of the Geological Survey, visited Skidegate Inlet at the request of gentlemen interested in the Cowgitz Coal Mines. Mr. Richardson's time was limited to a few days, and much of it was necessarily devoted to the immediate vicinity of the mine, but he nevertheless sketched the geological structure of a considerable portion of Skidegate Inlet, and collected a large number of fossils. In connection with the description of these,* a map indicating the fossiliferous localities, with the position of the rocks so far as that had been determined, was printed.

In my examination of the region in the summer of 1878 I had the advantage of being able to refer to Mr. Richardson's printed report and map, and have availed myself largely of these in drawing up the following account of the locality and in the construction of the geological map of Skidegate.

Cretaceous anthracite.

The occurrence of a bed of true anthracite in rocks of Cretaceous age is a matter of considerable geological interest, while the proved existence of a really workable bed of this material on the Pacific coast would be of very great economic value. The study of the Cretaceous rocks of this district is in consequence invested with a peculiar importance.

Mr. Richardson grouped the coal-bearing rocks of this region under the following names, in descending order.—

Subdivision of the series.

A. Upper Shales and Sandstones.
B. Coarse Conglomerates.
C. Lower Shales with Coal and Iron Ore.

It was supposed that the last-mentioned subdivision rested unconformably on certain crystalline rocks, which have now, I believe, however, been distinctly proved to be a part of the series, and to represent an important intercalation of contemporaneous volcanic matter. These are again followed in descending order by a series of beds chiefly composed of ordinary sediments, and the whole rests unconformably on older rocks, probably for the most part Triassic, like those of other parts of the island, and consisting of argillites, limestones,

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* Mesozoic Fossils. Vol. I. Part 1. 1876.

&c. To Mr. Richardson's section it therefore becomes necessary to add two lower members, which may be designated :—

D. Agglomerates.
E. Lower Sandstones.

General conditions of deposit.

The letters applied to the subdivisions are my own—A., B. and C. corresponding to 3, 2 and 1 of the original classification.

The whole formation at this place bears the appearance of having been laid down along the north-eastern flanks of a land formed chiefly of the Triassic rocks previously described. It has a more or less littoral character throughout, with irregularity in thickness of the subdivisions, and shows especially a very decided thinning out to the southward and westward, in which directions it is probable that large areas of the older rocks may have remained uncovered by those of the coal-bearing group, and as may be supposed, their surface even where it has been buried is a very rough and irregular one. This, combined with the occurrence of the massive contemporaneous volcanic deposit (D.) and the general disturbance of the rocks,—which increases westward till at the head of the inlet some of those of the coal-bearing series are thrown past the vertical,—has produced a stratigraphical problem of more complexity than would at first sight appear.

Subdivision A.

A. *Upper Shales and Sandstones.*—The highest rocks seen in Skidegate Inlet are these so-called by Mr. Richardson, and in characterizing them I cannot do better than quote his description, which is as follows.—*

"These shales are by no means so black as the lower band, their darkest tint being a brownish or blackish grey, and most of them are somewhat arenaceous. They are interstratified with sandstones, generally from three to six inches thick; but a band of about thirty feet occupies a position which is conjectured to be about seventy feet from the base. Approaching the (underlying) conglomerates, some twenty or thirty feet are interstratified with beds of reddish-weathering greyish-brown argillaceous dolomite, varying in thickness from two to six inches, but constituting the chief part of the mass, and these seem to form a passage to the conglomerates."

Some beds of the shales are highly calcareous, and there are zones characterized by large calcareous nodules like those of portions of the Lower Shales, from which, notwithstanding their general difference in colour, it would be hard to find a distinctive lithological characteristic. The rocks of this subdivision occupy a breadth of three miles of the inlet, between the west end of Lina Island and Slate Chuck Creek.

* Report of Progress, 1872-3, p. 63.

They are in the form of a shallow synclinal, with several minor undulations, and have a thickness of not less than about 1500 feet, though the summit of the group was not recognized. They contain few fossils, the only form recognized being *Inoceramus problematicus*. Reef Island is also formed of these shales, and they no doubt underlie a considerable area which is concealed by water between Nose Point, Triangle Island and the group of islands of which Burnt Island is the largest.

B. *Conglomerates.*—The rocks of this subdivision are for the most part well rounded conglomerates, interbedded with grey and yellowish sandstones, which in some places are very regularly stratified. The pebbles, which in some layers are several inches in diameter, are generally derived from the older more or less distinctly crystalline rocks of the islands, but occasional rounded shaly fragments like some of the rocks of the next underlying subdivision are found, with other evidence of slight erosion in progress during the deposition of the conglomerates, but not such as to indicate any true unconformity. The dolomitic character of the upper layers of the conglomerate has already been referred to in connection with the overlying subdivision. The thickness of the conglomerate appears to be greater toward the southern part of the area under description, where they spread out widely. At the west end of Maude Island, and near Christie Bay, the thickness was estimated at over 3000 feet, while north of Lina Island it appears not to exceed 1900 feet. An average thickness of about 2000 feet may be assumed for this subdivision. Subdivision B. Variable thickness.

On the north side of the inlet, about the mouth of Slate Chuck Creek, the conglomerates form a wide belt which apparently runs up inland toward Nipple Mountain. They are, however, much disturbed, and probably affected by undiscovered faults. North of Lina Island they leave the shore with a northerly course, and are supposed to bend round to the eastward, conformably to the strike of the underlying rocks, reaching, probably, to the main fault near Double Mountain, of the Admiralty chart. An outlying patch on the west end of Lina Island consists, where seen along the shore, chiefly of sandstones, and appears to be the point of a synclinal cut-off to the north by the fault just referred to. The centre of the peninsula at Withered Point is another small outlier. Burnt, Wedge, Angle and Tree Islands, with the west end of Maude Island, form a connected series of conglomerate exposures, and show high south-westerly dips. The same zone, with lower dips, is supposed to cover the north-western half of South Island, and spreads over both sides of the entrance to the narrow channel which leads from South Bay to the west coast. From Nose Point to Christie Bay similar rocks continue to prevail, near the first-named place, with low dips off shore, but near Christie Bay becoming disturbed and eventually verti- Continuation northward. Conglomerate islands.

cal. South of Anchor Cove, the conglomerates are characteristically shown on the eastern half of South Point, where it is probable that they represent the western edge of a small synclinal holding the basal beds, but of which the remainder is concealed by the water. To the north of Anchor Cove, as traced by Mr. Richardson, they appear to fringe the shore with slight interruptions till the first described area at Slate Chuck Creek is reached. In the western part of this we appear to have the continuation of the synclinal just alluded to. Triangle Island is also composed of conglomerates, which fold round the southern end of an anticlinal, showing a narrow margin of the Lower Shales at the water's edge on the north side. The lowest bed of the conglomerates is here again undulating, and holds shaly fragments. The massive character of the conglomerates causes the regions occupied by their outcrop to be characteristically rough and hilly, while the islands composed of this subdivision are high and abrupt. The only fossils found in rocks of this subdivision were some fragments of *Belemnites*, which occurred near the first or eastern narrows on the channel to the west coast.

Lower beds.

Fossils.

Subdivision C.

C. *Lower Shales and Sandstones.*—This subdivision, at the base of which the anthracite coal is found, consists of blackish or grey shales, interbedded with grey or yellowish-grey sandstones, and numerous layers composed of sandy argillaceous material, intermediate in character between shale and sandstone. The bedding is generally regular, and certain zones are characterized by large calcareous nodules, generally lenticular, and occasionally several feet in diameter or even coalescing to form sheets of calcareous matter. Layers so coarse as to be called conglomerates scarcely occur. The beds immediately underlying the conglomerates of Subdivision B. are generally grey shales, very regular in their bedding, and quite hard. Below these is a considerable thickness of strata in which shaly beds usually preponderate, while toward the base of the subdivision sandstones are more important. The lowest beds are of interest as being those in association with which the coal is, and require to be described in greater detail, though the structure of the actual locality in which the mine was opened will be noticed subsequently.

Composition.

Irregular junction with D.

Subdivision C. rests on a series of volcanic rocks constituting Subdivision D., which apparently forms a member of the same formation. The upper surface of the agglomerate and ash rocks of D. must, however, have been an irregular one, and to its undulations the lower beds of C. more or less closely conform. The appearance at the junction of Subdivisions C. and D. is therefore that of unconformity more or less marked. This is particularly evident in the Channel Islands, which, though belonging to the volcanic portion of the series, appear to be separated from the larger mass of these rocks on Maude Island by an overlapping edge of C. This partial unconformity is, however, believed to be essentially unimportant, and only such as might be anticipated at the junction of two classes of deposits so dissimilar. The apparent unconformity has probably been further accentuated by movements occurring between the already hard beds of D. and the as yet partially consolidated beds of C. during the flexure of the strata. The occurrence of fossils identical with those of subdivision C. in beds below the volcanic horizon, with the inclusion of marine forms in some parts of the upper portion of the rocks of volcanic origin (at points on the east side of Alliford Bay), serve to show the continuity of the conditions of deposit. Partial unconformity.

The passage beds have been observed in a number of localities to be coarse felspathic or tufaceous sandstones, generally pale in colour, and formed apparently by the rearrangement of the still unconsolidated materials of the upper beds of D. These vary in thickness, but are generally associated with black carbonaceous argillites, which are sometimes shaly, and at the Cowgitz Mine hold the seam of anthracite coal. These are those to which Mr. Richardson refers as being quarried by the Indians at a spot some miles up Slate Chuck Creek, and though they there hold no distinct coal seam, films of anthracite are still found. Nine miles east of the mine this horizon is again recognised, and pretty well exposed on the east end of Maude Island, near Robber Island. Coarse agglomerates are here overlain by beds which may be called as above, felspathic sandstone. Their material is evidently derived from the underlying agglomerate and ash beds, and composed in great part of felspar in partly rounded grains. It is generally pale greyish or greenish in color, and is here well bedded, and appears to decompose readily, exfoliating in concentric layers. The higher beds hold thin layers of conglomerates, with well-rounded pebbles, and occasional streaks of coaly matter representing plant fragments, but nothing like a true coal seam. Above these are beds still evidently in great part of similar material, but darker in tint, and holding fossils, of which a coral is the most remarkable. These are followed by soft argillaceous sandstones and shales, in the upper part of which are dark carbonaceous argillites, charged with great numbers of marine fossils in good preservation. Above these are the sandstones of Robber Island and the north-east part of Maude Island, in which small trunks and branches of trees are very frequently found converted into coal. Passage beds. Felspathic sandstone.

One-third of a mile from the head of Alliford Bay, at a small point on the south shore, thin carbonaceous layers occur in sandstone very near the base of Subdivision C., and though quite unimportant in themselves, Coaly layers.

in their relation to the surrounding rocks more nearly represent coal beds than anything elsewhere seen in this vicinity.

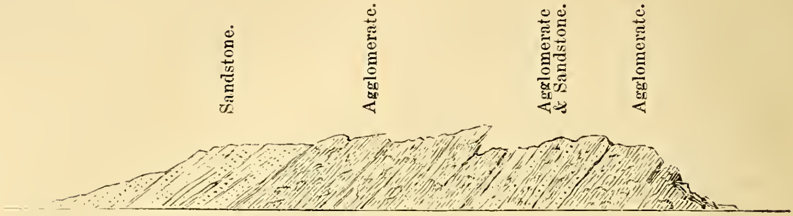


FIG. 3. PASSAGE BEDS BETWEEN SUBDIVISIONS C. AND D., EAST SIDE ALLIFORD BAY.

Lowest beds of C.

On the opposite side of the Alliford Bay synclinal, the lowest beds of C. skirt the point and islands lying off it to Flowery Island. On the latter the lowest bed of the felspathic sandstone is brownish-grey and sometimes quite hard, and rests with an appearance of slight unconformity on the bluish-grey trappean rock of D. This irregularity of junction is, however, no more than might be expected to occur between beds very dissimilar in character, and the idea that it represents a break of importance or true unconformity appears to be negatived by other circumstances. The junction of Subdivisions C. and D., which varies thus a little in character from place to place, but the conditions of which remain on the whole uniform, is again well shown on the north side of the inlet at the point next west from Image Point. It is also seen at a locality four miles up the channel which leads from South Bay to the west coast, where the rocks of C. seem to form a little broken synclinal, with steep dips, and strike nearly parallel to the direction of the passage. Grey felspathic sandstones are here interbedded with dark argillites, all much hardened, and holding on the north side of the fold a little anthracite coal, the fragments of which are bounded by small faults by which the rocks are here dissected. No estimate of the thickness or character of the seam at this place can be formed, and the coal is only interesting as showing that the rocks continue thus far at least to maintain their coal-bearing character. This locality was one of which Mr. Richardson was informed, but had not time to visit.

Broken anthracite.

Fossiliferous character of C.

Subdivision C. is throughout characterized by the great abundance of fossils.* These occur in both the sandstones and shales, and frequently are specially abundant in the calcareous nodules, of which each one in some places contains an *Ammonite* or other form. The rocks form a synclinal in Alliford Bay, and fringe the north-eastern part of Maude

* The fossils described by Mr. J. F. Whiteaves in Mesozoic Fossils, Vol. I., Part 1., are almost exclusively from this horizon. Those collected by me during the summer of 1878 are not referred to in this report, but will be described in a succeeding part of the volume to which reference is here made.

Island, crossing it with considerable width about the middle, and running thence to the south-east end of South Island. They constitute the whole north shore of Bear-skin Bay and the greater part of Lina Island. Westward, after a gap occupied by the upper beds, they reappear at Shallow Bay, and run thence northward, past the coal mine and up the valley of Slate Chuck Creek. They form the shore for a breadth of over a mile in the vicinity of Salt Spring Bay, and in a compressed and partly overturned synclinal occupy the entire width of the Long Arm, appearing in a zone of variable thickness on both shores. A short distance north-west of Steep Point, a promontary is composed of rather massive sandstones of this series, the thickness of which must be about 600 feet. These appear again at Young Point, on the opposite side of Long Arm. Areas occupied by C.

On the south shore, east of Alliford Bay, the rocks described on page 70 B. are also probably referable to subdivision C.

The thickness of subdivision C., though variable, is great. On the north side of Bear-skin Bay, south of the main fault, the section appears to be undisturbed, and would indicate a thickness of about 5000 feet, the summit not being seen. On Lina and Maude Islands, the thickness was estimated at about 4200 feet. North of Shallow Bay, near the coal mine, the thickness of the entire subdivision is probably not over 3200 feet, unless undiscovered faults affect the section, while in Long Arm, the part included in the fold is not over 1800 feet thick. Thickness.

D. *Agglomerates.*—Subdivision D. forms the mass of Mount Seymour, and the mountains on both sides of Long Arm, the greater part of the eastern end of Maude Island, Leading Island and islets adjacent, and in a horse-shoe-shaped synclinal surrounds Alliford Bay, and the low land at its head. On the north shore it stretches north-eastward from the point next west of Image Point for at least three miles, and forms Bare and Tree Islands. Its great spread here is accounted for by the fact that it is undulating at angles not very high. The thickness of the rocks is estimated at about 3500 feet. They are almost exclusively of volcanic origin, though some layers show traces of water action in the rounding of fragments. Some beds may have been flows of molten matter, but most are of a fragmental character, either agglomerates or tufaceous sandstones, of greenish, greyish, brown or purple tints. On the east end of Maude Island, and near Leading Island, some fragments are four or five feet in diameter. The material is almost everywhere predominantly felspathic, and some specimens resemble typical porphyrite of rather coarse grain. At the east side of the point north of Alliford Bay, hard dark tufaceous sandstones are found graduating into agglomerates, some of which, however, have their fragments so well rounded as to be more appropriately designated Subdivision D. Thickness. Lithological character.

conglomerates. Many layers here become calcareous from the inclusion of organic remains, of which some are evidently shells, though too poorly preserved for recognition, except in the case of one or two specimens, which appear to be *Ostreæ*.

Subdivision E.

E. *Lower Sandstones.*—Subdivision E. underlies the last. Near the centre of the south side of Maude Island a small area, which is supposed to represent the rocks of the Triassic, is found. Westward it appears to be limited by a fault, but eastward it is overlain by a small thickness of beds partly of a tufaceous character, but containing also ordinary sandstones, which in some places include calcareous layers with many fossils. These, while in some cases specifically identical with those of Subdivision C., include a few species not yet found in that part of the section, and thus present a general *facies* somewhat different from it. On the east side of South Bay, similar rocks are again found intervening between those of supposed Triassic age and subdivision D.

Fossils.

Beds East of Alliford Bay

East of Alliford Bay a break in the section occurs, in which the junction of D. and E. is concealed, but beyond it, and apparently dipping conformably below D, are greenish, ashy sandstones, interbedded with shales, and pretty closely resembling the rocks of the two last-mentioned places. Following the shore eastward, the section is not continuous, but the beds above described might be supposed to overlie a great series which is frequently well exposed on the beach for a distance of three and a half miles, beyond which the rocks are concealed by the superficial deposits of the flat land about Spit Point. East of the greenish ashy sandstones and shales first described, this series consists of dark shales, more or less arenaceous, and a great thickness of massive or thin-bedded sandstones, with occasional layers of well rounded conglomerate and frequent zones characterized by large calcareous nodules. Toward the base, fragments of coal, produced from drift wood, are frequently imbedded in the sandstones. With the exception of these conglomerate layers, the series so much resembles that of subdivision C., as represented on the north shore of Bear-skin Bay, that it is probable it belongs to this subdivision. The fossils found, though not very numerous, also seem to resemble those of C. It is therefore supposed that a fault, with about the position marked on the map, crosses the mouth of the inlet east of the Alliford Bay synclinal, and by an extensive downthrow to the east causes the repetition of the lower shales, which, between the line of the fault and eastern end of the section, must be represented in nearly their entire thickness.

Probably belong to C.

The thickness of the entire series of rocks belonging to the

Cretaceous coal measures of Skidegate Inlet, may thus be given as about 13,000 feet, composed as follows:— Thickness of Cretaceous series.

A	1500
B	2000
C	5000
D	3500
E	1000 ?
	13,000

The fault alluded to in the preceding paragraphs as the *main fault* is one which was indicated by Mr. Richardson as running from Anchor Cove across to Shallow Bay. It appears again westward on the south-west side of Steep Point, and probably runs on through the hollow which leads from Long Arm to North Arm. In the opposite direction it appears to run north of Triangle Island, to cut off the continuation of the conglomerates north of Burnt Island, to pass between Lina Island and the north shore of the inlet, and to strike that of Bear-skin Bay where a sudden change of attitude is found in the beds. At this fault an extensive downthrow northward has occurred. A second important fault is supposed to run north-westward across Maude Island, with a downthrow of the strata to the south-west, which accounts for the sudden disappearance of the beds of sub-divisions D. and E., and the underlying Triassic rocks. Where it cuts the north shore of Maude Island the beds are disturbed, and indications of its course are again found near Withered Point. A third fault must run across the south-eastern extremity of South Island, on which the strata have slipped down to the north-west, bringing the beds of Subdivision C. in contact with the older limestones. (see p. 62 B.) Main fault. Other faults.

The Cowgitz Coal Mine.—This mine is situated on that outcrop of Subdivision C. which has been described as running northward from Shallow Bay, and eventually turning north-westward up the valley of the Slate Chuck. The principal openings have been made at a distance of about a mile in a north-north-easterly direction from Anchor Cove. The Queen Charlotte Coal Mining Company (limited) was formed in Victoria in 1865 to open up the deposits of anthracite which had been discovered here, and in the attempted development of the property a large sum of money was expended between that date and the abandonment of the enterprise about 1872. The mine was connected with the coast by a substantial tramway, a wharf and the necessary buildings for the accommodation of the men erected, with screens and all the appliances for a large output. It is very desirable to take into careful consideration all the circumstances which have operated in bringing about the unfortunate suspension of this enterprise, not only in the Coal mine. Works and buildings.

interest of those who have invested money in it, but on account of the importance which would attach to the discovery of really workable deposits of anthracite coal on the Pacific seaboard.

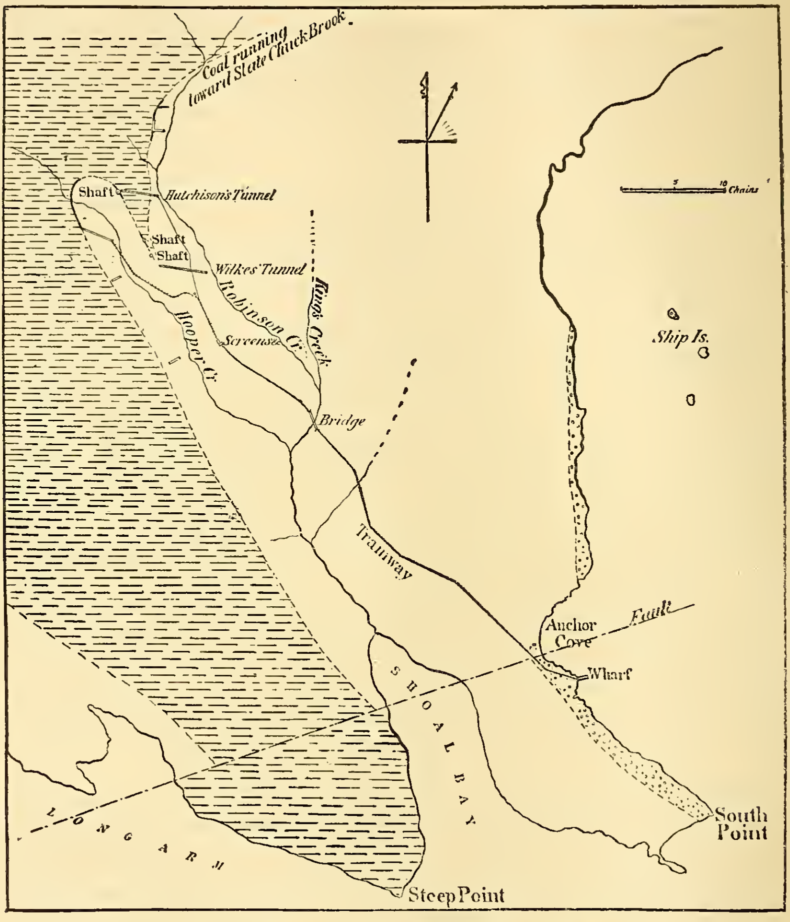


FIG. 4. PLAN OF COWGITZ COAL MINE AND VICINITY, SKIDEGATE,

Showing the Openings Made on the Coal and the Probable Course of the Seam.

(The area shaded in broken lines is that occupied by Subdivision D. The area without shading is that of C., overlain by B., represented by dotted shading.)

The Plan based chiefly on measurements made by Mr. Richardson in 1872.

Examination by Mr. Richardson.

Mr. Richardson at the time of his visit in 1872 enjoyed facilities for the examination of the immediate vicinity of the mine not existing at present, for during the years intervening a thick growth of bushes and weeds has covered everything, and the various tunnels and openings have much deteriorated in condition. I shall therefore briefly allude to the facts established in Mr. Richardson's report, to which reference must be made for the details of his observations.*

The position of the coal is best shown in the opening called Hooper Creek Tunnel in Mr. Richardson's report, but spoken of as King's Opening and Nicholson's Tunnel in reports addressed to the Company. This is situated on the right or west bank of Hooper Creek, where it descends steeply from the base of Mount Seymour before reaching the less steeply inclined valley by which it flows to Shallow Bay. This tunnel has been driven, according to Mr. Richardson, in a direction N. 69° W. for 190 feet through vertical beds of black shale, with clay ironstone. At this point it intersected the coal, and followed it in a bearing N. 53° W., gradually turning to N. 29° E. in a distance of about 450 feet. Where first struck the coal showed from two to three feet thick of good anthracite. It increased in a short distance to a total thickness of about six feet, in which there were two veins of pure coal averaging three feet, and one foot three inches in thickness respectively, but separated by a shaly midrib of about six inches. Towards the end of the tunnel the seam gradually narrowed, and where the work was stopped Mr. Richardson could not convince himself that any coal was present, though it is stated in a report made to the Directors in 1869 that the seam where abandoned had again expanded to a width of one foot six inches. Mr. Deans also informs me that by removing the surface covering he has traced the seam, though in a broken and weathered state, some distance beyond the position of the end of the tunnel, so that there is no reason to believe that the coal absolutely terminates at this point. This outcrop called King's vein was discovered by Mr. King in 1867, and after it had been opened by the tunnel above described, in 1869, about 800 tons of coal were extracted, and a portion of it shipped to Victoria. The anthracite rests either directly on a tufaceous or felspathic sandstone like that formerly described as characterizing the summit of Subdivision D., or with the intermediation of a thin and irregular layer of compact black shale. It is overlain by similar black shales, which in some places hold abundance of *Unio Hubbardi*, and show occasional films of anthracite. The surface on which the coal lies has been undulating, and the irregularity of the deposit has been increased by subsequent small local disturbances, evidenced by slickensided surfaces. The beds are now either vertical or slightly overturned. In working in this tunnel the quantity of inflammable gas exuding from the shales was so great as to necessitate the use of safety-lamps. In other smaller openings, made lower down Hooper Creek on the same side, no coal appears to have been found,

Hooper Creek or King's tunnel.

Appearance and thickness of coal.

Coal traced beyond workings.

Coal shipped.

Position of the coal.

* Report of Progress, 1872-73, p. 57.

though it is to be presumed its horizon was reached. The larger tunnels driven westward from Robinson Creek have not been carried far enough to strike the Hooper Creek seam.

Openings on Robinson Creek

On Robinson Creek, joining Hooper Creek from the north-east, but running nearly parallel with it where opposite the Hooper Creek tunnel, a good deal of work has been done. In Hutchinson's tunnel, situated about eleven chains north-eastward from the Hooper Creek tunnel, and 430 feet in length, no coal appears to have been obtained, with the exception of a three inch seam near its mouth. In three small tunnels made by Mr. Robinson, at distances of three, nine and eleven chains above Hutchinson's, coal was found. In the first, according to a report prepared by Mr. Landale for the company, in November, 1869, the seam was three feet thick; in the second and third, seven feet, but 'soft,' an expression which seems from the appearance of coal still to be seen on the dumps, to mean that though good anthracite it is completely crushed, probably by movement of the strata subsequent to its formation. About thirteen chains below Hutchinson's tunnel, also on the right bank of Robinson Creek, is Wilkes' Tunnel, said to be 450 feet long. It appears to have been driven sufficiently far to intersect the coal subsequently to be mentioned as occurring between Hooper and Robinson Creeks, and at its end a black shale with *Unio Hubbardi*, like that seen in the Hooper Creek tunnel, was found by Mr. Richardson.

Shafts between Hooper and Robinson Creeks.

On the hill between Hooper Creek tunnel and Hutchinson's, three small shafts have been sunk. In one of these good coal occurs, related, as shown in the following section by Mr. Richardson, to the neighbouring beds.—

	FEET	IN.
Coal, good anthracite	0	6
Black argillaceous shale	4	6
Coal, good anthracite, called "the three-feet seam"	2	5
Black argillaceous shale, with nodules of clay ironstone	11	0
Grey trap, or it may be altered sandstone	8	0
	26	5

The first-mentioned bed is on the south-west side, the strata being vertical. In one of the other shafts earthy impure coal was found; in the third little or no anthracite was obtained.

Supposed existence of three seams.

It has been supposed that there are in the vicinity of the Cowgitz Mine two or three distinct seams of anthracite, that on Hooper Creek being the lowest, while those opened on to the eastward and northward are higher in the series. It appears to me probable, however, that with the possible exception of small irregular seams, there is but a single coal-bearing horizon, and that that lies immediately above the agglomerates and felspathic sandstones of Subdivision D. The coal in Hooper Creek tunnel is found turning east, and probably bends round eventually to a south-easterly strike, running to the trial shafts above described, and then again doubling abruptly on itself, continues up the south-west side of Robinson Creek. This strueture may be, and probably is, complicated by small faults, which destroy to some extent its regularity; but by supposing its existence we account readily for the presenee of the peculiar dark argillites with *Unio Hubbardi* near the seam on both Hooper and Robinson Creeks, the absence of the so-called three-feet seam in the Wilkes tunnel, the appearance of the trap-like rock on the north-east of the coal in the above quoted section (this roek seeming to represent that found on the south-east side of the coal on Hooper Creek), the similarity of appearance and strueture in the coal seam in the section and that of Hooper Creek, and other points. In the diagram of the vieinity of the coal mine the probable course of the seam on this supposition is indieated, with the areas oceupied by Subdivisions B., C. and D.

Probably but one seam.

From the descriptions above given, it will be evident that the coal seam is in itself irregular in quality and thickness. This has arisen partly no doubt from the inequality of the surfaee on which it has been laid down, but there seems also to have been a eonsiderable amount of movement between the top of the already hard volcanic rocks of D., and unconsolidated sediments of E., during the flexure of the strata; whieh, while it may cause the seam to be very thin or altogether wanting in some places, may have rendered it extremely thick in others. Such irregularity, though to a smaller degree, has been met with in the now well known measures of Nanaimo, and if it can once be shown by more extended exploration that the average thickness of the seam is sufficiently great, this will be of comparatively little consequenee.

Irregularity of seam.

I had supposed, before visiting the mine, that the coal might prove to be an inspissated bituminous deposit like the well known Albertite of New Brunswick, but which had been more thoroughly metamorphosed. This is not the case, however, and an origin similar to that of ordinary coals must be attributed to it, though it is probable that the carbonaceous material has, at the time of its deposition, assumed that pulpy state which has elsewhere resulted in the production of cannel or anthraeite coals. It will be observed, however, that with the exeeption of the beds immediately surrounding the coal seam, the fossils found are marine, and do not indieate the recurrence at different stratigraphical horizons of the terrestrial conditions which, in the Carboniferous coal formation, has resulted in the accumulation of many superposed coal beds. Many fragments of wood eonverted to coal occur in the higher members of the formation, but these have been drifted from the shore

Character and conditions of deposit of the coal.

But one coal-bearing horizon known.

and imbedded with sea-shells. We cannot, therefore, in the areas yet examined, look very hopefully for coal seams in any of the beds overlying the horizon now under discussion. It appears, however, that at the time represented by this horizon the conditions for the deposition of coal were somewhat wide spread. As already mentioned, the characteristic massive carbonaceous shales with lenticular seams of anthracite, occur in the same relation to Subdivision D. some miles up Slate Chuck Creek. Southward they are again found holding anthracite—but, so far as known, broken and impure only—near Salt Spring Bay; while five and a half miles on a due south-bearing from Cowgitz is situated the locality previously described, on the channel which leads to the west coast.

Direction proper for further explorations.

The definition of the true relation of the coal to series C. and D., as above given, will prove an important aid in carrying on further explorations in this locality. The junction of these rocks is easily traced, though the precise horizon of the coal is often covered by low land, and it is in following this from place to place, and examining it where necessary by shallow surface work, that the best means of proving the true value of the deposit will be found. Attention may be directed in particular to the thorough exploration of this line on all the little streams flowing into the Long Arm, and also, perhaps, to the east end of Maude Island. The locality about the Cowgitz Mine is exceptionally disturbed, and this by the duplication of the outcrops has no doubt caused an appearance of a great quantity of coal, and supplied fragments in abundance to the gravels of the various brooks. It has added, however, to the difficulty of tracing the seam, and greatly hindered its satisfactory exploration by workings. The great degree of flexure and disturbance has also probably caused the more complete alteration of the coaly matter forming the seam, but the character of the beds on the Long Arm, while more regular, is such as to show that any coal, even if originally bituminous, would probably there also be converted to anthracite.

Composition of the coal.

In appearance, the coal resembles the anthracites of some portions of the Carboniferous coal-measures, and in composition compares favorably with them. The two following analyses, by Dr. B. J. Harrington are quoted from the Report of Progress 1872-73, p. 81. The first is of a specimen from the Hooper Creek tunnel, the second from the so-called three-feet seam. Both were collected by Mr. Richardson.

	I	II
Water	1·60	1·89
Volatile combustible matter	5·02	4·77
Fixed Carbon	83·09	85·76
Sulphur	1·53	0·89
Ash	8·76	6·69
	100·00	100·00

On reviewing the appearance presented by the seams, it would appear that too great dependence has been placed on their continuity and uniformity, without the necessary amount of preliminary exploration to determine these points. The indications were not such as to justify a heavy expenditure in preparing for the shipment of coal, but quite sufficiently promising to render a very careful and systematic examination of the locality desirable. This yet remains to be accomplished, not necessarily by expensive underground work, but preferably by the tracing and examination by costeening pits or otherwise of the whole length of the outcrop of the coal-bearing horizon. Economic value of the deposit.

It is, however, evident that the knowledge of this region so far obtained affords no ground for the belief that it is equally important as a coal-bearing district with Nanaimo or Comox, on Vancouver Island, where the conditions suitable to the formation of coal have occurred not only over wide areas, but at several distinct horizons in the Cretaceous rocks.

Cumshewa Inlet and Coast between Skidegate and Cumshewa.

Between Skidegate and Cumshewa the coast being low, exposures are infrequent. The rocks seen are agglomerates and tufaeeous sandstones generally highly felspathic, and associated with some massive felspathic materials of uncertian origin. These rocks on the whole resemble pretty closely those of Subdivision D. of the Skidegate section, to which they may belong. Under the supposition that they represent this part of the series, and that if softer ordinary sedimentary beds underlie the coast line they have been worn away and concealed, the whole has been coloured—though still with some doubt—as belonging to the Cretaceous. Agglomerates and tufaceous sandstones.

The northern entrance point of Cumshewa Inlet is composed of intrusive roek, eheifly diorite and dioritic granite, but the greater part of the shores of the inlet are formed of rocks of the Cretaceous series. The Skidegate section having been described in some detail, it will be unnecessary to refer to these in other than brief terms, though the subdivision adopted for Skidegate cannot here be strictly carried out. Dioritic granite

Between McKay's Cove and the Cumshewa Indian village, and on the little island near the village, the rocks are agglomerates and tufaceous sandstones of dark colour. They are hard and traversed by dioritic dykes in a few places. On the island, though well bedded, the rocks from their fine grain might well be mistaken for diorites. A few hundred yards east of the Indian village, many small veins traverse the agglomerate rocks, and contain iron pyrites and galena in about equal proportion. One vein about eighteen inches wide was noticed, Agglomerates. Lead.

but found to run out rapidly in both directions. These volcanic rocks are supposed to represent those of Subdivision D. of Skidegate.

Exposures on north side of inlet.

In following the north shore of the inlet, a gap of about a mile now occurs in the section, beyond which the rocks are frequently seen, and sometimes continuously exposed for long stretches between tide marks. To the vicinity of Conglomerate Point they appear to represent the lower shales and sandstones, or Subdivision C. of the Skidegate section. Their general dip is southward, and they lie as a rule at an angle of about twenty degrees, though in several places they are nearly horizontal, or slightly undulating, over considerable areas, and occasionally become quite vertical. Owing to the close general correspondence of the direction of the shore with their strike, and irregularities in the rocks themselves; it was found impossible to arrive at a satisfactory estimate of the thickness of the entire series, though a measurement was carried out with this object. It may be stated, however, that this thickness is probably not less than 2000 feet, and may be much more.

In their general character the rocks resemble pretty closely those of the same part of the series in Skidegate, but sandstones are here less important, and arenaceous shales more largely represented. Many layers are nodular, and in some cases highly fossiliferous, though each nodule does not invariably contain a fossil. In some beds the nodules become large pale lenticular masses of limestone, like those frequently found in Skidegate.

Section in the Peninsula.

A short distance east of the Peninsula pale yellowish grits, which are supposed to be the base of Subdivision C., are seen. They form a small anticlinal, as shown in Figure 6, and to the south-west are overlain by dark argillites, in some places concretionary and fossiliferous. These appear to be interleaved with one important, and perhaps one or more minor sheets of volcanic rock, which seems to be contemporaneous in origin. At the extremity of the Peninsula the argillites are seen in wide exposures between high and low-water marks, and appear to be folded in a rather sharp synclinal, though this may be a local disturbance not profoundly affecting the rocks. According to the view taken of it, the thickness of strata shown between the grits and highest argillites, is either 800 or 1200 feet.

Fossiliferous locality.

A mile and a quarter west of the Peninsula, is situated the locality in which fossils were found most abundantly. Half a mile further on, a green basic volcanic rock forms a low cliff along the shore. It is associated with sandstones, and has an appearance of being stratified, which is probably, however, in this instance fallacious, as the rock seems to be a diorite, and the strata near it are confused.

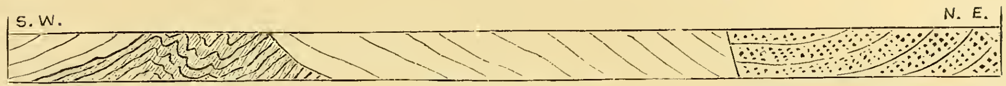


Fig. 5. Section at Conglomerate Point, illustrating the Unconformable Overlap of the Cretaceous Coal-bearing Rocks on the Triassic.

Scale 10 inches to 1 mile.

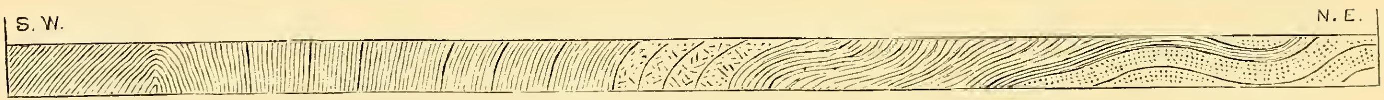


Fig. 6. Section through the Peninsula, Cumshewa Inlet.

Scale 10 inches to 1 mile.

Conglomerate Point.

The little promontory of which Conglomerate Point forms the southern extremity, is composed of massive conglomerates and coarse greenish-grey sandstones. The conglomerates hold fragments often several inches, and sometimes two feet in diameter of felspathic and dioritic rocks, with occasional pieces of grey sub-crystalline limestone, and argillites and argillaceous limestone of dark colours. These are evidently derived from the underlying Triassic formation, which has been fully hardened at the time of the formation of the conglomerate. Some pebbles of shaly argillite were found to contain fossils.

The conglomerates join with the associated sandstones along undulating lines, and the whole deposit evidences littoral conditions and the action of currents.

Conglomerate and lower shales.

These conglomerates probably represent those of Subdivision B. at Skidegate. They form a synclinal, of which the axis runs about N. 40° W., but which appears to be cut off southward by a fault or faults, the downthrow of which has been to the north. On the north side of the conglomerates the lower shales go down with at least the volume above assigned to them as a minimum thickness of the subdivision, but south of the fault they reappear with a visible thickness of only 660 feet. This thickness is exposed in a distance of about a quarter of a mile, between the fault at Conglomerate Point and the outer side of the next point to the south-west. The southern edge of the lower shales is here found resting uncomformably on the flaggy argillites of the Triassic, and as this is one of the places in which the unconformity between the formations is most clearly shown, a short description of it may be given.

Unconformable junction with Triassic.

The underlying series is exposed for a breadth of 300 feet, and is found to be composed of regularly bedded flaggy argillites, becoming calcareous in some places. These have a general southward dip at an angle of about 40°, but are somewhat contorted on a small scale. On the north side, a concealed interval of 140 feet intervenes between these and the lowest visible rocks of the overlying group, which are then found with north-eastward dips at angles of 20° to 30°. They are sandstones, generally soft and rather shaly, and spread over a wide area on the beach, holding large and small calcareous nodules, which are arranged parallel to the bedding, and in some cases contain abundance of marine shells, of which a *Leda* or *Yoldia* is the most abundant. The nodules also hold obscure fragments of plants and calcified stems and twigs of wood, while in the sandstones similar woody fragments have been converted into true coal. This is in some cases evidently in the form of branches or small trunks of trees, but is also found in rounded masses, which, it is supposed, may have been derived from partly consolidated peaty beds of nearly contemporaneous origin.

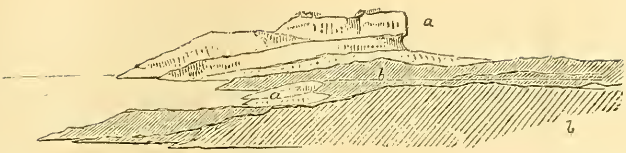


FIG. 7. SKETCH OF OVERLAP OF CRETACEOUS SANDSTONES ON TRIASSIC ARGILLITES.
a. Cretaceous sandstones. *b*. Triassic argillites.

FIG. 8. DETAILS OF JUNCTION OF CRETACEOUS SANDSTONES AND TRIASSIC ARGILLITES.
a. Cretaceous sandstones. *b*. Triassic argillites.

On the south side of the underlying rocks, and resting upon them, sandstones like those just described are seen at low tide. The beds of both formations here dip in the same direction and nearly at the same angle, and might be supposed to form parts of a conformable series, but on close examination it is found that the overlying sandstones irregularly overlap the argillites in several places, as shewn in the cut. It is only by accident that they rest for a certain distance parallel to the bedding of the underlying argillites, in the same way that the sand of a modern sea-beach might lie upon and against the sloping broken surface of a bed of rock. It is found that the surface of the argillites is irregular below the sandstones, with pieces of the former detaching themselves to become pebbles. The sandstones also fill irregular channels and hollows in the argillites, the surfaces of which have been completely rounded and smoothed by the action of the waves before the deposition of the sandstones. The lower beds seem to have been in hardness and habit of weathering exactly as at present, and their surface is now being again exposed under the action of a later sea. (See Figs. 7 and 8.) Unconformable junction of Cretaceous and Triassic.

The small area of underlying rocks here seen must have been at the sea-level at the time of the deposition of the beds above described, and was doubtless covered by the succeeding beds of the Lower Shales, which have since been removed by denudation. The beds here found lying upon the older rocks are not, however, probably the lowest of the overlying formation. There has doubtless been a progressive overlap, and in the part of the series here shown we do not find the conditions which have accompanied the deposition of the coal at Skidegate. If the coal-bearing character of the strata persists thus far southward it is in the lowest beds of the Lower Shales that the seams must be looked for. From this place to the head of the West Arm of Cumshewa Inlet, rocks of the Cretaceous series continue to characterize Character of the overlap.

6

the north shore wherever it was examined; the strike is not far from parallel with the coast line, being N. 80° W., with the dips generally northward. Between the point above mentioned and Boat Cove a shallow synclinal may occur, which would account for the reappearance of conglomerates in the little islands off the mouth of the cove. The point of high land which separates the western and southern arms of the inlet may probably be an anticlinal. It is formed, as far as examined, of older rocks. The apex of the point is composed of a hard but much shattered felspathic rock which may be intrusive, while on the south side of the North Arm grey limestones, interbedded with greenish altered amygdaloids of the character frequently found in the older or Triassic series of rocks, occur.

Conglomerate.

Beds with Monotis.

On the south-east side of the South Arm flaggy argillites occur. They were observed to become conglomeritic in one place with fragments of the underlying limestone, which might be supposed to show that they belong to the coal-bearing series. They hold, however, the characteristic Triassic *Monotis*. Near where the south shore of the inlet turns to an east and west course the Cretaceous sandstones again appear with general southerly dips.

Agglomerates.

Near the southern entrance point of the inlet, the rocks are greyish or greenish agglomerates, with interstratified tufaceous beds and sandstones. The whole not unlike those of the vicinity of Cumshewa village. These rocks probably form the cliff which rises behind the Skedans village, while the little promontary near it is composed of older rocks, much altered locally. A mile and a half south-west of the village, near the bottom of the bay, the southern margin of the Cretaceous is found, though its actual junction with the older rocks is concealed. The lowest bed seen is an agglomerate, comparatively soft, which holds some fragments of flaggy argillite and of the massive grey limestone associated with it. The superior position of this agglomerate to those which are associated with the limestones, is shown by the fact that the limestone and argillite fragments appear to have been fully hardened when included, and moreover, in some places show evidence of water action in rounding them.

Folds and faults.

There are thus in Cumshewa Inlet probably several folds of the Cretaceous rocks, the axes of the flexures lying nearly parallel to the main direction of the inlet. Beds exactly representing those with which the coal occurs at Skidegate were nowhere seen, nor was any indication of the existence of workable deposits of coal in the parts of the series exposed discovered. The existence of several faults, running nearly parallel to the inlet is suspected, though the only one of these actually placed, is that of Conglomerate Point.

North-western Extremity of Graham Island, and North Island.

Junction of Cretaceous and Tertiary.

On the east side of the point east of Pillar Bay, on the north shore of Graham Island, the rocks, which are entirely, or for the most part, of the Tertiary igneous series, are strangely disturbed. They dip at high angles in various directions, and some beds have been shattered in place. These appearances may indicate the existence of an important fault. West of the point beds of the Cretaceous coal-bearing series are found, and best exposed in the vicinity of the remarkable Pillar Rock. This tower-like rock rises abruptly from the beach between tide-marks to a height of about ninety feet. It stands near the eastern side of the bay, with no cliffs or other rocks comparable in height near it, though it is surrounded by reefs and rocks awash, and connected at low water with a little low tree-clad islet, and with the mainland by a spit of sand. It is composed of conglomerate, formed of well rounded but often very large pebbles, dipping S. 43° E. $< 45°$. The bedding is distinctly seen in the bare sides of the rock, and is also marked by the slope of its summit, which is truncated by a parallel plane.

Pillar Rock.

Conglomerates.

From the Pillar Rock the conglomerates and associated sandstones are frequently seen along the shore to Parry Passage. The conglomerates greatly preponderate, but are well bedded, and contain layers of thin-bedded sandstones, holding occasional large stones. They resemble pretty closely the conglomerates of Subdivision B. at Skidegate, differing chiefly in the abundance of large well-rounded stones, which would appear to indicate a rough shore-line. The pebbles are in some cases of grey massive limestone, and of black shaly rocks like those of the Triassic, while dioritic and granitic fragments are abundant.

Rock of North Island.

On the east end of Lucy Island and the reef running off from it, conglomerates, with some shaly beds, are seen. These strike across in the direction of the Indian village on North Island, and dip off a mass of grey crystalline micaceous trachyte-porphyry. On the east coast of North Island, conglomerates, underlain by thin-bedded sandstones and dark shaly beds, continue for three miles, when they are replaced by crystalline diorite, differing from the rock of Lucy Island, and probably intrusive and of greater age than the Cretaceous series. The south-west shore of North Island, to about the centre of Cloak Bay, is composed of the Cretaceous rocks, bounded to the north-west by crystalline rocks like those just mentioned, of which Lucy Island is also composed. At the east end of Cloak Bay the conglomerates rise in cliffs and rugged pinnacled rocks, against which the sea breaks with great fury in south-westerly gales. The west side of Henslung Cove is of conglomerate, the east of shaly beds and sandstones, which appear to overlie the last. These are again followed in ascending order by massive conglomerates and sandstones, which, with the exception of a considerable thickness of shaly beds north of Lucy Island, continue to the south-east point.

South side of Parry Passage, and Lepas Bay.

On the south side of Parry Passage, the Cretaceous rocks are found overlying a rock like that of Lucy Island. The bedded rocks dip of the igneous, but the character of the line of junction is such as to lead to the belief that the igneous rock is an intrusion of later date, and has thrust up the strata, acting on them somewhat about the junction. This is also borne out by the fact that no pebbles of the peculiar rock of Lucy Island were found among those of the conglomerates, while diorites like those of the north end of North Island are abundantly represented. In Bruin Bay, rather soft blackish and olive shaly beds occur nearly horizontal in the coves, while the points are of the intrusive rock. Similar igneous rock is seen on the trail which leads across to Lepas Bay, south of Cape Knox, on the west coast, and appears also to form Cape Knox itself. On the south side of the bay, greyish, blackish and olive coloured shaly beds like those of Bruin Bay occur, dipping nearly due south. They were found in one place to hold thin layers of limestone, which is composed almost entirely of broken shells of *Inoceramus*, is brown in colour, and gives a slightly fœtid odour when struck. These, with some worm-tracks from the same place, were the only fossils found in this area of the Cretaceous.

Trachyte.

Just beyond the south point of the bay last mentioned, the shales are overlain by a massive grey rock which appears to be in great thickness, rather fine grained and apparently a trachyte. Its junction with the shales is well shown, and seemingly quite conformable. It is probably a part of the series, and is traversed in several directions by jointage planes, and sometimes assumes pseudo-columnar forms, giving rise to the pinnacles and jutting crags by which this part of the coast is characterized.

General character of rocks.

The subdivisions used in describing the Cretaceous rocks of Skidegate Inlet do not seem to be applicable to those of the north-west extremity of the islands, though it is possible that we have here represented beds referable to Subdivision E. only. The character of the deposit is here pre-eminently littoral, as evidenced by the rough conglomerates. No coal was observed, and the only traces of plants were a few obscure fragments in the rocks of the east coast of North Island.

Tertiary.

Area of the Tertiary.

Rocks of Tertiary age, so far as ascertained, occur on Graham Island only. They form the greater part of this island, extending from Skidegate to Pillar Bay on the north coast, and underlying the low country which forms the north-eastern part of the island probably throughout, though seldom seen where the drift covering is deep. At the heads of

Masset Inlet volcanic rocks of Tertiary age still prevail, and as the distance through to the west coast cannot be great and no high land intervenes, it is probable that a considerable portion of the shore from Hippa Island northward is also characterized by these rocks. Though this part of the coast was not examined, the supposition is further confirmed by the statement of Vancouver that the coast to the north of Hippa Island is less bold and broken than that southward, and by the fact that I was shown by the Indians a fragment of amber said to have been picked up on that part of the coast. The comparatively shoal region to the north of the island doubtless depends on the submarine extension of the Tertiary, while a great part of the strait between Graham Island and the archipelago fringing the mainland also probably lies over Tertiary rocks. As elsewhere mentioned, lignite is washed ashore abundantly on the east coast of Graham Island.

Amber.

It is not improbable that strata of Tertiary age may underlie a part of the coast about Spit Point, to the south of Skidegate Inlet, or at least may occur at no great distance off shore; as specimens of lignite are found there on the beach. On the north side of Skidegate Inlet, however, rocks of this age are found in place about the mouth of Chin-oo-kun-dl brook, south of Lawn Hill. They are here hard thin-bedded arenaceous clays, grey in colour, and frequently with bedding planes covered with shining micaceous particles. There are also hard, coarse, sandy beds and clayey gravels, holding well rounded pebbles, associated with argillaceous lignite, and including trunks and branches of trees which are converted into coal-black lignite, though still retaining much of their woody texture. The beds appear on the whole to be nearly or quite horizontal.

Rocks at Chin-oo-kun-dl Brook.

Lignite.

Opposite Lawn Hill, on the coast, igneous rocks referable to the Tertiary appear, and account for the existence of this slight elevation. A fine-grained dull greyish-brown basaltic rock, with a thickness of fifty feet or more, is the highest. It appears to be regularly bedded, though this is probably owing to flow structure, and rests upon a great mass of pale-coloured tufaceous agglomerate. This is a soft light porous rock, still in much the same state as at the time of its formation. It contains occasional small fragments of lignite, and is thus pretty certainly of later date than the ordinary sedimentary beds just described.

Tufaceous agglomerate.

Drift lignite.

From this point to Tow Hill on the north coast of Graham Island, between Rose Point and Masset, no deposits of greater age than those of the glacial period are seen along the shore. The country continues low, and on the beach many fragments of lignite may be picked up. These have evidently been torn from parts of the bottom which are subject to the occasional action of the sea during storms. Two varieties of lignite are represented, one compact and evidently produced from wood; the other laminated and much softer. This is frequently perforated by the holes of boring molluscs.

Tow Hill. Forming the bank of the Hi-ellan River at its mouth at Tow Hill, is a dark greenish-brown granular rock probably doleritic which weathers brown, and is laminated in such wise as to simulate regular bedding. Below high-water mark on the west side of the point a similar rock is found overlying a small exposure of pale grey sandy clay, very hard, and holding obscure root-like vegetable traces. These rocks pass beneath those of Tow Hill, which presents a cliff of over 200 feet in height to the sea, but slopes away more gradually inland. The cliff displays a mass of columnar prisms which run with scarcely a break from base to summit. This material is like that just described, but more compact, and less easily affected by the weather.

Lignite. At Ya-kan Point one and a half miles further west, the next rock exposures are found. The rocks are here sandstones, generally with a calcareous cement, and in some layers becoming irregularly honey-combed and weathering away fast along crack-lines. Pebbles are abundant in a few places, while other beds contain so much argillaceous matter that they might almost be called shales. Many branches and irregular masses of wood converted to lignite are included. Some of the bedding planes are covered with obscure vegetable fragments, among which an impression of a dicotyledinous leaf was recognized. The beds undulate at low angles but have perhaps a general dip inshore. Pieces of lignite are here abundant on the beach, together with agates such as are elsewhere found in the Tertiary volcanic rocks.

Fossiliferous sandstones. Nine miles further westward, the intervening bay showing no exposures, Skon-un Point is composed of Tertiary sandstones, which differ from any rocks of this age seen elsewhere in the islands by holding marine shells. The sandstones are here again calcareous, grey in colour, and are composed of quartz, felspar and hornblende grains, such as might be derived from the waste of dioritic or granitic rocks. In some layers these are crowded with shells, roughly heaped together as though thrown upon a sea-beach, but little worn. Underlying the shelly sandstones is lignite, in thick beds, but not so well exposed as to admit of measurement. Though in some places quite black and compact, the general character of the lignite is not such as to warrant a belief in its value as a fuel so long as good wood can be obtained in abundance.

Beds of lignite.

The matrix being rough, many of the shells collected here are more or less exfoliated, and consequently present some difficulty in their determination. Mr. J. F. Whiteaves has examined the collection and furnishes a list of species, with remarks, as follows.—

Gasteropoda.

Tertiary fossils.

Mangelia? sp. undt. One worn specimen.

Nassa, sp. Unlike any of the living species on the N. W. coast.

Lunatia? sp. Test exfoliated.

Trochita, or *Galerus.* Test exfoliated.

Crypta adunca, Sby. One specimen; undistinguishable from the living species. Mr. Gabb (Pal. Cal. vol. 2, p. 82,) says that this shell occurs in the Pliocene and Post Pliocene of California.

Lamellibranchiata.

Solen, sp. One fragment of a large species.

Siliqua — Possibly the young of *S. patula*, Dixon. Two examples.

Standella — Very like *S. planulata*, Con., and *S. falcata* Gld., but smaller than either. Several specimens.

Macoma nasuta, Conrad. Two or three specimens. According to Gabb. (Pal. Cal. vol. 2, p. 93) this recent species occurs also in the Upper Miocene, Pliocene and Post Pliocene of California.

Mercenaria — Mr. W. H. Dall thinks this shell is closely related to his *M. Kennicotti*, from Alaska.

Chione, sp. undt. Two specimens.

Tapes staminea, Conrad. The most abundant shell in the collection. It is abundant, in a living state, on the N. W. coast, and Mr. Gabb says that in California it is found in the Post Pliocene, Pliocene and Miocene.

Saxidomus, species undistinguishable. The outer layer of all the specimens, which are not numerous, is entirely exfoliated.

Cardium, one exfoliated valve. Appears to resemble *C. Islandicum.*

Cardium. Several valves of a species, which may be referable to *C. blandum*, Gld.

Arca microdonta, Conrad. An extinct species, found so far only in the Miocene and Pliocene of California. Two specimens.

Axinæa. Possibly a form of *A. patula*, Conrad, but barely distinguishable from the smooth form (var. *subobsoleta* Carpenter) of the living *A. septentrionalis*, Middendorf, of the N. W. coast. Four single valves.

Volcanic rocks of Masset Inlet.

Throughout the whole extent of the great Masset Inlet, the rocks exposed appear to be those of the Tertiary, and, with the exception of those seen on the Ma-min River, all of volcanic origin. It will be unnecessary to do more than explain their general character. The whole western portion of the first expansion of the inlet shows a preponderance of dark-brownish or greenish-brown rocks of fine grain, which may be named collectively basalts, though no perfect columnar structure was observed. These are associated with some amygdaloidal layers. Near the entrance to the upper expansion of the inlet, and also at one place on the north shore, a few miles west of the Ain River, Agglomerates. they are associated with rough agglomerates, which, in one instance, were noticed to hold fragments up to four feet in diameter. In some places agates are quite abundant, but these were nowhere observed to be of fine colours, being in general either milky-white or pale grey. With the exception of the agglomerates, which are sometimes considerably disturbed, the rocks of the western portion of the first expansion of the Inlet lie at very moderate angles, and are often nearly horizontal or undulating with low dips.

Banded trachyte. A mile south of the Ain River, a rather remarkable pale greyish-purple trachytic rock, with partly decomposed felspar crystals porphyritically imbedded, occurs in well marked beds. In several places in the upper expansion similar rocks more acidic in composition than those first described are found, but varying in colour and texture from place to place. Near the head of this part of the inlet, and in a small island south-west of Tas-kai-guns Island, a peculiar laminated felspathic rock was noted, which may occur in many other localities, as it is quite abundant among the pebbles in the drift deposits of the eastern shores of the Inlet.

The rock is generally grey in colour, and its lamination is evidently the result of movement while in a viscous state. Under the microscope, the structure is resolved into a series of closely alternating light and dark felspathic bands. In some places very small segregations of quartz have been formed subsequent to the cooling of the mass.

Obsidian. A second small islet north-east of Tas-kai-guns is composed in great part of a species of obsidian. The rock is roughly bedded and dips two ways, as though forming a small anticlinal. The greater part of the obsidian is dark grey or black, with a glassy lustre, but very tender, being traversed by innumerable fine cracks, which cause it to fall into prismatic fragments under a light blow. Some small beds are reddish in general colour, a granular material of that tint being intercalated with resinous-looking dark conchoidal-fracturing obsidian in little layers or lenticular masses. The obsidian is finely laminated, and under the microscope is found to be very rich throughout in small microlites.

Lignite on Ma-min River. The Ma-min River flows into the eastern side of the upper expansion of Masset Inlet, coming from the south-east. Coal was reported to occur on this stream, and supposed possibly to indicate the extension of the Skidegate measures. After some little difficulty, an Indian who knew the locality was found, and my assistant, Mr. R. Dawson, visited it with him. The tide runs up the river about half a mile; above this there are occasional little rapids, but the country is all flat and low. About one mile and a half below the coal exposure, which is about six miles from the mouth of the river, Tertiary basaltic rocks begin to appear in the stream. The so-called coal proves, however, to be merely lignite, which forms thin seams in a fine-grained argillaceous shale. This appears to be, in part at least, of a tufaceous character, and also holds occasional obscure plant impressions, among which a coniferous twig was recognized. The deposit of lignite is valueless in this remote place, but interesting in extending the area over which deposits of this kind, of Tertiary age are known.

On the west side of the outer part of the entrance to Masset Inlet the rocks are fine-grained and nearly black, apparently basalts, but with small glassy-white or yellowish felspar crystals scattered through them. They have in some places a peculiar prismatic structure, and may be nearly horizontal. A heavy sea prevented landing at other points between this and Virago Sound, but the rocks, which continue in almost uninterrupted low exposures along the shore, appear to be of the same character. Masset to Virago Sound.

The country surrounding Virago Sound and Naden Harbour is low, and though rock in place is seldom seen, it is doubtless underlain by the Tertiary. In the bed of a stream on the east side of the harbour rolled pieces of lignite abound, and have probably come from some outcrop not far up its course. The point at the extremity of the harbour, and one place on its western shore, show rock exposures, the material being dark greenish-brown dolerite, not unlike that found near Tow Hill. Near the old Indian Village a close-grained grey felspathic porphyrite is seen. From Virago Sound westward along the coast to the edge of the Cretaceous in Pillar Bay, igneous rocks of Tertiary age appear to continue uninterruptedly. They are basaltic and dark coloured, or grey and felspathic, and resemble those of the upper parts of Masset Inlet, but become brecciated over considerable areas, forming agglomerates which generally assume a ruddy hue on weathering, and are occasionally worn into fantastic forms by the sea along the shore. Rocks of Virago Sound and Naden Harbour

Glaciation and Superficial Deposits of the Queen Charlotte Islands, with Notes on those of the Coast of the Mainland Adjacent and Vancouver Island.

Glaciation and Superficial Deposits of the Queen Charlotte Islands.

We find everywhere in the Queen Charlotte Islands evidence of the descent of glacier, ice from the axial range of mountains toward the sea, and little or none of the passage across the group of any more ponderous ice mass. Without attempting to enter into the detail of observations, which would be to outline again the physical features of the region, it may suffice to refer in brief to a few of the more important localities. Glaciation local.

In Houston Stewart Channel, near the south end of the island, though the mountains in this vicinity are not very high, and do not show any permanent snow, the sides of the valleys, now forming arms of the sea, are everywhere scored and grooved. The eastern end of this channel lies nearly east and west, while that which opens to the Pacific lies south-west and north-east. At the angle formed by these two the arm forming Rose Harbour runs north-westward, ending among some of the higher summits. Here the Sedmond River enters, and the rocks at its mouth are found to be glaciated from west to east. The ice has then turned at nearly a right angle following Rose Harbour, and a portion at least of the stream, again changing its direction to east, passed on to the open sea at the outer points of the channel. The sides of the channel opening westward to the Pacific are similarly scored. Many of the boulders on the beaches are evidently glaciated, and as they lie in some places rudely packed together, seem to have been little disturbed since they were deposited there. There is apparently a total absence of clay or sand deposits due to the glacial period on this part of the island. The shores are abrupt and the water deep.

Course of ice in Houston Stewart channel.

In Carpenter Bay, next north of Houston Stewart on the east coast, and in many parts of Skincuttle Inlet, similar traces of the passage of ice from the highlands to the sea are again found. They are not confined to the narrower channels, but may be traced also in the wide eastern opening of Skincuttle Inlet.

Extent of local glaciers.

In the inlets near Laskeek it was observed that while the marks of very heavy glaciation were found in their upper reaches, the rocks near their seaward terminations had been lightly shaped only, in most places still retaining the irregular forms due to old sub-aerial weathering or to the sea, though rounded off at the corners, tops and sides by the passage of ice. This would show that the glaciers did not for a very long period continue to push out beyond the mouths of these inlets, and enables us to form some estimate of the extent to which other parts of the island were buried in ice. In Cumshewa Inlet glacial grooving was found as far out as Village Island, near its mouth.

North of Cumshewa Inlet (Lat. 53°) the character of the coast changes. It becomes low, is sometimes shoal, and is no more backed by steep mountain slopes. With little exception the shore continues to preserve this character to the north-west point of the island. The flat beaches between Cumshewa and Skidegate are thickly strewn with boulders, some of which are of great size.

Glaciation of Skidegate Channel.

In Skidegate Inlet or Channel there is a great spread of sandstone and shales of the coal-bearing series, which from their easily decomposed character are not suited to preserve glacial traces, but these were nevertheless observed in a few places, and where the channel opens westward to the Pacific the crystalline rocks there forming its sides are heavily glaciated.

Boulder clay.

Owing to the dense forest covering of the country, sections of the clays and sands which rest at least in some of the hollows are seldom found, but in the cuttings made on the road to the now abandoned Cowgitz coal mine, and in the banks of the brook, a true boulder clay, a hard greyish sandy material packed with stones and boulders of various sizes, is shown. This is the most southern locality in which boulder clay was clearly distinguished in the islands.

The character of the coast between Skidegate and Masset Inlets has already been described in sufficient detail, with the great stretch of flat country which forms the north-eastern part of Graham Island. The long lines of wasting cliff on the eastward-facing shore present excellent sections of the deposits of which this low land is composed, and these appear with scarcely any exception to be those of the glacial or even yet more modern periods.

Section of clays and sands.

A few miles north of Lawn Point, at the entrance to Skidegate, the most southern exposure is found in a low cliff or bank, in which deposits evidently of glacial age are cut off above by a gently undulating surface of denudation, and overlain by ten or fifteen feet of superficial material which shows no sign of blending with that below. The upper deposit consists of sand and well rounded gravel, in regular and often nearly horizontal layers. It has become in places quite hard, being apparently cemented with ferruginous matter. Its lower layers hold some small boulders, a few of which measure eighteen inches or two feet in diameter. The lower deposit at the north end of the exposure—which may be in all about two hundred yards in length—is a typical boulder clay, with many half-rounded and sub-angular stones and occasional boulders of some size. The matrix is bluish-grey, hard and somewhat arenaceous. The whole is irregularly mingled, and shows no sign of bedding. The boulders were not observed to be striated, but smaller stones now loose on the beach were so. Among the fragments pieces of lignite from the Tertiary formation, which there is good reason to believe underlies all this region, are quite abundant. When followed a few yards southward this boulder clay begins to show bedding and to become interstratified with hard clayey gravels composed of well-rounded pebbles. The bedding of these is undulating and rather irregular, and there is, as may be supposed, some local unconformity by erosion between the different layers. A few paces further on these become interbedded with, and are eventually replaced by, hard bluish-grey arenaceous clays, which hold only occasional pebbly layers, but contain in abundance imperfect and broken specimens of several species of molluscs, among which *Leda fossa* is the most common. A small

Included shells.

Cardium-like shell and fragments of a *Balanus* were also observed, but all broken, and tender from partial decomposition.

In general appearance with their relation to the sea level, and the shells found in them, these beds resemble very closely those previouly described as occuring in the vicinity of Victoria, on the south-eastern extremity of Vancouver Island.*

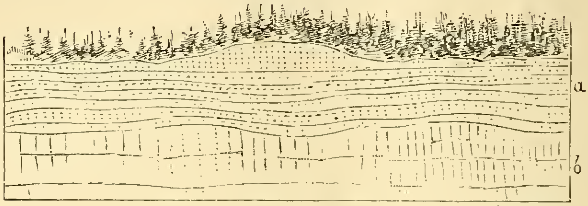


FIG. 9. SECTION IN CLIFFS NORTH OF CAPE BALL.
a. Stratified sandy deposits. *b.* Imperfectly stratified clays.

End of clay exposures.

Ten miles north of Cape Ball the last large exposures of the clayey beds forming the lower part of the section were observed. The clay is here very hard, and in some places distinctly bedded, with occasional gravelly layers, but these are not nearly so prominent as in the last described localities. No shells were found, but fragments of wood partly converted to lignite,—but still quite distinct in appearance from the more highly altered wood found in the underlying Tertiary formation,— were noticed in several places. The junction with the overlying sands is generally sharp, and forms as before in many places an undulating plane. The sands are in thin and regular layers of pale yellowish colours, with some beds of well rounded gravel. In consequence of the undulating upper surface of the clays, these rise considerably higher above the water level in some places than in others, and where the hard clays are most largely developed, the more prominent points of the coast are found. Above both the clays and sands banks of wind-blown sand are occasionally seen in section.

Woody fragments.

Fossiliferous bed.

In the narrow sound leading to the wide southern expansion of Masset Inlet, eleven miles above Masset, at the mouth of a small stream called *Wa-toon*, are some interesting exposures probably referable to the upper part of the clay beds, or to the sands overlying them. The bank here rises about eight feet above high-water mark, its upper half being composed of regularly bedded coarse sands and fine gravels of general yellowish colour. Below this, and usually meeting it at a pretty well defined line, is a hard bluish-grey sandy clay, thickly packed with rounded pebbles, generally about the size of walnuts, but in some instances having a diameter of several inches. One small frag-

* Quart. Journ. Geol. Soc., Vol. XXXIV., p. 95., 1878.

ment of Tertiary lignite was also observed. This lower part is filled with marine shells, but all the specimens are tender and being imbedded in a hard matrix, difficult to preserve entire. Several inches of the upper part of the shell-bearing layer has been so affected by atmospheric waters, that the shells have been completely removed leaving hollow casts. This part of the bed has also been changed to a yellowish colour.

Mr. J. F. Whiteaves has examined the collection from this place, and enumerates the following species:— Fossils.

Hemithyris psittacea, Linn.
Modiolaria nigra, Gray.
Saxicava rugosa, Lamarck.
Puncturella galeata, Gould.
Balanus— ?

And fragments of bivalves, which are scarcely determinable.

In several other places on this sound, similar sandy beds were seen generally when near the water level well compacted, but were not again found to hold shells. At Echinus Point, on the south shore of the first great expansion of the inlet, at low tide, a very hard sandy clay almost like stone is exposed. It is charged with pebbles and boulders, some of which appear to be ice marked. Extent of clay and sand deposits.

Deposits of this character probably underlie the whole flat country between Masset Inlet and the east coast, while on the southern and western margins of the expansions of the inlet superficial deposits other than boulders, which are evidently derived from the mountains of the immediate vicinity, are wanting, and ice marking was observed in many places on the rocky sides of the valleys.

On the little islands which lie immediately to the west of the entrance to Masset Inlet, on the open coast, glaciation, very distinct and heavy though somewhat worn, was found, with a course of S. 10° E. or the reverse. The mountainous axis of the islands in this their northern part is not high, and this marking is further from it than elsewhere seen. It is pretty evidently glacier work and not that of floating ice, and the question presents itself whether it should be attributed to ice passing off the islands themselves, or the edge of an ice sheet coming down from the channels of the Prince of Wales Archipelago to the north. Boulders are not commonly found along the north shore of Graham Island from Rose Point to Masset, but from that place westward they are abundant, and with the beach gravel, in many cases formed of rocks which must have been transported from the mainland to the north or east, and unlike those of the Queen Charlotte Islands. It is quite probable, however, these erratics were carried here by North to South glaciation. Erratics.

floating ice, at a time when extensive glaciers debouched in many places on the coast.

Bluish clays. In Virago Sound and Naden Harbour several exposures of beds probably referable to the glacial period were found. They are best seen in a low cliff nearly opposite the Kung Indian Village, where they are hard bluish clays, generally in very regular and somewhat thin beds, but occasionally undulating, and sometimes for a small thickness twisted in a remarkable manner, as though by the grounding of floating ice. Such disturbed portions may be bounded above and below by regular horizontal layers. Small stones, at times several inches in diameter, are often imbedded in an irregular manner, and seams of gravel in a few places occur, and are generally associated with the disturbed portions of the deposit above alluded to. In one place a few feet of a clay holding gravel and boulders was seen at the base, resembling the boulder clay of the east coast of the island. Gravels and sands lie above the clays, their junction forming a distinct line. These beds would appear to have been deposited in much less disturbed water than those of the east coast.

Facts Indicating Change in Elevation.

Raised beach. A few facts bearing on changes in elevation of the land subsequent to the glacial period, in the Queen Charlotte Islands, may here be noted. In an article in the *Canadian Naturalist* (Vol. VIII., p. 241, 1877) the general question of changes of elevation in the coast of British Columbia has been treated by me at some length.

About three hundred yards above the mouth of the Naden River, which enters the harbour of the same name, a bank about sixteen feet high, in appearance evidently more recent than the deposits last described, occurs. For about five feet above high-water mark the material is a rather soft sandy clay, holding, besides broken fragments of shells, many large bivalves, with both sides united, and evidently resting in the mud in the position they have occupied during life. The deposit is such as might be formed in a shallow bay, and contains occasional small fragments of charcoal, which appear to prove the presence at the time of its formation of inhabitants. Above this stratum is a second, not dissimilar, but coarser, in which shells are comparatively scarce, and for the most part broken. This is capped with from one to two feet in thickness of a deposit composed altogether of shells such as the Indians ordinarily use for food, mingled with much charcoal, and some stones which have the appearance of those used by the natives in cooking. This layer in fact represents such a clam-heap as may be found in very many places along the coast. The shells in it are comparatively strong, while those

Evidence of inhabitants.

below are much decayed. An elevation of the coast to the extent of at least fifteen feet since the country became inhabited appears to be indicated by this deposit.

Specimens collected in the lower layers include, according to Mr. J. F. Whiteaves, the following species:— Shells from raised beach.

Saxidomus squalidus, Desh.
Tapes staminea, Conrad.
Macoma, sp.
Nassa mendica, Gould.
Cryptobranchia concentrica, Midd. (*Lepeta cæcoides*, Cpr.)
Tornatina eximia, Baird.
Littorina Sitchana, Phil.

And other small gasteropods.

In the highest layer the following species were found to occur:—

Saxidomus squalidus, Desh.
Tapes staminea, Conrad.
Cardium Nuttalli, Conrad.
Purpura crispata, Chemn.

On the Ma-min River, at the head of Masset Inlet, about a mile and a half up the stream and some feet above the present level of high tide, a deposit similar to that just described forms the bed of the stream, and rises in a bank from six to ten feet above it. The following species of shells resembling those of the last locality were found here. Many of them are imbedded with the valves united, and in some cases the ligature at the hinge has been preserved. Raised beaches on Ma-min River.

Macoma nasuta, Conrad.
Saxidomus squalidus, Desh.
Tapes staminea, Conrad.
Lucina filosa, Stimpson.

In two places the burrows of lithodomous molluscs were observed in rocks above the present water-line. One of these is in the bay on the east side of North Island, where a dark calcareous shale is affected in this way just above the high-water mark. The second is on one of the Bolkus Islands, in Skincuttle Channel, in an earthy dolomitic limestone eight or ten feet above the tide. Other evidences of elevation.

The flat land forming the north-eastern portion of Graham Island may be regarded broadly as a terrace, proving the former presence of the sea at a level two or three hundred feet above the present, but this must have been while the glacial conditions still endured. A terrace of much more recent origin was seen in several places in Skidegate Inlet, and where measured in one locality was found to stand twenty-six feet above the highest point now ever reached by the tide. The terrace is generally but faintly impressed, which would seem to show that the water did not remain for a long time at this level. Several indistinct benches of lesser height are met with elsewhere in the same vicinity down to the present water-line. In Masset Inlet a faintly marked terrace at a height about the same with that above given was also seen.

Shingly points. Along the low north-eastern part of the islands, and more particularly on that part of the coast between Cumshewa and Skidegate, the points are often found to be composed of shingle, forming a flat of greater or less width standing about twenty feet above the present high-water mark, and in most instances covered with a certain quantity of vegetable soil which supports a forest. These have evidently been produced by the waves acting at different times in opposing directions, but imply a subsequent elevation nearly equal to their height. On the north shore, east of Masset, several tiers of low terraces, now densely wooded, are found. On some parts of the east shore the land is evidently making by the addition of drift sand, while in others the clay cliffs are being gradually cut back by the sea. No recent change. There is no evidence that any elevation has occurred within the period of growth of the present forest, as large trees stand in the sheltered inlets quite down to the sea level. It would on the contrary appear that, if anything, the latest movement may have been a slight subsidence, for in many places, especially in the bays, the waves are now by degrees washing the vegetable soil away from the roots of the trees and undermining them. At the point on the east side of Masset Inlet the sea is evidently encroaching pretty rapidly on the forest. One fact, however, which would seem to show that any change of level must have been slight or have occurred very many years ago, is the existence of a narrow level border near high-water mark, seen especially where the rocks on the shore are pretty soft, and evidently produced by the mechanical action of the waves. Line of greatest erosion. It was difficult at first to account for the fact that this line of maximum horizontal erosion should lie near the high-tide mark, where the rocks are for the shortest time exposed to the wash of the sea, but it is explained by the circumstance that below this line the rocks are to a great extent preserved from wear by a thick growth of sea-weed and acorn-shells.

Additional Notes on the Glaciation and Superficial Deposits of Other Parts of the Coast.

In the channels penetrating the mainland and intervening between the numerous islands, from the southern extremity of Alaska to the north end of Vancouver Island, marks of the passage of glacier-ice, generally in strict conformity to the direction of the passage, are to be found wherever the rocks are well suited for their preservation. It is quite certain that all these valleys have been filled with glacier-ice descending to the sea from the Coast Range, which here still supports many small glaciers. Whether at any time the mass of ice was so great as to flow to the sea at right angles to the main direction of the range, quite regardless of the contours of the surface, has not been ascertained. The outer islands of the archipelago have scarcely been examined, but the little group called the Gnarled Islands, lying on the southern side of the strait between Dundas Island and Cape Fox, which has a width of thirteen miles, are glacier-shaped and show heavy grooving from N. 50° E. to S. 50° W. It is probable that the ice of the Coast Range has reached at least as far westward as the outer islands of the archipelago which fringes the coast. Glaciation of coast archipelago.

The absence from the coast region generally of well marked terraces has been remarked on in the publication already referred to.* Behind Fort Simpson, however, the surface bears a considerable thickness of detrital matter, and from a distance this appears to form an ill-defined terrace at a height of somewhat over one hundred feet. A few miles further southward, at Melta Katla, there is a well-defined terrace-flat, much of which has now been bared of trees for firewood. Barometrically measured, the height of this was found to be about ninety-five feet above high-water mark. Terraces.

It will be remembered that it has been shown that at one time during the glacial period, a vast glacier filled the entire Strait of Georgia, which separates the south-eastern part of Vancouver Island from the mainland, and that the glacier-ice swept across the low south-eastern extremity of the island, and may even have passed some distance southward to Puget Sound, and westward by the Strait of Fuca.† It still remained to determine whether the ice supply of this glacier was wholly derived from the neighbouring mountainous country, or whether —as according to some theories of glaciation might be supposed—a great ice-sheet entered at Queen Charlotte's Sound, at the north-western end of the island, and passed continuously southward between it and the mainland. It is now found that the latter idea must be abandoned. In several places about the northern end of Vancouver Island, but more particularly on the little islands of the Masterman Group near Hardy Bay, and those in Beaver Harbour, are marks of very heavy glaciation from south-east to north-west, in bearings varying from N. 49° W. to N. 62° W. This not only passes over the islands, but has grooved, polished and undercut vertical and nearly vertical faces of the rock, on Former great glaciers of the coast. Glaciers of Queen Charlotte's Sound.

* Quart. Journ. Geol. Soc., Vol. XXXIV., p. 99.

† Quart. Journ. Geol. Soc., *loc. cit.*, Report of Progress, 1877-78, p. 133 B.

their south-eastern parts, while the north-western slopes are comparatively rough. These traces precisely resemble those found in the track of the Strait of Georgia glacier near Victoria, and show that here, as there, the ice rode over the low extremity of the island. The seaward margin of the continental shore is here also low, and the width of the glacier of Queen Charlotte Sound can scarcely have been less than twenty or twenty-five miles, though it may have been much greater. Traces of glaciation were also seen on the rocks, in a few places on Quatsino Inlet opposite Beaver Harbour on the west coast of Vancouver Island, and it appears probable that the ice may have passed westward over the low intervening country.

Deposits of sandy clay.

On Cormorant Island, and also on Harwood, Mary, Hernando and Savary Islands, situated between Vancouver Island and the mainland, hard regularly bedded deposits of sandy clay and sand occur, forming in some places cliffs two hundred feet in height. Clays containing boulders probably underlie these, as erratics in great numbers are frequently scattered on the beaches above which the cliffs rise. Similar deposits are shown at Cape Mudge, Cape Lazo and elsewhere, and resemble those of the islands in the southern part of the Strait of Georgia. They probably represent the time immediately subsequent to the retreat of a great mass of glacier-ice. True boulder clay was noticed in the bank of the Sable River near Comox.

Fossiliferous clays at Nanaimo.

In a cutting on the colliery railway between Nanaimo and the Chase River Mine, hard sandstone rocks have been bared, and show heavy and well-marked glaciation running parallel to the general trend of the coast and Strait of Georgia, in such a way as to show that the entire width of the strait must have been filled with ice, and that no local glaciation,—which would be radiant from the mountains of the district,—will account for the facts. In a clay which is found to rest in the hollows of these glaciated rocks, marine shells like those formerly obtained in the clays at Victoria are found. The elevation above the sea level of the place where they were seen is about seventy feet. The species represented in a small collection are:—

Saxicava rugosa.
Mya truncata.
Leda fossa.

The last named is still found in waters of moderate depth on the coast. The two first are shells of very wide range, and are not confined to arctic waters.

Conclusions, and General Remarks on Glaciation.

There is good reason to believe, from facts observed in the interior of British Columbia, that at least two periods of extensive glaciation have occurred. During the first, and most intense, there are some grounds for the belief that the entire interior plateau was covered by a glacier-sheet with a slow southward motion, the gradual disappearance of which was accompanied by a subsidance of the land amounting to several thousand feet, or by the formation of a great lake held in by glacial barriers. It is possible, however, that the north-to-south glaciation of the interior may have been effected simultaneously with the deposit of the boulder-clays, without the aid of a great ice-sheet, but by floating ice. The second period seems to have been a temporary advance of glaciers from the various mountain systems, and must have been inconsiderable in duration and severity as compared with the first. It is not intended to do more than mention these hypothesis here, to indicate their possible bearing on the explanation to be adopted for the glacial phenomena of the coast.

Conditions of the glacial period.

On the coast, we find that the great hollow between Vancouver Island and the mainland must have been blocked with ice, supplied from the mountains of the island and the Cascade or Coast Range, with, possibly, the addition of ice flowing westward through gaps in the range from the central plateau. The great glacier-mass thus formed, from a position near Chatham Point of Vancouver Island, flowed south-eastward as the Strait of Georgia glacier, and north-westward as that of Queen Charlotte's Sound, till it reached the ocean in both directions. Local glaciers doubtless filled the inlets of the west coast of Vancouver Island.

Glaciers of the coast.

Northward, to the southern extremity of Alaska, the ice discharge of the various inlets may probably have formed a coalescent glacier along the coast, ending seaward near to, or somewhat beyond, the outer points of the present coast archipelago.

In the Queen Charlotte Islands, with a comparatively limited gathering ground, the glaciers were probably much smaller, but the islands must have been well capped with ice at this time.

No evidence of a great south-to-north-moving ice sheet has anywhere been found, though it may be remarked that if such had existed at a more remote period, the glaciation of which we can trace the history, would probably have been sufficient to remove it in most places.

When the Strait of Georgia glacier began to diminish, the sea must have stood considerably higher in relation to the land than at present, and the glaciated rock surfaces became covered about Victoria and Nanaimo with deposits holding marine shells. This must have occurred also in the Queen Charlotte Islands, and to this time are doubtless due the clays and sands of the low north-eastern part of the islands above described. The material of these must have been supplied from the glaciers of the islands themselves, and added to

Sea at relatively higher level.

Hollows left by glaciers.

by *débris* from floating ice from the larger glaciers of the mainland, the sea levelling and spreading abroad the detritus, and preventing the formation of any well marked terminal moraines by the island glaciers. The basins now occupied by the two expansions of Masset Inlet and by Naden Harbour lie along the border of the high central axis of the islands, and are bounded north-eastward by the low plains of drift material. The rocky beds of these depressions may have been shaped to some extent by the ice, but the absence of drift material from their areas, and especially of erratics derived from the coast of the mainland, which are abundant over the drift-covered region to the north-east, are, with their situation, good reasons for supposing that they mark the areas last covered by glacier ice, and from which the ice eventually retreated with some rapidity, leaving the hollows formerly occupied by it to become first inlets, and then with increasing elevation in some instances lakes.

Submerged hollows.

It is probable that complete explorations will reveal a series of such hollows along the whole eastern flank of the mountain ranges of the islands. Besides those just mentioned, there are two very large lakes on the same line between the upper part of Masset Inlet and Naden Harbour. One of these discharges into the latter, the other by the Ain River into Masset Inlet. There is also at least one similar lake between the head of Masset Inlet and Skidegate. None of these have, so far as I know, been visited by any white man. In Skidegate Inlet and in Cumshewa Inlet, both obstructed at the mouth by bars, and with comparatively shoal water far off shore, while deep toward their upper parts; we seem to have exactly the same feature, though in a partially submerged condition. Further south, with high mountains rising abruptly from the water, the glaciers even at this period of their decadence must have pushed some distance seaward. There must also have been less material supplied from them, and little from the mainland, owing to its greater distance. In the halibut banks off Laskeek, however, it is possible that traces of the position of the front of the glaciers are again found.

Accumulations about the mouth of Bute Inlet.

In Hernando and Savary Islands, strewn with boulders and formed above at least of stratified deposits, we may have the remnants of a similar sea-modified moraine of the glacier fed by Bute and other neighbouring inlets. Features somewhat similar characterize most of the fiords and inlets of the coast of the mainland, and west coast of Vancouver Island, and though in some instances marine currents may have been efficient in silting up and reducing the depth of the inlets near their mouths, while the upper reaches have remained deep; it is by no means improbable that moraine accumulations, spread abroad by water beyond the front of the glaciers, may account for this arrangement in many cases. As pointed out elsewhere, most of the inlets, were the land somewhat elevated, would become fresh-water lakes, discharging seaward across a flat or gently sloping border formed of detrital materials.

It is still a question, however, whether the glaciers which have lately occupied these hollows were those of the first period of cold, shrinking back toward the mountains, or whether these depressions may not represent the beds of the glaciers of the second period, when at their greatest extension. The latter is perhaps the more probable supposition, but in either case the final retreat of the glaciers would seem to have been pretty rapid.

APPENDIX A.

ON THE HAIDA INDIANS

OF THE

QUEEN CHARLOTTE ISLANDS.

BY GEORGE M. DAWSON, D.S., A.R.S.M., F.G.S.

The following account of the Haida Indians is chiefly the result of personal observations during the portion of the summer of 1878 spent in the Queen Charlotte Islands, prosecuted during moments not occupied by the geological and geographical work of the expedition, at the camp fire in the evening, or on days of storm when it was impossible to be at work along the coast. I am also indebted to the Rev. Mr. Collison, of the Church Missionary Society, for various items of information, and largely to Dr. W. F. Tolmie, of Victoria, for comparative notes on the Tshimsians. Mr. J. G. Swan has published a brief notice of the Haidas in the Smithsonian Contributions to Knowledge (Vol. XXI, 1876, No. 267.) This may be consulted with advantage on some points, more particularly on the nature of the tattoo marks of these people. The present memoir is, however, I believe the first detailed account of the Haidas which has been given.

Homogeniety of the Haida nation.

The Haida nation appears to be one of the best defined groups of tribes on the north-west coast. Its various divisions or bands differ scarcely at all in customs, and speak closely related dialects of the same language. They have been from the earliest times constantly in the habit of making long canoe voyages, and taking into account the ease with which all parts of their country can be reached by water, it would indeed be difficult to explain the slight differences in dialect which are found to exist, but for the knowledge that in former times they carried on, at least occasionally, intertribal wars; besides constituting themselves, by their warlike foreign expeditions and the difficulty of pursuing them to their retreats, one of the most generally dreaded peoples of the coast, from Sitka to Vancouver Island. This warfare, however, partook of the barbarous character of that of the other American aborigines, and consisted more frequently in the surprise and massacre of helpless parties, even including old people and women, than in actual prolonged conflict.

Territory.

The original territory of the Haidas, as far as tradition carries us back, is the well-defined group of islands called by Captain Dixon in 1787 the Queen Charlotte Islands, but which the people themselves call *Hai-da-kwē-a*.* These islands lie between the latitudes of 51° 55′ and 54° 15′, with an extreme length of about 190 miles. They are separated by waters of considerable width from the mainland to the east and from the southern extremity of the territory of Alaska to the north. At the present day, however, people of the Haida stock, and closely related in every way to the tribes of the northern end of the Queen Charlotte Islands, occupy also a portion of the coast of the southern islands of Alaska, being the south end of the Prince of Wales Archipelago, from Clarence Strait westward, together with Forrester's Island.

Islands not directly peopled from mainland.

It has been supposed that from the large islands adjacent to the mainland the Queen Charlotte Islands have been peopled, but this is not the case, for the traditionary account is still found among the natives of internecine wars as a result of which a portion of the Haidas of the northern part of the Queen Charlotte Islands were driven to seek new homes on the Prince of Wales group. Their story is borne out by other circumstances, and the date of the migration cannot be more than 150 years ago. These Haidas living beyond the Queen Charlotte group are generally known collectively as *Kai-ga-ni*, which name is also among the Indians applied to the country they inhabit.

Frequently, among tribes pretty closely related in language, the process of differentiation has gone so far that neighbouring peoples disclaim any community of race, though on comparing their vocabularies their national identity becomes apparent. This is not the case, however, among the Haidas, who speak of all the people of their nationality as Haida, adding when necessary the name of the region inhabited by the tribe. A comparison of the Haida language with those of the other tribes of the coast shows very few points of resemblance.

Physical peculiarities and dress.

Build and appearance of the Haidas.

Physically, the various tribes of the north-west coast differ to some extent, so that a practised eye may distinguish between them, but the differences are slight as compared with those obtaining between the coast tribes generally, and those of the interior of British Columbia. The Haidas are, however, markedly fairer skinned than most of the

* On the orthography of Indian words see note in connection with the Haida vocabulary.

coast tribes, and possess somewhat finer features. In the coarseness of the mouth, width and prominence of the cheek bones, and somewhat disproportionately large size of the head as compared with the body, the main departures from ideal symmetry are to be found. The body is also not infrequently long and large as compared with the legs, a circumstance doubtless brought about by the constant occupation of these people in canoes and the infrequency of their land excursions. The hair is black and coarse, and only in the case of 'medicine men' have I observed it to be allowed to grow long in the male sex. A scanty moustache and beard sometimes clothe the upper lip and chin, generally in the case of old people who have given up the habit of eradicating the hair as it grows. In some instances, and these more numerous than in the other coast tribes, both men and women of prepossessing appearance, and with features of considerable regularity as measured by European standards, occur. The average physiognomy of the Haida shows more evidence of intelligence and quickness than that of most of the coast tribes, an appearance not belied on more careful investigation. I have not been able to discern in their appearance anything of that exceptional fierceness said to be characteristic of them by the earlier voyagers, and can only suppose that these statements may have arisen from the more elaborate character of their armament and dress, and the liberal application of pigments to the skin. Many of the Haidas are said to be strong and dexterous swimmers, but I have never seen them exercising the art, which may probably be reserved for occasions of necessity. They are not long-lived, though grey-haired men and women may occasionally be seen. Pulmonary diseases accompanied by spitting of blood, and blindness generally caused by a species of opthalmia, are not uncommon; and other diseases incident to a life of exposure tend to reduce the term of life, as they do among all the aborigines of the continent. Besides these, however, and much more fatal, are diseases introduced among them since contact with the whites. Great numbers of the Haidas, with all the other tribes of the coast, have been cut off by small-pox, both during their periodical visits to Victoria and after their return to their native islands. This disease is with them almost certainly fatal, and I could learn of a single instance only in which recovery had occurred. Owing to the complete demoralization of the Haidas since contact with the whites, and their practice of resorting to Victoria and other places, where they maintain themselves by shameless prostitution, venereal diseases are extremely common and destructive.

Diseases.

Costume.

In dress the Haidas, like other Indians, have adopted, so far as their means enable them, the customs of the whites, though their costume as a rule might be considered rather scanty, and some of the older people use scarcely anything but a blanket as a protection from the elements. The blanket with these people has replaced the "robes of sea-otter skins" which so much pleased the eyes of the early traders. In Dixon's narrative* (p. 201) the sea-otter "cloaks" are said to "generally contain three good sea-otter skins, one of which is cut in two pieces; afterwards they are neatly sewed together so as to form a square, and are loosely tied about the shoulders with small leather strings fastened on each side." The women's dress is more particularly described on another page in the following terms:—"She was neatly dressed after their fashion. Her under garment, which was made of fine tanned leather, sat close to her body, and reached from her neck to the calf of her leg; her cloak or upper garment was rather coarser, and sat loose like a petticoat, and tied with leather strings."

Dixon's description of their original dress.

These extracts both refer particularly to the Haidas, but in the general account of the natives of this part of the north-west coast, the dress of the people is more minutely described in the following paragraph:—"In their dress there is little variety; the men generally wearing coats (such as I have already described) made of such skins as fancy suggests or their success in hunting furnishes them with, and sometimes the loose cloak thrown over the shoulders and tied with small leather strings. Besides this, some of the more civilized sort, particularly those in Cook's River, wear a small piece of fur tied round the waist when the heat of the day causes them to throw their coat aside or they are disposed to sell it. The dress of the women differs in some respects from that of the men. Their under garment is made of fine tanned leather, and covers the body from the neck to the ankle, being tied in different parts to make it fit close; over this is tied a piece of tanned leather like an apron, and which reaches no higher than the waist. The upper garment is made in much the same manner as the men's coats, and generally of tanned leather, the women not caring to wear furs, as they were always unwilling to be stripped of their garments, which, should they happen to be worth purchasing, their husbands always insisted on their being sold. Indeed, the deportment of the women in general was decent, modest and becoming."

Armour.

In former days a sort of armour was worn, consisting of split sticks arranged in parallel order and combined with the stronger parts of the hide of the sea-lion. None of these suits can now, however, be found. A cloak or blanket very much prized by the Haidas and called *naxin* is obtained in trade from the Tshimsians. It is shaped somewhat like a shawl, with a blunt point behind, and surrounded by a deep and

* A Voyage Round the World, but more particularly to the North-west Coast of America. Performed in 1785, 1786, 1787 and 1788, in the *King George* and *Queen Charlotte*, Captains Portlock and Dixon. London, 1789.

thick fringe of twisted wool. Finely shred cedar bark is used as a basis or warp, on which the wool of the mountain goat is worked in. The cloaks are made in many small separate pieces, which are afterwards artfully sewn together. The colours of wool used are white, yellow, black and brown, and the pattern bears a relation to the totem, so that an Indian can tell to what totem the cloak belongs. These cloaks or blankets are valued at about $30. They are used specially in dancing, and then in conjunction with a peculiar head-dress, which consists of a small wooden mask ornamented with mother-of-pearl. This stands up from the forehead, and is attached to a piece fitting over the head, ornamented with feathers, &c., and behind supporting a strip of cloth about two feet wide, which hangs down to the feet, and is covered with skins of the ermine. The cloaks are described by the chronicler of Dixon's voyage as "a kind of variegated blanket or cloak, something like our horse-cloths; they do not appear to be wove, but made entirely by hand, and are neatly finished. I imagine that these cloaks are made of wool collected from the skins of beasts killed in the chase; they are held in great estimation, and only wore on extraordinary occasions." Peculiar cloak or shawl.

Shred cedar bark, twisted into a turban, and stained dull red with the juice of the bark of the alder, is frequently worn about the head, more, however, as an ornament than a covering, and apparently without any peculiar significance among the Haidas, though with the Tshimsians and Indians of Millbank Sound it is only worn on occasions of religious ceremony, and it would be considered improper at other times. Cedar bark turban.

Feathers, buttons, beads, portions of the shell of the Haliotis, with the orange-coloured bill of the puffin, are used as ornaments, strung together or sewn on the clothes. The Dentalium shell was formerly prized and frequently worn, but has now almost disappeared. Ornaments.

Painting is frequently practised, but is generally applied to the face only. Vermillion is the favourite pigment, and is usually—at least at the present day—rubbed on with little regard to symmetry or pattern. Blue and black pigments are also used, but I have not observed in any case the same care and taste in applying the paint to form a symmetrical design as is frequently seen among the Indians east of the Rocky Mountains. The face is almost always painted for a dance, and when—as very often happens—dances recur on occasions of ceremony for several nights, no care is taken to remove the pigment, and most of the people may be seen going about during the day with much of it still adhering to their faces. To prevent unpleasant effects from the sun in hot weather, especially when travelling, the face is frequently first rubbed with fat, and then with a dark brownish powder made by Paints and painting.

roasting in the fire the woody fungus found on the bark of trees, and afterwards grinding it between stones. This soon becomes nearly black, and resembles dried blood. A mixture of spruce-gum and grease, also of a dark colour, is used to protect the face in cold weather, while those in mourning frequently apply grease and charcoal to the face.

Bracelets and bangles.

Bracelets beaten out of silver coins are very generally worn by the women, who often carry several on each arm. The custom of wearing several or many polished copper rings on the ankles and arms was formerly common among the Haidas and Tshimsians. Those for the ankles were round in section, those for the arms flat on the inner side. In Dixon's narrative "large circular wreaths of copper" are spoken of as being frequently worn, both at Norfolk Sound and in the Queen Charlotte Islands. They "did not appear to be foreign manufacture, but twisted into that shape by the natives themselves to wear as an ornament about the neck."

Tattooing.

Tattooing is universally practised, or rather was so till within the last few years, for it is noticeable that many of the children are now being allowed to grow up without it. The front of each leg above the ankle and the back of each arm above the wrist are the places generally chosen, though the breast is also frequently covered with a design. The patterns are carefully and symmetrically drawn, of the usual bluish colour produced by the introduction of charcoal into punctures in the skin. In one instance, however, a red pigment had also been employed. The designs are often hereditary, and represent the totem crest of the bearer, in the usual conventional style adopted by the coast Indians in their drawings. I have never observed any tattooing to extend to the face, where it is commonly found among the Tinneh people of the interior, in the form of lines radiating from the corners of the mouth, on the chin or forehead.

Labret.

Till quite lately the females among the Haidas all wore labrets in the lower lip. Dixon particularly notes this as being the case, though in Norfolk Sound it was only practised by women of rank. Dixon further gives an admirable illustration of the Haida labret in the plate facing page 226 of his volume, already several times referred to. A small aperture first made is gradually enlarged by the insertion of lip-pieces of ever-increasing size, till the lower lip becomes a mere circle of flesh stretched round the periphery of a flat or concave-sided labret of wood or bone, which projects at right angles to the plane of the face. One obtained by Dixon was found by him to measure $3\frac{7}{8}$ inches long by $2\frac{5}{8}$ broad, which is larger than any I have seen. Only among the old women can this monstrosity be now found in its original form. Many middle-aged females have a small aperture in the lip, through which a little beaten-silver tube of the size of a quill is thrust, projecting from the face about a quarter of an inch. The younger women have not even this remnant of the old custom.

The piercing of the lip was the occasion of a ceremony and giving away of property. During the operation the aunt of the child must hold her. The shape of the Haida lip-piece or *stai-e* was oval. Among the Tshimsians it was more elongated, and with the Stickeen women nearly circular. It was also formerly the custom to pierce the ears in several places. Three perforations in each ear were usual among common people, but chiefs or those of importance had five or six. These held little ornaments formed of plates of haliotis shell backed with thin sheet copper, or the small sharp teeth of the fin-whale. This custom obtains also among the Tshimsians and Stickeen Indians, and the Chiefs Callicum and Maquilla of Nootka Sound, Vancouver Island, are represented with the same adornment in Meares' engraving of them. Piercing of lip and ears.

The septum of the nose is generally perforated in both males and females, and was formerly made to sustain a pendant of haliotis shell or a silver ring, though it is not now used in this way. No process of distortion of the head or other parts of the body is practised among the Haidas. Perforation of nose.

Food.

Like most of the tribes of the coast, the Haidas live principally on fish. The halibut and salmon are chiefly depended on. A complete list of the articles used by them as food would, however, indeed be a long one, as few organic substances not absolutely indigestible would be omitted.

The halibut fishery is systematically pursued, and the main villages are so situated as to be within easy reach of the banks along the open coast on which the fish abounds. The halibut is found in great numbers in all suitable localities from Cape Flattery northward, but is perhaps nowhere finer, more abundant and more easily caught than in the vicinity of the Queen Charlotte Islands. It may be taken in most of the waters at almost any season, though more numerous on certain banks at times well known to the Indians. About Skidegate, however, it is only caught in large numbers during a few months in the spring and early summer. When the fish are most plentiful the Haidas take them in large quantities, fishing with hook and line from their canoes, which are anchored by stones attached to cedar-bark ropes of sufficient length. They still employ either a wooden hook armed with an iron—formerly bone—barb, or a peculiarly curved iron hook of their own manufacture, in preference to the ordinary fish-hook. These implements are described with others in treating of the arts of the Haidas. Halibut fishery

The halibut brought to the shore are handed over by the men to the

Curing the halibut.

women, who, squatted on their haunches, rapidly clean the fish, removing the larger bones, head, fins and tail, and then cutting it into long flakes. These are next hung on the poles of a wooden framework, where, without salt—by the sun alone, or sometimes aided by a slow fire beneath the erection—they are dried, and eventually packed away in boxes for future use.

Salmon.

There are no rivers of great size on the islands, but many streams large enough to be known as 'salmon rivers' to the Indians. A run of small red-fleshed salmon occurs about the middle of July up some of the larger streams. These answer no doubt to the fish known on the Fraser River as the suckeye, and much prized. They are, however, in inconsiderable numbers, and not much sought after by the Haidas. About the middle of August a larger species begins to arrive in great numbers, and this run sometimes lasts till January. These fish when they first appear and are still in salt-water are fat and in good condition. They soon begin, however, to become hook-hilled, lean and pale-fleshed. They ascend even very small streams when these are in flood with the autumn rains, and being easily caught and large, they constitute the great salmon harvest of the Haidas. They are generally either speared in the estuaries of the streams or trapped in fish-wiers made of split sticks, which are ranged across the brooks. The various 'rivers' are the property of the several families or subdivisions of the tribes, and at the salmon fishing season the inhabitants are scattered from the main villages; each little party camped or living in temporary houses of slight construction in the vicinity of the streams they own.

Other fishes.

It is scarcely necessary to particularize at length the other species of fish used as food, comprising all those abundant in the vicinity of the islands. Trout, herring, flounder, rock-cod, &c., constitute minor items in the dietary. The mackerel and cod are found, but not specially sought after by the Indians, and it is not yet known whether at certain seasons and localities they may be sufficiently abundant to attract commercial enterprise. The spawn of the herring is collected on spruce boughs placed at low water on the spawning grounds, dried and stored away in a manner exactly similar to that practised by most of the coast Indians.

Pollock.

The pollock is found on the western coast. It is generally caught in deep water with hook and line, and owing to its fatness is much prized. The Haidas of Gold Harbour or Port Kuper make an annual business of catching these fish in the latter part of the summer. They extract the oil from them by boiling in large wooden boxes with hot stones, and then skimming it from the surface. The oil is carefully stored away, and used as a condiment to dried fish or berries, instead of the oolachen grease, which by this tribe of Haidas is not much in request.

Both the Haidas and Tshimsians have the custom of collecting salmon roe, putting it in boxes, and burying these below high-water mark on the beach. When decomposition has taken place to some extent, and the mass has a most noisome odour, it is ready to eat, and is considered a very great luxury. Sometimes a box is uncovered without removing it from the beach, and all sitting round eat the contents. Fatal poisoning has followed this on several occasions. It is attributed to a small worm which is said at times to enter the decomposing mass from the sea. The Haidas also occasionally allowed the heads of salmon and halibut to lie on the beach between high and low water marks till partly decomposed, when they were considered to be much improved. Salmon roe.

The dog-fish is very abundant along some parts of the coast, and its fishery is now beginning to be engaged in. The fish is not eaten by the Haidas, but the oil extracted from the liver is readily sold to white traders, and constitutes one of the few remaining articles of legitimate marketable value possessed by the natives. Large sharks abound on the northern and western coasts, and are much feared by the Haidas, who allege that they frequently break their canoes and eat the unfortunate occupants. No instance of this kind is known to me, but they fear to attack these creatures. When, however, one of them is stranded, or found from any cause in a moribund state, they are not slow to take advantage of its condition, and from the liver extract a large quantity of oil. The whale and hair-seal (if it be proper to include these among products of the fisheries) abound in the waters surrounding the islands. I cannot learn that the former were ever systematically pursued as they were by the Makah Indians of Cape Flattery and Ahts of the west coast of Vancouver Island. When, however, by chance one of these comes ashore it is a great prize to the owner of the particular strip of beach on which it may be stranded. The seal is shot or speared, the latter doubtless having been the primitive mode. Both the flesh and blubber are eaten, the Indians comparing the animal on account of its fatness to that—to many of them hypothetical creature—from which pork is derived. They speak of it in the Chinook jargon as *si-wash co-sho.** It is interesting to remark in this connection that most of the Haidas will on no account eat pork, for some reason which I have been unable to determine. Fish yielding oil. Whales and seals.

The oyster is not found on the coasts of the Queen Charlotte Islands, though it occurs in some sheltered localities about Vancouver Island. Clams (*Saxidomus squalidus*, *Cardium Nuttalli*, &c.,) however, abound, with the large horse mussel (*Mytilus Californianus*) which on rocks exposed to the full force of tidal currents attains a great size. These shell-fish of course form a portion of the native diet. They are not Shell fish.

* Meaning simply Indian pig. *Si-wash* from French *sauvage*. *Co-sho* from *cochon*.

eaten, however, at all seasons, but during the winter months only. At other times (April to October) they are reputed to be poisonous, and more than once have proved fatal to those eating them. The Indians attribute this to a worm which they say during the summer season inhabits the cavity of the shell. The Tshimsians and other northern tribes also abstain from shell-fish during the summer for the same reason, while those of the southern part of Vancouver Island appear to eat them at all seasons.

Chitons, both the large red species (*Cryptochiton Stelleri*) which sometimes attains a length of eight inches, and the smaller black variety (*Katherina tunicata*), very common everywhere near low-water mark, are favourite articles of diet.

Sea eggs.

Sea-urchins, the large purple-spined (*Loxechinus purpuratus*) and the smaller green species (*Euryechinus chlorocentrotus*), are often brought ashore in large quantities, and it is surprising to observe how many of these rather watery creatures an Indian—squatting perhaps on his haunches on the beach—will devour in making a light lunch. A gentle knock on a stone serves to open the shell, when the finger run round the smooth interior brings out the edible parts, consisting chiefly of the more or less mature ova.

A large brown tuburculated holithurian is also eaten, though some of the younger people now profess to eschew these rather unpleasant looking animals.

Oolachen grease.

Oolachen grease, called *tow* is an important and much relished constituent of many of the Haida dishes. The oolachen or candle-fish, (*Thaleichthys pacificus*) from which it is derived, does not occur in the waters surrounding the Queen Charlotte Islands. It is found in some of the inlets on the west coast of Vancouver Island, but is especially abundant at the spawning season, in early spring, in the estuaries of the larger rivers of the mainland, and of these pre-eminently in the Fraser and the Nasse. Like its eastern representative and zoological ally, the capelin, it swarms in the shallow water along shore, and is easily caught in immense numbers. For the extraction of the oil the fish is generally allowed to partially putrefy, and is then boiled in a mass in wooden boxes, with hot stones. The oil or grease is semi-solid when cold, with a fœtid and rancid smell and taste. From the Nasse fisheries the oil is obtained by barter by the inland tribes of the northern part of British Columbia and by the Haidas. For a box containing somewhat over one hundred pounds of this grease from six to ten 'blankets,' or say from $12 to $20, is paid.

With dried fish, dried or fresh berries, and in fact with food of any description, no condiment is so grateful to the Haida palate as this oolachen grease; and in the absence of farinaceous substances, it doubtless enables the otherwise imperfect food to go further in supplying the wants of the system.

The Haidas are not great hunters. They kill a considerable number of black bears at two seasons of the year, when they are found prowling along the sea shore, but do not follow them far into their mountain fastnesses. In early spring, when the grass along the edges of the woods begins to grow green, with the skunk-cabbage (*Lysichiton Kamtschatense*) and other succulent vegetables, bruin coming out to browse upon the tender shoots may fall a victim to the lurking Indian. Again in autumn, when tempted to the shores and estuaries by the dead and dying salmon, he is apt to get into trouble, and at this season his skin, being in good condition, is of some value. Haidas not good hunters. Bears.

There is pretty good evidence to show that the wapati occurs on the northern part of Graham Island, but it is very seldom killed. The small deer (*C. Columbianus*) is not found on the islands, nor is the wolf, grizzly bear, mountain sheep or mountain goat. Geese and ducks in vast numbers frequent the country about Masset and Virago Sound in the autumn, and for a time form an important item in the diet of the natives. They now shoot them with the flint-lock trade muskets with which they are generally armed. I have seen a bow, with blunt wooden arrows, also in the canoe, to be used in despatching wounded but still living birds, and thus to save ammunition. Sea-fowl of many kinds are articles of food on occasion, though the gull, the loon and some others are exempt on account of their exceptionally rank flavor. The eggs of sea-birds, and especially those of the large white gull, are collected in great quantity in the early summer. Every lonely and wave-washed rock on which these birds deposit their eggs is known to the natives, who have even these apportioned among the families as hereditary property. The singular rocks extending southward from Cape St. James are frequented by myriads of sea-fowl, and some of them are so abrupt and cliff-surrounded that, lashed by the never-ceasing swell of the Pacific they remain inaccessible even to the Haidas. Wapati. Water fowl. Eggs.

The potato, called *skow-shīt* in Haida, introduced by some of the early voyagers, now forms an important part of the food supply. A Skidegate Indian told me that it was first grown at Skidegate, but I do not know how far this statement may be reliable. The greater part of even the flat low lands of these islands is so thickly wooded, and with trees of such great size, that the task of clearing the ground is quite beyond the energy of the Indian. There are places, however, near the shore, where by cutting down and grubbing out small bushes limited garden patches may be made. These are very often spots which have been occupied by Indian houses, and where great quantities of shells and other refuse have accumulated, forming a rich soil. Such spots Potato.

are utilized as potato gardens, but are generally small and often scattered far away from the main villages, wherever suitable localities can be found. Little attention is paid to the cultivation of the plant, and the variety in use is generally run down so as to yield very small and poor tubers.

Roots, bark, &c. Formerly many small roots indigenous to the country, and containing more or less starch, were eagerly sought after, dried and stored away. One of these was a wild lily. No effort is now made to gather these, though a few may be collected where they occur abundantly. The cambium layer of the spruce (*A. Menziesii*) and hemlock (*A. Mertensiana*) is collected, the trees being cut down and barked for the purpose, and is eaten in a fresh or dried state. This substance has a not disagreeable sweet and mucilaginous taste, but also possesses a distinct resinous flavour. It is considered very wholesome. The cambium layer of the scrub pine (*P. contorta*) is not eaten, though this tree is found in some abundance on the west coast of the islands, and on the mainland of British Columbia is barked for this purpose almost exclusively. The growing shoots of the epilobium, heracleum and other plants are eaten when in season. A sea-weed resembling dulce, but which I have only seen in dried cakes, is found, especially in the southern islands. preserved by drying and boiled into a sort of tea or soup.

Berries. Berries abound, the most important being the sal-lal (*Gaultheria shallon*), known to the Haidas as *skit-hun*, and crab-apple or *kyχil* (*Pyrus rivularis*). The latter, about one-third of an inch in length and less in width, has much the taste of a sour Siberian crab. It is gathered late in the autumn, and generally boiled and put away in boxes, covered with water, and allowed to remain so till winter, when the berries are sorted, mixed with oolachen grease, and thus made ready for use. The sal-lal berries are eaten fresh in great quantities, and are also dried for use in winter. The strawberry (*Fragaria Chilensis*), flowering raspberry (*Rubus Nutkanus*), current (*Ribes sp.*), *Vaccinium parviflorum*, &c., occur in some places abundantly. The mahonia (*Berberis aquifolium*) is not found. The service-berry (*Amalanchier alnifolia*), so much prized by the Indians of the interior, occurs sparingly, and scarcely seems to ripen its fruit.

Native tobacco. Before the introduction of the potato, the only plant cultivated was one which has been described to me as 'Indian tobacco.' There is a mythical tradition concerning the origin of this plant, which is given in another place. Its cultivation is now entirely abandoned except at Cumshewa, where a single old woman continues to grow it, some of the older Indians still relishing it. This I learnt after leaving Cumshewa, and have consequently been unable to ascertain whether the plant is really tobacco or not. It is probable, however, that it is some less potent weed, or its cultivation would not have been so soon given up and high prices paid for imported tobacco. The Haidas used to grow it not only for themselves, but as an article of trade with other neighbouring tribes. To prepare the plant for use it was dried over **How prepared.** the fire on a little framework, finely bruised in a stone mortar, and then pressed into cakes. It was not smoked in a pipe, but being mixed with a little lime prepared by burning clam-shells, was chewed or held in the cheek. The stone mortars—elsewhere more fully described—are still to be found stowed away in corners of the houses. They appear to have been used in the preparation of the 'tobacco' only, and though often large enough for the purpose, were certainly not employed to reduce any cereal to the state of meal, as none such were known to the Haidas. It is, therefore, unsafe to conclude from the **Kinnikinick.** mere discovery of stone mortars, among other relics, that certain extinct tribes cultivated corn and used it as food. The leaves of the bear-berry or kinnikinick (*Arctostaphylos uva-ursi*) are mixed with tobacco when smoking, to eke out the precious narcotic. These leaves are used for the same purpose by the Indians everywhere over the northern part of the American continent. I have seen on Vancouver Island the leaves of the sal-lal roasted before the fire and mixed with tobacco, and among the Chippeway Indians and others the bark of the red osier dog-wood (*Cornus stolonifera*).

The dog is the only domesticated animal among the Haidas. The **The dog.** original breed is now much disguised by imported strains. The present natives are grey wolfish-looking curs about the size of a coyote.

Social organisation.

The Haidas, like other tribes inhabiting the coast of British Colum- **Houses and carved posts.** bia and its adjacent islands, have permanent villages. The general type of construction of the houses in these is nearly the same among all the tribes, but among the Haidas the buildings are more substantially made, and much more care is given to the accurate fitting together and ornamentation of the edifice than I have elsewhere seen. This may be due in part to the comparatively late date at which the Haidas have come closely in contact with the whites, but probably also indicates an original greater facility in constructive and mechanical processes than is found among the other tribes. This would be fully borne out by their present character in these regards. Especially in the great number, size, and elaborate carving of the symbolical posts, is this superiority shown. Among the Tshimsians at Port Simpson, most of the original carved posts have been cut down as missionary influence spread among the people. At Nawitti (Hope Island), Quatsino Inlet (Vancouver Island) and elsewhere, where the natives are still numerous and have scarcely been reached by missionaries, though similar posts are found, they are small, shabby, and show little of the peculiar grotesque art found so fully developed among the Haidas.

Villages.

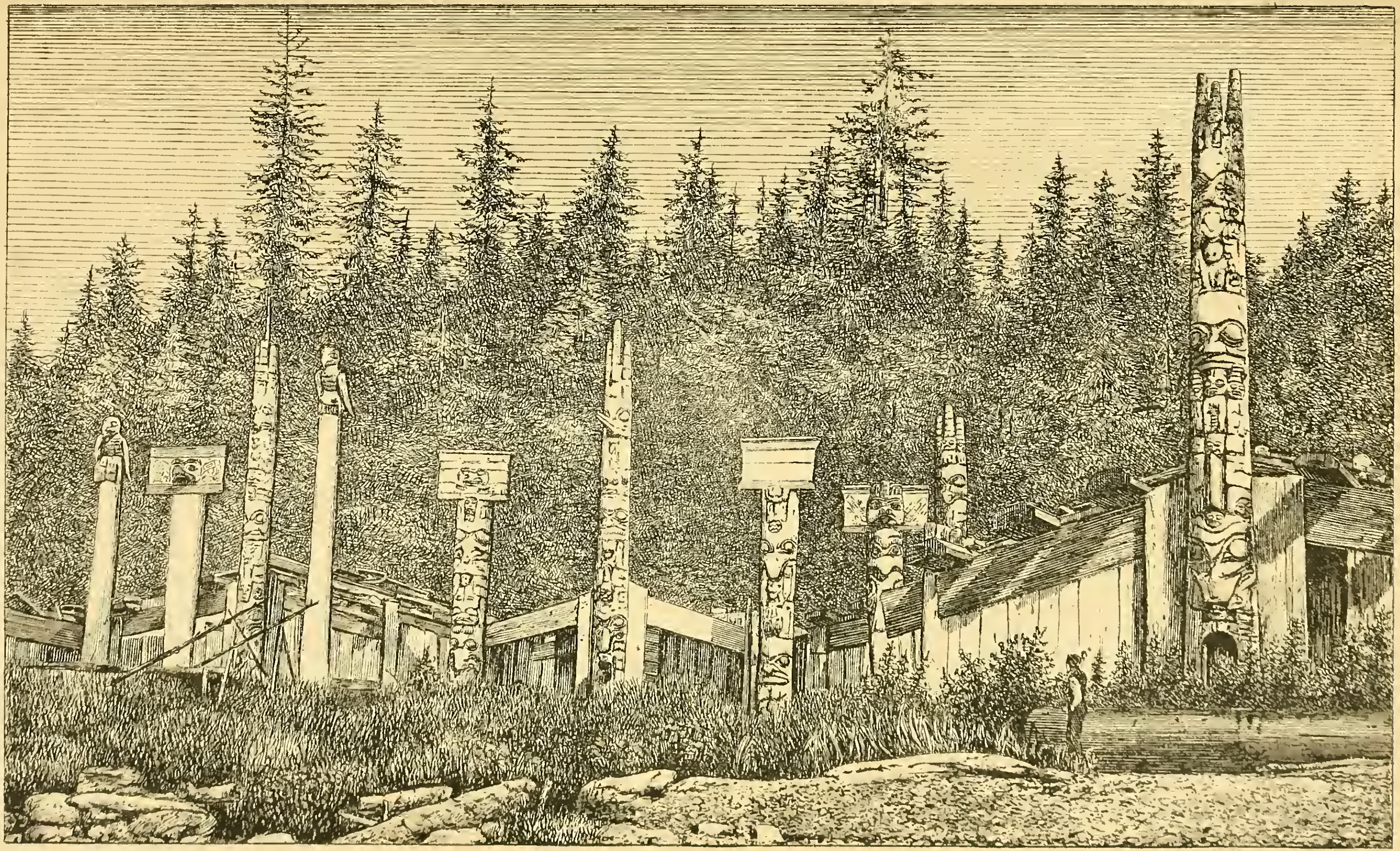
As before mentioned, the permanent villages are generally situated with regard to easy access to the halibut banks and coast fisheries, which occupy a greater proportion of the time of the natives than any other single employment. The villages are thus not infrequently on bleak, exposed, rocky coasts or islands, though generally placed with care, so as to allow of landing in canoes even in stormy weather. The houses may stand on a flat, elevated a few feet above the high-tide mark, and facing seaward on a sandy or gravelly beach, on which canoes can be drawn up. The houses are arranged side by side, either in contact, or with spaces of greater or less width between them. A space is left between the fronts of the houses and edge of the bank, which serves for a street, and also for the erection of the various carved posts, and for temporary fish-drying stages, &c. Here also, any canoes are placed which it is not desired to use for some time, and are carefully covered with matting and boughs to protect them from the sun, by which they might be warped or cracked. As a rough average, it may be stated that there are at least two carved posts for each house, and these, when the village is first seen from a distance, give it the aspect of a patch of burnt forest with bare, bristling tree-stems. The houses themselves are not painted, and soon assume a uniform inconspicuous grey colour, or become green or overgrown with moss and weeds, owing to the dampness of the climate. The cloud of smoke generally hovering over the village in calm weather, may serve to identify it. Two rows of houses are occasionally formed, where the area selected is contracted. No special arrangement of houses according to rank or precedence appears to obtain, and the house of the chief may be either in the centre of the row or at the end. Each house generally accommodates several families, in our sense of the term; which are related together, and under the acknowledged guidance of the elder to whom the house is reputed to belong, and who is really a minor chief, of greater or less importance in the tribe—or village—according to the amount of his property and number of his people.

Arrangement of villages.

Carved posts

In front of one or more of the principal houses platforms are often found, on which a group of people may be seen squatting in conversation or engaged in their interminable gambling game. The forest of carved posts in front of the village, each of them representing a great expenditure of property and exertion, doubtless presents to the native eye a grand and awe-inspiring appearance and brings to the mind a sense of probably mysterious import, which possibly does not in reality

Plate III.



G. M. D., Photo. July 16, 1878.

The Burland Lithographic Co. Montreal

HOUSES AND CARVED POSTS, CUMSHEWA VILLAGE.

exist. Behind the dwelling houses, or toward one end of the village and not far removed from it, are the small houses or sheds in which the dead are placed, or pairs of posts supporting a hollowed beam which contains the body.

Tombs.

These permanent villages of the Haidas are now much reduced in number, in correspondence with the very rapid decrease of the people themselves. Those villages least favourably situated as fishing stations, or most remote from communication, have been abandoned, and their people absorbed in others. This has happened especially on the tempestuous west coast of the islands, where there is now but a single inhabited village. Even those still occupied are rapidly falling to decay; the older people gradually dying off, the younger resorting more and more to Victoria and beginning to despise the old ways. Many houses have been completely deserted, while others are shut up and mouldering away under the weather, and yet others, large and fitted to accommodate several families, are occupied by two or three people only. The carved posts, though one may still occasionally be erected, are as a rule more or less advanced toward decay. A rank growth of weeds in some cases presses close up among the inhabited houses, the traffic not being sufficient to keep them down. In a few years little of the original aspect of these villages will remain, though at the present moment all their peculiarities can be easily distinguished, and a very little imagination suffices to picture them to the mind as they must have been when swarming with inhabitants dressed in sea-otter robes and seal skins.

Abandonment and decay of villages.

The Haidas reside in these permanent villages during the winter season, returning to them after the close of the salmon fishery, about Christmas-time. A portion of the tribe is, however, almost always to be found at the permanent village, and from time to time during other seasons of the year almost the whole tribe may be concentrated there. The villages differ somewhat in this respect. When the territory owned by its people is not very extensive, or does not lie far off, they live almost continually in the village. When it is otherwise, they become widely scattered at several seasons.

Residence.

The Haidas trouble themselves little about the interior country, but the coast line, and especially the various rivers and streams, are divided among the different families. These tracts are considered as strictly personal property, and are hereditary rights or possessions, descending from one generation to another according to the rule of succession elsewhere stated. They may be bartered or given away, and should one family desire to fish or gather berries in the domain of another, the privilege must be paid for. So strict are these ideas of proprietary right in the soil, that on some parts of the coast sticks may be seen set

Property in land.

up to define the limits of the various properties, and woe to the dishonest Indian who appropriates anything of value—as for instance a stranded shark, or seal or sea-otter which has died from its wounds—that comes ashore on the stretch of coast belonging to another. Along the shores the principal berry-gathering grounds are found, and thus divided. The larger salmon streams are often the property jointly of a number of families; and at these autumn fishing grounds temporary houses, small and roughly constructed, are generally to be found. The split cedar planks of the permanent houses are not usually carried by the Haidas to these less substantial houses, though this custom prevails elsewhere on the coast. The construction of the houses thus temporarily occupied is generally so slight and rough as to necessitate no particular description. Poles or cedar planks are built or piled together in whatever manner seems best suited to keep out the rain. In some cases where they are more substantial they resemble on a reduced scale those of the permanent villages. The mode of construction of the latter is described further on. In these temporary shelters, or in even less commodious camps among the trees, the natives live during a considerable part of the year, engaged in salmon fishing, the cutting down of trees and rough hewing of canoes, the gathering and preparation of cedar bark for mats, and other occupations, which, each at its appropriate season, fill out the annual round of duties.

Temporary houses.

Gatherings for construction of houses.

The actual construction of the permanent houses devolves entirely on the men, but is not effected by individual effort. Indeed, the very size of the beams and planks used necessitates the coöperation of many hands. The erection of a house, therefore, in all its stages, from the cutting and hewing out of the beams in the forest, the launching of these and towing them to the village, their erection and fitting, forms the occasion of a 'bee' or gathering of natives, which generally includes detachments from neighbouring villages, and is the occasion of a potlatch or giving away of property by the person for whom the labour is undertaken. Several such gatherings are usually required for the completion of a house, which may be some years in course of construction, as the man for whom the work is done generally exhausts his available resources on each occasion, and requires again to accumulate property, and especially blankets, for a new effort. Dancing and gaming relieve the monotony of the work, which generally occupies but a small portion of each day, and is conducted with much talk and noise, and the shouting of many diverse orders as the great beams are handled.

Chieftaincy.

Among the Haidas each permanent village constitutes a chieftaincy, and has a recognized head chief. The chiefs still possess considerable influence, but it is becoming less, and was doubtless very much greater in former times. It was never, however, the absolute and despotic authority which is sometimes attributed to Indian chiefs. The chief is merely the head or president of the various family combinations, and unless his decisions carry with them the assent of the other leaders they have not much weight. He has no power of compelling work from other members of the tribe. Should he require a new house he must pay for its erection by making a distribution of property, just as any other man of the tribe would do; and indeed it is expected of the chief that he shall be particularly liberal in these givings away, as well as in providing feasts for the people. He is also supposed to do the honours to distinguished visitors. In Captain Dixon's narrative, the following statements concerning the position of the chiefs at the time of his visit are found :—" Though every tribe met with at these islands is governed by its respective chief, yet they are divided into families, each of which appears to have regulations and a kind of subordinate government of its own : the chief usually trades for the whole tribe; but I have sometimes observed that when this method of barter has been disapproved of, each separate family has claimed a right to dispose of their own furs, and the chief always complied with this request."

Power of chiefs limited.

The chieftaincy is hereditary, and on the death of a chief devolves upon his next eldest brother, or should he have no brother, on his nephew, or lacking both of these his sister or niece may in rare cases inherit the chieftaincy, though when this occurs it is probably only nominal. It is possible—as occasionally happens in the matter of succession to property—that a distant male relative may, in want of near kinsmen, be adopted by the mother of the deceased as a new son, and may inherit the chieftaincy. I have not, however, heard of cases of this kind. Should all these means of filling the succession fail, a new chief is then either elevated by the consensus of public opinion, or the most opulent and ambitious native attains the position by making a potlatch, or giving away of property greater than any of the rest can afford. Should one man distribute ten blankets, the next may dispose of twenty, the first tries to cap this by a second distribution, and so on till the means of all but one have been exhausted. This form may in reality become a species of election, for should there be a strong feeling in favour of any particular man, his friends may secretly reinforce his means till he carries his point. In no case, however, does the chieftaincy pass from the royal clan to any of the lesser men of the tribe. On being elevated to the chieftaincy the chief assumes a hereditary name, which is also colloquially used as that of the tribe he rules. Thus there is always a Cumshewa, Skedan, Skidegate, &c.; and since the islands have been frequented by vessels, the word 'captain' is

Succession to chieftaincy.

frequently added to the titular name of the chief in speaking of him to the whites, to signify his rank.

Mysterious properties.

Certain secrets are reputed to appertain to the office of chief, among which is the possession of various articles of property which are supposed to be mysterious and unknown to the rest of the Indians, or common people (Haida *a-li-kwa*). A very intelligent Skidegate Indian from whom I derived much information, as he was well versed in the Chinook jargon, told me, for instance, that on the death of the last Skidegate chief, the new chief wished him to perform a dance in honour of the great departed, this being one of the rites which it is necessary that the heir should attend to. The dance is one made by a single man, the performer being naked with the exception of the breech-cloth. When my informant was about to engage in the dance the chief took him aside, showing him various articles of the mysterious *chief's properties.* Among others a peculiar whistle, or cell with vibrating reed tongues, which concealed in the mouth enables the operator to produce strange and startling noises, that may be supposed by those not in the secret to indicate a species of possession in the excited dancer. These things are explained by the chief to his probable successor, and are also known to some of the more important Indians, but not to all. They are, no doubt, among the devices for obtaining and holding authority over the credulous vulgar.

Tshimsian jester.

Among the Tshimsians in former days, and probably also among the Haidas, a chief had always his principal man, who has considerable authority, and gives advice and instruction to the chief's successor. He never inherits the chieftaincy, however. Each chief with the Tshimsians had also his 'jester,' who is sent on errands of invitation, announces the guests on their arrival, and makes jokes and endeavours to amuse the company, though preserving his own gravity. The jester is not, of course, always in attendance. He receives nothing for his trouble, apparently looking on the position as honourable, and inherits nothing on the chief's death.

No league of tribes.

It not infrequently happens that a chief grown old, decrepit or poor, though the honourable title still clings to him, is virtually succeeded by some more energetic man, who sways the actions of the tribe in his stead. The village appears to be the largest unit in the Haida system of government, and there has not been any permanent premier chief, or larger confederacy or league of tribes. Such unions may doubtless have been formed from time to time for offensive and defensive purposes, but have not endured.

Offenses atoned for.

No laws appear to be acknowledged, but any action tending to the injury of another in person or property lays the offender open to reprisals by the sufferer, but may be atoned for, and the feud closed by payment in blankets or other valuable property to a satisfactory amount. The culprit generally prefers this mode of settlement to having an uncertain retribution hanging over him, and as the value set on property is great, and the disinclination to reduce the store of blankets—which may possibly be accumulating for a prospective distribution—excessive, the restraint is proportionately severe.

Religion and 'medicine.'

It is difficult to decide precisely how much should be included under the heading *religion.* The older Indians, and indeed those of every age where they have come not too closely in contact with the whites, show a persistent—one might almost say a fervent—reverence for their time-honoured customs, among which, in this case, the giving away of property or *potlatch* and the various dances, are the most prominent. There are no priests, however, nor could I hear of any religious ritual among the Haidas. The medicine or mystery man, or shaman (Haida *skā-ga*), occupies a position perhaps partly partaking of the priestly function, but more closely allied to that of the prophet, sorcerer, or physician. The Tshimsians say that the Haidas had originally no religion whatever, but adopted their ceremonies not a very great while ago. This may account for the use of Tshimsian words in the dances among the Haidas, and the high esteem in which the Tshimsian language is held by them. It is possible that some of the dances described farther on may have, in part, a religious significance and form a portion of the religious ceremonies above referred to. Religion.

It is, however, unquestionable that the Haidas have, and had before any missionary leaven spread among them, an idea of a chief deity, or lord of all things, whose dwelling was in some remote, undefined region. This I ascertained by careful inquiry from the Skidegate Indian already referred to, and Mr. Collison, who has been two years among the Masset Haidas as a missionary, and can speak the language with some fluency, confirms me in this statement. The name of this being is *Sun-ī-a-tlai-dus*, or *Sha-nung-ī-tlag-i-das*. His attributes are generally good, but it is difficult to ascertain exactly what they are, owing to the reticence observed by natives in speaking to whites of those of their customs or beliefs which they fear may be ridiculed, but perhaps also in this case to the fact that they have at no time been very precisely defined. The idea of a spirit, soul, or essence being in reality the man, and distinctly separable from the more perishable body, is also firmly rooted in the Haida mind. There is also a recognised principle of evil, called *Hai-de-lān-a*, a name signifying chief of the lower regions. This being is either typified by, or assumes the form of a certain inhabitant of the sea, believed to be the killer whale (*Orca ater*). Indians who lose their lives Idea of a chief deity. Power of evil.

by drowning are taken possession of by the power of evil, and are turned into beings like himself under his chieftainship. Those killed in battle, or even non-combatants accidentally killed during a fight, go at once to the country of *Sun-ī-a-tlai-dus,* which is supposed to be a happy region. The spirits of those who die from disease, or in the course of nature, become latent, or pass to an ill-defined Hades, but are from time to time recovered, returning to the world as the souls of new-born children, generally—or always—in the tribe to which they themselves formerly belonged. This new birth may occur in each case five successive times, but after this the soul is annihilated, "like earth, knowing nothing." So at least say some of the Haidas. The medicine-men profess, in many cases, to be able by means of dreams or visions to tell in the person of what child such an one formerly dead has returned—hence a considerable part of the influence they exercise.

After death.

Transmigration

The Indian informant, already several times referred to, told me that the medicine-man had assured him that his brother had returned in the form of a child lately born. He was in doubt whether to believe implicitly or not. I have been told also of a case at Masset, where an old chief dying said to those about him that he would return in the form of a child then about to be born from the wife of one of his relatives. He enjoined them to be careful of the child.

Departure of the soul.

It would seem also to be believed that before death the soul loosens itself from the body, and finally takes its departure altogether. This, at least, would appear to be implied by the fact that the medicine-men sometimes profess to catch the soul of one about to die. This, however, belongs more strictly to the curative function of the *skā-ga.*

Initiation of medicine-man.

The office of *skā-ga,* shaman or medicine-man is not, like the chieftaincy, hereditary, but is either chosen or accepted in consequence of some tendency to dream or see visions, or owing to some omen. The would-be doctor must go through a severe course of initiation. He must abstain from connexion with women, and eat very little ordinary food, and that only once a day, in the evening. He goes into the woods and eats 'medicine,' of which the *Moneses uniflora* was pointed out to me as one of the chief constituents. This plant is hot and bitter to the taste. A course of this character continued for some months, or for even a year, causes the body to become thin, and the mind may eventually be somewhat deranged, or at least the *skā-ga* pretends to see strange things. He speaks mysteriously, and soon takes an acknowledged place in the tribe. When sickness occurs he must be in attendance on the patient, and seeks by every means to exorcise the evil spirit which, abiding in the body, may have caused the disease. The greatest effort is to drive out this spirit, and for this purpose he comes armed with his rattle, or with a drum. The house where the

Curative function.

patient lies is probably filled with his friends, the *skā-ga*, drumming or rattling and singing about him, seems to strain every nerve to drive away the evil one. The relatives encourage him to redoubled exertions by promises of property, which, in event of recovery, he will be given.

Peculiarities of medicine-men.

A *skā-ga* has his hair long and tangled, as, in obedience to custom, it is neither allowed to be cut or comb passed through it. This constitutes a part of his 'medicine.' Besides the rattle or drum the most important property of a *skā-ga* appears to be a hollow bone, carved externally; in some cases also inlaid with pieces of haliotis shell, and open at the ends. In this, using a little shred cedar bark to plug the ends, he can enclose the soul or *ka-tlun-dai* about to depart, and may succeed in restoring it to the body.

From their position the medicine-men are often able to levy blackmail on the credulous, and profit by this species of priestcraft. At Metla-katla the following incident occurred, and was related to me by Mr. Duncan. This was among the Tshimsians, whose customs in regard to these matters are, however, closely like those of the Haidas:—A medicine-man from an outlying district, coming among the Indians at the mission, put a family into great distress by communicating to them that in walking along, not far off, he had seen the soul of a young girl, had caught it, and for a certain consideration would restore it to the owner, who must otherwise assuredly soon die. The girl indicated was in good health, but some of the relatives were so much alarmed that they came to Mr. Duncan, telling him all the circumstances. He partially reassured them, and finally quieted their fears by frightening the medicine-man himself away.

Venerated after death.

The *skā-ga* dying, remains still an object of superstition, and his body is not disposed of in exactly the same way with those of mere ordinary mortals. He is not, as they are, boxed up and deposited in little houses in the immediate vicinity of the village, but removed to some distance, in some instances to a place designated by himself before death. The method of sepulture may not be quite uniform, but I can describe that of a medicine-man considered very potent, who died about ten years ago at Skidegate:—On a small island, some miles from the village, is a little box-like hovel, about five feet in height, and nearly square, made of split cedar boards, neatly joined, and roofed with similar planks, on which large stones had been piled to keep the whole firm. The erection stands under a few scattered pine trees, near the rocky shore. A board having fallen out, a good view could be gained of the interior. The side furthest from the water was entirely covered by a neatly made cedar-bark mat. The body leaned against this, in a sitting posture, the knees had originally been drawn up nearly to the chin, but the whole had slipped down somewhat during decomposition. It was

How entombed

not enclosed in any box, but a large red blanket, wrapped round the shoulders, covered the entire lower portion of the body to the ground. The hair, which was long, was still in place, black and glossy, carefully wound up to form a large knot on the top of the head, through which a couple of carved bone pins or skewers were stuck. A carved stick, like those used in dancing, rested in one corner, and before the knees was a square cedar box, which no doubt contained various other properties. Had I not had with me an Indian of the tribe, I should have been tempted to investigate further. The face was the only part of the body uncovered, and the flesh appeared to have been partly dried on the bones, giving it a mummy-like aspect. I mention this fact as it is believed both at Skidegate and Masset, and probably generally among the Haidas, that the bodies of medicine-men do not decay like those of others, leaving only the bones, but dry up without decomposition. In this particular case, it is said among the people of the tribe that if anyone looking at the dead man should see a skeleton only, he or some of his near kinsfolk will surely soon die, whereas if flesh is seen the omen is propitious.

Ghostly apparition.

Of another *skā-ga* entombed near the Skidegate Village, I was told by a Haida that on one occasian he was returning to the village, about twilight, when, on looking to where he knew the tomb to be, he saw the *skā-ga* himself, standing erect with his medicine rattle in his hand. My informant was much frightened, and on getting to the village told the people what he had seen, causing no small commotion among them, for the apparition was universally accepted as an evil omen. Shortly afterwards his wife, brother, brother's wife, and two sisters went, with others, to Victoria, and all taking small-pox died there.

A medicine-man is entitled to take from the grave of his predecessor any of his peculiar properties. The privilege is, however, not always or immediately made use of, and it may probably be necessary to wait for some dream or omen before doing so.

Incantation for a wind.

The following method of procedure to obtain a fair wind, though not confined in practice to medicine-men, but known to most of the Haidas, may serve to show the childish nature of their mystery performances. An Indian fasting, shoots a raven, quickly singes it in the fire, and then going to the edge of the sea, sweeps it four times on the surface in the direction in which the wind is desired. He then throws it behind him, but afterwards picking it up, sets it in a sitting posture at the foot of a spruce tree, facing toward the required wind. Propping its beak open with a stick, he then requests a fair wind for a certain number of days, and going away lies down and covers himself up with his blanket, till a second Indian asks him for how many days he has required the wind, to which question he answers.

There are among the neighbouring Tshimsians four 'religions,' or systems of rites of a religious character. These have no relation to the totems, but divide the tribe on different lines. They are known as (1) *Sim-ha-lait*, (2) *Mi-hla*, (3) *Noo-hlem*, (4) *Hop-pop*. The first is the simplest and seems to have no very distinctive rites. The central figure of the worship of the second was at Fort Simpson a little black image with long hair known as "the only one above." The third are "dog-eaters," a portion of their rite consisting in killing and cutting, or tearing to pieces, dogs, and eating the flesh. They eat in reality, however, as little of the flesh as they can, quietly disposing of the bulk of it when out of sight. The *hop-pop* or "cannibals" are those who, in a state of real or pretended frenzy, bite flesh out of the extended arms of the people of the village as a part of their rite. When they issue forth for this purpose they utter cries like hop-pop—whence their name. On this sound being heard all but those of the same religion get out of the way if they can, frequently pushing off in canoes for this purpose. Those of the same creed, and brave, resolutely extend their arms to be bitten. A man may belong to more than one religion, and is in some cases even forced to become initiated into a second. If, for instance, one should pass where dog-eaters are holding a solemn conclave, he may be seized and initiated as a dog-eater *nolens volens*. Great hardships are sometimes endured during initiation. The more savage religions pretend to mysterious supernatural powers, and go to great pains sometimes to delude the common people, or those of other creeds. At Fort Simpson, for instance, a young chief was on one occasion carefully buried in the ground beforehand. When discovered the operators were pulling at a rope, and were supposed to be drawing the chief underground from the back of an island some way off. The rope after a time breaking, great apparent excitement occurs among the operators, who say the chief is now lost, but catching sticks begin to dig in the ground, and soon unearth him to the great amazement of the vulgar. In this case, however, the cold and cramped attitude so affected the chief that he was lame for life. They instil the truth of such stories especially in the minds of the young, who firmly believe in them. At Fort Simpson, in former days, they have even got up such things as an artificial whale, in some way formed on a canoe. This appeared suddenly on the bay, seemingly swimming along, with a little child on its back.

Religions among the Tshimsians.

Rites and initiation.

Deception practised.

Potlatch or distribution of property.

The distribution of property, or *potlatch* as it is called in the Chinook jargon (Haida, *kie-is-hil*), implying, as it appears at first sight, such entire self-abnegation and disregard of the value of slowly accu-

Custom wide-spread.

mulated wealth, requires some explanation. The custom thus named is very widely spread, extending not only to all the coast tribes of British Columbia and its adjacent islands, but also to the native inhabitants of the interior of the Province, of entirely different stocks. I have been able to ascertain more about this custom among the Haidas than elsewhere. Whether in all the other tribes it is so perfectly systematized, or carried out precisely in the same way, it is impossible at present to tell, but among the inhabitants of at least the whole northern part of the coast the usage appears to vary very little.

Method of distribution of property.

The potlatch besides being a means of combining labour for an industrial 'bee,' for purposes in which individual effort is insufficient, is also a method of acquiring influence in the tribe, and in some cases, as we have seen, of attaining even to the chieftaincy. The more frequently and liberally an individual thus distributes property, the more important he becomes in the eyes of his tribe, and the more is owing to him when some other member performs the same ceremony. Only in certain special circumstances are the blankets—which generally constitute the greater part of the property distributed—torn into shreds and destroyed. In most cases it is known long beforehand that a certain man is about to make a distribution, for the purpose of raising a house, cutting out and erecting a new carved post, or other exertion. Some months previously, among the Haidas, he quietly distributes among his friends and the principal members of the tribe his property, be it in blankets or money. The mode of distribution and value of property given to each person is thoroughly systematised, and all the members of the tribe know beforehand how many blankets go to each. A short time before the ceremony all this property is returned with interest; a man who has received four blankets, giving back six, or some larger number in something like this ratio. This retention of a certain amount of the property and its return with increase, appears to be looked upon as an honour by those to whom it is given out. The members of the tribe are then called together for a certain date, and at the same time parties from other, and perhaps distant, villages are invited. The work in hand is accomplished, the man for whom it is done making feasts of the best he has for his guests, and the toil being varied by dancing and gambling with the gaming-sticks, which occupy all the time not more profitably employed. The work finished, the distribution takes place, and shortly afterwards all disperse.

Occasions on which practised.

It is usual to make a potlatch on the occasion of tattooing a child, and at other stages in its advance toward manhood. When it is desired to show an utter disregard of worldly wealth, the blankets are torn into strips and scattered among the crowd, and money is also strewn broadcast. This procedure is sometimes followed in competitions for the chieftaincy, already referred to. A similar practice is also a method of showing rage or grief. At Masset, lately, it became known to a father that a young man had made improper advances to his daughter. The father immediately, in great anger, tore up twenty blankets, which not only served as an outlet for his feelings, but placed the young man under the necssity of destroying a similar number of blankets; and in this case, not being possessed of sufficient property, those of the young man's totem-clan had to furnish by subscription the requisite number, or leave upon themselves a lasting disgrace. The feelings of the subscribers were not naturally of the kindest toward the young man, but they did not in this case turn him out of the tribe, as they had a right to do *after* having atoned for his fault. **Fault atoned for.**

Among the Tshimsians an ordinary man confines his potlatch or *yak* to those of his own village, while a chief generally, or often, invites people from other villages also. The chief may be assisted in giving potlatches by his people. Should he desire help of this kind, he gives a feast with many different dishes, to which all are invited. The next day a drum is beaten for him by his jester in a peculiar manner, when all who have been at the feast come together with gifts, which are afterwards, with those belonging to the chief himself, given away. **Distribution among the Tshimsians.**

Dancing ceremonies.

The dance is closely connected with the potlatch ceremonies, but also takes place in some instances without the occasion of a giving away of property. In most of the dances the Tshimsian language is used in the song, which would appear to indicate that the ceremonial has been borrowed from these people. Notwithstanding the old-time hostility of the Haidas and Tshimsians, the former profess a great liking for the Tshimsian language, and many of them speak it fluently.

Six kinds of dancing ceremonies are distinguished, and are designated in the Skidegate dialect by the following names:—(1) *Skā-ga*, (2) *Ska-dul*, (3) *Kwai-o-guns-o-lung*, (4) *Ka-ta-ka-gun*, (5) *Ska-rut*, (6) *Hi-atl*. Of these I have only witnessed No. 3, the description of the others being at second-hand from the intelligent Skidegate Indian already more than once referred to. **Six varieties.**

1. *Skā-ga* is performed on occasions of joy, as when friendly Indians arrive at a village in their canoes, and it is desired to manifest pleasure. A chief performs this dance. He takes his stand in the house at the side of the central fire furthest from the door. He should wear over his shoulders one of the *na-χin* or Tshimsian blankets, made of fine cedar-bark and the wool of the mountain goat. He wears, besides, the **Ska-ga.**

best clothes he may happen to have, and on his head an ornament made of the stout bristles from the whiskers of the sea-lion. These are set upright in a circle, and between them feather-down is heaped, which as he moves is scattered on all sides, filling the air and covering the spectators. He dances in the usual slouching way common among the Indians, bending his knees, but not lifting his feet far from the ground. The people, sitting around in the fire-light, all sing, and the drum is continually beaten. This dance may last half an hour or an hour.

Ska-dul and Kwai-o-guns-o-lung.

2. The dance distinguished as *Ska-dul*, appears to be merely the beginning of that known as (3) *Kwai-o-guns-o-lung.* Any man who knows the mode of singing starts the dance alone, when it is called *Ska-dul*, soon others join in, and it becomes No. 3. This is performed by no particular number of people, the more the better, and occurs only when a man desires shortly to make a house. The man himself does not dance, nor does any giving away of property take place. The women occupy a prominent place in this dance, being carefully dressed with the little marks and *na-χin* or cloaks previously described. One man performs on a drum or tamborine to which all sing, or grunt in time, shuffling about with a jerky motion as they do so. There is a master of the ceremonics who leads off the chorus. Rattles are freely used. The song is in praise of the man who intends to build, and also of the dancers. It eulogises his strength, riches, and so on, and is in the Tshimsian language.

Ka-ta-ka-gun.

4. *Ka-ta-ka-gun.* This is performed by the male relatives of a man's wife, and takes place when a house has been finished, the owner at the same time making a distribution of property. The dancers are attired in their best, ornamented, and with faces painted, but no birds'-down is used. It is performed in the newly finished house, and may occupy half an hour or an hour. The man who makes the distribution does not dance. All sing in the Tshimsian language.

Ska-rut.

5. *Ska-rut.* One man performs this dance, but is generally or always paid to do the duty for the person more immediately concerned. It takes place some days before a distribution of property, on the occasion of such an event as the tattooing of a child or death of a relative or friend. The dance is performed by a single man, naked with the exception of his breech-cloth. In the first part of the dance, which appears to be intended to simulate a sort of possession or frenzy, one of the grotesque wooden masks is worn, and this is the only dance in

Mask.

which they are used. The wearing of the mask is not, however, absolutely necessary, but is a matter of choice with the performer. Getting heated in the dance, he throws the mask away, snatches up the first dog he can find, kills him, and tearing pieces of his flesh eats them.

This dance is not performed in the house as the others are, but at large through the village. The usual present tariff for the performance of the ceremony is about ten blankets. On enquiring what the feelings of the man might be whose dog was devoured, I found that afterwards the dog is appraised and paid for to the satisfaction of all parties. This is characteristic of the manner in which, among the Haidas themselves, the principle of nothing for nothing is strictly carried out.

6. *Hi-atl.* This dance is very frequently indulged in, and is on occasion of any joyful event, as the arrival of visitors, &c. It is performed by several or many men, who wear feathers in their hair and paint their faces. The Haida language is used in the song. No distribution of property happens, except in the case of the dance being to denote the conclusion of mourning for a dead friend. In this instance a potlatch occurs by the former mourner, who invites his friends together to dance with him. Hi-atl.

Gambling is as common with the Haidas as among most other tribes, which means that it is the most popular and constantly practised of all their amusements. The gambler frequently loses his entire property, continuing the play till he has nothing whatever to stake. The game generally played I have not been able to understand clearly. It is the same with that of most of the coast tribes, and not dissimilar from gambling games played by the natives from the Pacific coast to Lake Superior. Sitting on the ground in a circle, in the centre of which a clean cedar mat is spread, each man produces his bundle of neatly smoothed sticks, the values of which are known by the markings upon them. They are shuffled together in soft teased cedar bark, and drawn out by chance. Gambling.

Social customs.

Some points connected with the social relations of the Haidas have already been touched upon, others may be noted here.

A man wishing to marry, informs his mother on what girl his heart is fixed, and she, going to the mother of the beloved one (sweetheart or *ka-ta-dha*), endeavours to arrange the match. An understanding having been arrived at, the man, when ready, invites his friends to accompany him, and going together to the house of the girl's parents, they enter, and sit down around the fire, beside which the girl and her friends also are. The young man's friends then speak in his favour, recommending him to the father of the girl, and praising his good qualities. When the talk is finished, the girl rises, and going to where her would-be husband is, sits down beside him and takes his hand. The ceremony is then complete, and the father of the girl gives Marriage.

various articles of property to her, constituting her dowry. She is led away by her husband, but after a time returns on a visit to her parents, bringing presents, generally of food, from her husband.

Polygamy.

Marriage is contracted early. Polygamy is practised, but not extensively; it was formerly more usual, but was always mainly or entirely confined to recognised chiefs. I could hear of but a single instance in which a man yet has two wives. This case is at Skidegate. Three or four wives were not uncommon with a chief in former days, and it was told to me as a tradition by a Haida that a Tshimsian chief at one time had ten wives. As the women do not contribute materially to the support of the family, attending only to the accessory duties of curing and preserving the fish, it is probably difficult for a man to maintain many wives. The women appear to be well treated on the whole, are by no means looked upon as mere servants, and have a voice in most matters in which the men engage. Children are desired, and treated as well as the mode of life and knowledge of the Haida admits. Very few children are now, however, seen about some of the villages, the women resorting to Victoria for purposes of prostitution. Their husbands, be it said to their shame, frequently accompany them, and live on their ill-gotten gains. It is said that in the early days of their contact with the whites, the Haidas were distinguished by good morals. If so, they differed from most of the coast tribes, among whom great laxity has always prevailed. Female chastity is certainly not now prized.

Training of girls.

When a girl is about to reach maturity she must attend to various ceremonies, and pass through certain ordeals. It was the custom that she should wear a peculiar cloak or hood at that time for several months, or even half a year. This was made of woven cedar-bark, nearly conical in shape, and reached down below the breast, though open before the face. It was, I believe, called *ky-χe*. The face was painted with the powdered fungus already alluded to, and fasting more or less severe was practised. It was also customary to screen off a corner of the lodge and give the girl a separate fire, and allow her to go out and in by a separate door at the back of the house. This was connected with an idea of ceremonial uncleanness. Did she require to pass out by the front door, it was necessary first to remove all the arms and various other things. In meeting men, the face was to be quickly covered with a corner of the blanket. These or other similar customs were also in vogue among the Tshimsians, whose practices so closely resemble the Haidas in most respects. Among these people great care was taken to teach the girls submission, contentment, and industry. At certain times they were not allowed to lie down to sleep, but if overcome with drowsiness must prop themselves in a sitting posture between boxes. Before drinking, the cup must be turned round four times in the direction of movement of the sun. It was also usual for the mother to save all hairs combed out of the head of the girl, and twist them into cords, which were then tightly tied round the waist and ankles, and left there till they fell to pieces of themselves. This was supposed to give a fine shape to the body. In eating, the girl must always sit down, to prevent a too great corpulence. If orphaned the various ceremonies must be again performed by the girl, even though already all attended to.

Among the Tshimsians peculiar ceremonies exist in connection with the 'bringing out' of young men and women, and it is an occasion of public feasting. In the case of a young woman, the people being all collected, a curtain is raised, and she is seen sitting with her back to the spectators, peculiarly dressed, and surrounded by a circle of upright 'coppers,' if enough can be mustered. She then begins to sing, or, if she does not, an old woman begins to sing near her, and she becoming encouraged joins. The old woman then gradually drops her voice till the novice is singing alone. She then eventually makes a dance before all the people. The songs and dances are practised before the time for the rite arrives. Similar customs probably exist among the Haidas, though I did not learn any details concerning them. Tshimsian practises.

With the Haidas a first-born son may be called by the name of the mother's eldest brother, the second-born after the mother's second brother, or by one of the additional names of the first. Should the mother have no brother, the name of some dead friend is chosen, or in cases where the medicine-man reveals the return of some one formerly dead in the new-born child, the name of the person supposed to be thus returning to the tribe takes precedence of all others. A chief's son is named by its mother after consultation with a medicine-man, whom she pays. He takes a night to think, and mayhap dream, about it. Thereafter he gives the name of a deceased male relative on the mother's side, which is adopted. The ceremony of naming is witnessed by many, and presents are given. A sister of the father's holds the child when named, and becomes its 'godmother' afterwards. For this she receives presents from the father, and from the boy himself when grown up if she has used him well. The next ceremony is that of piercing the lobes of the ears and septum of the nose, when gifts are again distributed, the godmother-aunt coming in for a good share. Four times in all a youth changes his name, always taking one from his mother's family. A potlatch and tattooing of the youth takes place on each occasion except the first, when the latter is omitted. Also a house-building bee. On the last of these occasions the young Naming a son. Stages in advance to manhood.

man is aided by his mother's people, makes the potlatch from his own house and in his own last-adopted name. Dancing and singing are in order at all potlatches. The first house-building is called *tuχ-kuχo.* The second *ki-au-ni-geχa.* The third *χashl.* The fourth *tlo-xo-kīs-til.*

Slavery. Slavery is intimately interwoven with the social system of the Haidas, as with that of most of the tribes of the coast. Slaves were formerly common among them, expeditions being undertaken—especially northward to the country about Sitka, where the totems are different—for the special purposes of securing slaves. The intertribal wars along the coast have now ceased, however, and such piratical expeditions have also been abandoned owing to the wholesome dread of gunboats. Slaves, in consequence, are becoming scarce, and the custom is dying away. A slave is called *elaidi* in the Haida language. They appear to have been formerly under the absolute rule of their respective masters, and were sometimes cruelly treated. In some cases a slave has been killed to bury beneath the corner post of a new house. They are veritable hewers of wood and drawers of water. They can be sold, and are supposed at the present time to be worth about two hundred blankets each, the price having risen owing to their scarcity. Children born of slaves are also slaves.

One slave still remains among the Gold Harbour Haidas. There are none at Skidegate or other of the southern villages, but a considerable number at Masset and the northern villages. Slaves sometimes regain their freedom by running away, but should they return to their native place are generally so much despised that their lives are rendered miserable.

Sickness and death. When a man falls sick it devolves upon his brother to call in the medicine-man, and also to invite the friends to the house of sickness, and provide them with tobacco to smoke. The house is thus generally full of sympathising Indians, with smoke, and the noise of the medicine-man's performances. Should the sick man die, the body is generally enclosed in a sitting posture in a nearly square cedar box, which is made for the purpose by all the Indians conjointly; or, if they do not wish to make it, they subscribe to purchase from some one of their number a suitable box. The coffin-box being the same in shape as those used for ordinary domestic purposes, there is generally no difficulty in securing one. In either case the brother, or other near relative of the deceased, makes a potlatch, or distribution of property, to repay the others for their labour or expense.

Entombment. If a man of ordinary reputation only, dies, his body (*tl-kō-da*) is put at once into the coffin-box (*sa-tling-un*), and is then stored away in the tomb-house (*sa-tling-un-nai*), which is generally a little, covered shed behind the house, or in the immediate neighbourhood of the village.

This tomb is also made by the combined labour of the men of the village and paid for in the same way as in the case of the coffin-box. In it may be placed but a single body, or two or more—those of relatives. Should the dead have been a man of great importance, or a chief, the box containing the body is placed in the house inhabited during life, the other occupants finding quarters elsewhere as best they can. The clothes and other articles of property of the dead man are arranged about him, and he sits in state thus for perhaps a year, no one removing any of the things. Indians from another village, however, may come to see the body, and do so. The body once consigned to the tomb-house is now left there, but it was formerly the custom in the case of chiefs to open the tomb from time to time and provide the body with fresh blankets or robes. This is said never to have been done to the bodies of the less important members of the tribe, and to have been long in disuse; it is a common practice among the Salish Indians of the interior of British Columbia. Both among the Haidas and Tshimsians the dead were also formerly burnt as an occasional or not unfrequent practice. In this case the ashes were collected and put in a box. This is never now done, but numerous instances occurred in the last generation. Burial customs

After the body has been entombed it becomes necessary sooner or later, if the deceased has been a person of any importance in the tribe, to erect a carved post. The Indians again collect for this purpose, and are repaid by a distribution of property, made by the brother of the deceased or other relative to whom his estate has come down as next in order of descent. The post erected, though sometimes equally ponderous with the carved posts of the houses, is not generally so elaborate. In many cases it consists of a plain upright, tapering slightly towards the lower end, or that inserted in the ground, while the upper bears a broad board, on which some design is carved or painted, or any 'coppers' formerly belonging to the dead man are attached. Monumental posts.

The custom of placing the bodies of the dead in canoes, which may either rest on the ground or be fixed in a tree, does not obtain among the Haidas, nor did I see any instance of the use of trees as receptacles of coffin-boxes, as practised among several other tribes of the coast.

The brother of the deceased inherits his property, or should there be no brother, a nephew, or the sister, or, failing all these, the mother. Occasionally some distant male relative may be adopted as a new son by the mother, and be made heir to the property. The wife may in some cases get a small share. As soon as the body has been enclosed in the coffin-box, and not before, the brother or other heir takes possession. When it can be amicably arranged, he also inherits the Inheritance.

wife of the dead man, but should he be already married, the nephew or other relative on whom the succession would next devolve is supposed to marry the relict. Should there be no relative to marry her, she may be married again to any other man.

Totems.

A single system of totems (Haida, *kwalla*) extends throughout the different tribes of the Haidas, Kaiganes, Tshimsians and neighbouring peoples. The whole community is divided under the different totems, and the obligations attaching to totem are not confined by tribal or national limits. The totems found among these peoples are designated by the *eagle*, *wolf*, *crow*, *black bear* and *fin-whale* (or *killer*). The two last-named are united, so that but four clans are counted in all. The Haida names for these are, in order, *koot*, *koo-ji*, *kit-si-naka* and *sχa-nu-χā*. The members of the different totems are generally pretty equally distributed in each tribe. Those of the same totem are all counted as it were of one family, and the chief bearing of the system appears to be on marriage. No one may marry in his or her own totem, whether within or without their own tribe or nation. A person of any particular totem may, however, marry one of any other indifferently. The children follow the totem of the mother, save in some very exceptional cases, when a child newly born may be given to the father's sister to suckle. This is done to strengthen the totem of the father when its number has become reduced. The child is then spoken of as belonging to the aunt, but after it attains a certain age may be returned to the real mother to bring up.

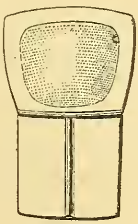
Totems and slavery.

An Indian on arriving at a strange village, where he may apprehend hostility, would look for a house indicated by its carved post as belonging to his totem, and make for it. The master of the house coming out, may if he likes make a dance in honour of his visitor, but in any case protects him from all injury. In the same way, should an Indian be captured as a slave by some warlike expedition, and brought into the village of his captors, it behoves any one of his totem, either man or woman, to present themselves to the captors, and singing a certain sacred song, offer to redeem the captive. Blankets and other property are given for this purpose. Should the slave be given up, the redeemer sends him back to his tribe, and the relatives pay the redeemer for what he has expended. Should the captors refuse to give up the slave for the property offered, it is considered rather disgraceful to them. This at least is the custom pursued in regard to captives included in the same totem system as themselves by the Tshimsians, and it is doubtless identical or very similar among the Haidas, though no special information on this subject was obtained from them.

Tattooing.

Tattooing, as already mentioned, is universal among the Haidas, the legs, arms and breasts being generally thus ornamented. Among the Tshimsians it is occasionally practised. The design is in all cases the totem-crest of the bearer.

The strictness of the custom of payment for privileges granted, and repayment for losses or injuries sustained, almost necessitated the definition of a currency of some kind. Among most of the coast tribes the dentalium shell was prized, but not so much as a means of exchange among themselves as for barter with the Indians of the interior. By the Haidas the dentalium is called *kwo-tsing*, but as these people were by their position debarred from the trade with the interior, it was probably never of so great value with them. It is still sometimes worn in ornaments, but has disappeared as a medium of exchange. Currency. Shells.



Length, about 18 inches or 2 feet.

Another article of purely conventional value, and serving as money, is the 'copper.' This is piece of native metal beaten out into a flat sheet, and made to take the form illustrated in the margin. These are not made by the Haidas,—nor indeed is the native metal known to exist in the islands,—but are imported as articles of great worth from the *Chil-kat* country, north of Sitka. Much attention is paid to the size and make of the copper, which should be of uniform but not too great thickness, and give forth a good sound when struck with the hand. At the present time spurious coppers have come into circulation, and though these are easily detected by an expert, the value of the copper has become somewhat reduced, and is often more nominal than real. Formerly ten slaves were paid for a good copper, as a usual price, now they are valued at from forty to eighty blankets. 'Coppers.'

The *blanket* is now, however, the recognised currency, not only among the Haidas, but generally along the coast. It takes the place of the beaver-skin currency of the interior of British Columbia and the North-west Territory. The blankets used in trade are distinguished by points, or marks on the edge, woven into their texture, the best being four-point, the smallest and poorest one-point. The acknowledged unit of value is a single two-and-a-half-point blanket, now worth a little over $1.50. Everything is referred to this unit, even a large four-point blanket is said to be worth so many *blankets*. The Hudson Bay Company, at their posts, and other traders, not infrequently buy in blankets, taking them—when in good condition—from the Indians as money, and selling them out again as required. Blankets

Blankets are carefully stowed away in large boxes, neatly folded.

A man of property may have several hundred. The practice of amassing wealth in blankets, no doubt had its origin in an earlier one of accumulating the sea-otter and fur-seal robes, which stood in the place of blankets in former days. This may help to explain the rich harvest of these skins which the first traders to the Queen Charlotte Islands gathered.

Payment for privileges.

Besides the payments already mentioned, as exacted from a stranger wishing to fish or gather berries in the territory of another, the Tshimsian Indians, who sometimes resort to the southern end of the islands to hunt the sea-otter, are forced to pay the neighbouring tribe for the privilege, though the chase is carried on on the open sea. Certain men, too, supposed to be specially skilled in various kinds of work, are regularly paid for their services. This is expressly the case with workers in wood and those competent to carve and paint the peculiar posts.

Trade in oolachen grease.

Oolachen grease, bought from the Tshimsians, is paid for in blankets, while a return trade in canoes—in the making of which the Haidas excel—is conducted on the same basis.

While at Cumshewa Inlet, we witnessed the arrival of some Tshimsian Indians who had come in canoes loaded with oolachen grease, hoping to sell it to the Haidas. Veritable merchants, ready if they find no market here, to go on to the next village. The sky was just losing the glow of sunset when the two canoes were seen coming round the point. The Haidas, looking attentively at them, pronounced them Tshimsians, and proved to be correct. The greater number of the occupants of the canoes were women, all fairly well dressed, and wearing clean blankets to make a good appearance on their arrival among strangers. The faces of some of them, covered with a nearly black coat of gum and grease. had a wild aspect, which was rendered rather comical, however, by the various and inappropriate nature of the hats and caps—all of civilized patterns—which they wore. Each of the canoes has a couple of masts, to which the light sails are now tightly clewed up, but from the foremost canoe floats a wide strip of red bunting. The paddles are dipped with a slow, monotonous persistency indicative of the close of a long day's work, and they tell us they have only slept twice since leaving Kit-katla. Arrived at the beach opposite the Haida village, the canoes are stranded, and the villagers crowd round to render assistance. The bark boxes holding the precious grease are carefully set in the water, beside the canoes. Kettles, mats, paddles and all the varied articles of the travelling outfit are carried ashore. The canoes are hauled up by united exertion, the boxes of grease carefully carried beyond high-water mark, and covered with brush; and in half an hour, the travellers, distributed among the houses of the village, are found at their evening meal. Business does not seem to occupy their attention; they will remain here several days to talk about that.

Arts and Architecture.

Under this special heading a few points may be taken up, some of which have already been incidentally referred to in general terms.

The primitive sea-otter or seal skin cloak of the Haidas has already been described in extracts quoted from old authors, together with the dressed skin undershirt (p. 106, B), while of the armour of skin and split sticks little can now be learnt. The *naxin*, or dancing shawls made by the Tshimsians, so much prized, and have been described, and the head-dress worn at the same time with the *naxin* mentioned. This consists essentially of a small, nearly flat mask (one in my possession is 6 inches long by 5¾ wide, and is represented in Fig. 4), fixed to an erection of cedar bark, feathers, &c., in such a manner as to stand erect above the forehead of the woman. At the back depends a train, which may be made of cloth, but should have ermine skins sewn on it. These masks are frequently well carved to represent a human face not unpleasant in expression, and have the teeth and eyes formed of inlaid Haliotis shell. Dancing costume.

On ordinary occasions a head-covering is usually dispensed with, unless it be some old hat of European style. The women, nevertheless, make, and occasionly wear, the peculiar basket-work hats common on the coast. These have the form of a rather obtuse cone, of which the sides are hollowed and the apex truncated. They are generally ornamented by painting in black, blue or red, in the conventional style common among these people. The feet are almost invariably bare. Basket-work hats.

Leggins ornamented with puffin beaks have been referred to as occasionally adopted as a part of the dancing costume. A species of castinet or rattle (one of which is represented in Fig. 25,) is also made from these for use in dancing. Each beak is threaded to a thin strip of sinew, and they are then attached at short intervals to the circumference of each of a couple of thin wooden hoops, the diameter of the larger of which may be 8 or 9 inches; of the smaller a little less. A cross-bar connects the two hoops, and being held in the hand, a slight motion in rotation being imparted by the wrist, causes the dry, horny beaks to rattle together. Ornaments of puffin bills.

Masks are to be found in considerable numbers in all the villages, and though I could hear that they were employed in a single dance only, it is probable that there may be other occasions for their use. The masks may be divided into two classes—the first, those which Masks.

represent human faces, the second those representing birds. Figures 1, 2 and 3 represent the first class, Fig. 5 the second. They are carved in wood. Those of the first class are usually large enough amply to cover the face. In some cases they are very neatly made, generally to represent an ordinary Indian type of face without any grotesque idea. The relief of the work is generally a little lower than in nature. Straps of leather, fastened to the sides of the mask, are provided to go round the head of the wearer, or a small loop of cedar-bark string is fixed in the hollow side of the mask, to be grasped by the teeth. The top of the forehead is usually fringed with down, hair or feathers. The eyes are pierced to enable the wearer to look out, and the mouth is also often cut through, though sometimes solid, and representing teeth. Grotesque masks are also made in this style, but none were observed to have a smiling or humourous expression. The painting of the masks is, according to taste, in bars and lines, or the peculiar curved lines with eye-like ovals found so frequently in the designs of the coast Indians. The painting of the two sides of the face is rarely symmetrical, a circumstance not arising from any want of skill, but intentionally brought about. Of the second class of masks, representing birds, there are various kinds. One obtained at the Klue Village had a beak five or six feet long projecting from the centre of a mask not much unlike those above described. The beak was painted red, and the whole evidently intended to represent the oyster-catcher common on the coast. Another mask represents the head of a puffin, (Fig. 5) and is very well modelled. It is too small within, however, to allow the head to enter, and must have been worn fixed to the top of the head.

Human and bird masks.

Rattles.

Rattles are also used chiefly in dancing. These are of two principal types. First and most usual are plain spheroidal or oval rattles, generally considerably flattened in shape. They are carved in wood with great neatness, the wood being sometimes reduced to a uniform and very small thickness throughout. Each is made in two pieces, which are fixed together generally by small threads of sinew passed through holes in their edges. Small round pebbles from the beach are placed within. The representation of a human face, which may be plain or coloured, according to the maker's taste, is generally found on each side of these rattles, though some are almost entirely plain. Rattles of this sort are represented in figures 16 and 17. The second species of rattle is much more elaborate in form, is highly prized, and apparently used only by persons of some distinction. These are made in the form of a bird, the handle being in a position corresponding with the bird's tail. Accessory carving of a very elaborate character is sometimes found on these rattles, which can scarcely be described at length here, but is shown in Fig. 26. They are generally carefully painted with red, blue and other colours. Rattles in other forms are also found; one was seen to resemble a killer whale, with a greatly exaggerated back fin. (Fig. 19.)

A carved stick is sometimes held in the hand in dancing, and struck upon the floor in time with the motion of the feet. Several of those which I have seen are about five feet in length, and are carved much in the style of the posts which are set up in front of the houses. Figures of men and conventionalized representations of animals appear to be seated one above another up the length of the stick. Baton.

A small apparatus held in the mouth to produce a peculiar noise when dancing, has been mentioned in connection with that custom on a former page. One which I obtained consisted of a wooden tube roughly oval in section, three-quarters of an inch in greatest width, with a length of an inch and a quarter. This is composed of two pieces tied together with a strip of bark, and within it are placed two vibrating pieces, each composed of two flat pieces of wood or reed tied together. In a box in one of the old houses in Parry Passage several such cells were found fitted in trumpet-shaped tubes about a foot in length made of cedar wood, each being composed of two pieces. Vibrating mouth piece.

In describing the performance of the medicine-men (p. 123 B.) a peculiar charm, or implement by which the departing soul may be caught and perhaps replaced, was referred to. This is made from a piece of bone, which from its size and general shape might be part of a human femur, but may possibly be that of a bear. This bone is pared down so as to have an almost perfectly symmetrical form, the ends being somewhat more expanded than the middle. A human face, often grotesque, ornaments the centre of one side, the remainder of a human figure being sometimes carved so as to extend round over the back in a more or less cramped attitude. The ends are slit, the slit in each instance passing through both sides of the bone, and representing the mouth of a creature the eyes and nostrils of which are rudely indicated in a conventional manner above. The upper side of the bone is pierced by a couple of holes for its suspension over the breast by a string which passes round the neck. A few small holes, probably for the attachment of tassels or other little ornaments are sometimes made in the lower side. Some examples are neatly inlaid with fragments of haliotis shell. The dimensions of two good specimens are, No. 1—Length $6\frac{5}{8}$ inches; vertical diameter in centre, 1 inch, horizontal diameter, $\frac{7}{8}$ inch; vertical diameter at ends, $1\frac{1}{4}$ inch; horizontal diameter at one end, 1 inch, at the other, $\frac{7}{8}$ inch; depth of slit at ends, $1\frac{1}{2}$; inches. No. 2—the dimensions in the same order, $7\frac{1}{2}$; 1; $\frac{3}{4}$; $1\frac{3}{8}$; 1; $\frac{3}{4}$; $1\frac{1}{2}$ inches. The first of these is that represented in figure 28. Medicine-man's charm.

Bone ornaments.

Bone pins, more or less carefully carved, are used by the medicine-men to secure the knot into which they tie up their hair; and pieces of bone carved to represent whales, birds, human figures, or combinations of these are not unfrequently found, though now seldom worn. They served formerly for ornaments, some of the smaller being probably ear-rings.

Speaking doll.

A peculiar and very ingenious speaking doll was obtained at Skidegate. This did not seem to be a mere toy, but was looked upon as a thing of worth, and had previously been used, in all probability, as an impressive mystery. It consisted of a small wooden head, $3\frac{1}{2}$ inches high by $2\frac{1}{2}$ inches wide and 2 inches deep from back to front, composed of two pieces of wood hollowed till quite thin, and the front one carved to represent a grotesque face, with a large round open mouth with projecting lips. The two wooden pieces had then been neatly joined, a narrow slit only remaining within the neck, and serving for the passage of air, which then impinging on a sharp edge at the back of the cavity representing the mouth, makes a hollow whistling sound. To the neck is tied the orifice of a bladder, which is filled with some loose elastic substance, probably coarse grass or bark. On squeezing the bladder sharply in the hand a note is produced, and on relaxing the pressure the air runs back silently, enabling the sound to be made as frequently as desired.

Dishes and vessels.

Most of the ordinary household utensils are made of wood, or rather it may be said were so made, for at the present day tin and cheap earthenware dishes are rapidly superseding those of native manufacture. Several distinct types of wooden dishes may be distinguished, and these appear to have been followed by the maker with little variation except in the detail of ornamentation. One form, used to hold berries and other food, is a tray of oblong outline, the length being about one and one-third times the width, and the depth comparatively small. These are cut out of solid wood, the edge being slightly undercut within, and the bottom within rounded though externally angular. The outer ends are generally the sides occasionally ornamented by incised carving or painting. The edge is frequently, in the better examples, set with a row of the strong, calcareous opercula of *Pachypoma gibberosum*. These trays are often ten feet or more in length (Fig. 31). Another very favourite form (represented in Fig. 20) may be said to be boat-shaped, the hollow of the dish being oval in outline, but provided at the ends with prow-like wooden projections which serve as handles. One of these is generally carved to represent the head of an animal, the other the tail and hind legs. These dishes are seldom more than eight or ten inches in length, and curve upwards from the middle toward the ends. Another form is oblong in outline, but nearly as deep as wide. Seldom more than about fifteen inches in length. The bottom in the larger of these vessels is frequently a separate flat piece of wood neatly joined. One end of many of these dishes is carved to represent the head of a beaver or other animal, while the other carries a representation of the legs and tail (Figs. 30 and 32). Other carvings may ornament the sides. This form is sometimes varied in the smaller sizes by making the vertical profile of the longer edges correspond to a graceful curve instead of keeping to one plane. Another modification of this type is found in a dish to one end of which a broad, flat expansion carved to represent the tail of a bird is fixed, while the head projects from the opposite end. The bird is represented as lying on its back when the dish is in its proper position, the hollow being made apparently in the bird's breast. One of these is represented in Fig. 33. Very large dishes are still occasionally, and were formerly frequently made for use, in feasts given by chiefs, &c. One of these had a general form like that of the first described kind of dish, but was nearly square, the sides being 3 feet 8 inches. It was composed of four side pieces and a bottom piece neatly pegged together, while the edge was surrounded by a double row of opercula. Another form seen in one of the old houses on Parry Passage is a parallel-sided trough six or eight feet long, with a head carved at one end, a tail and pair of swimming feet at the other, the whole being supposed to represent a sea-lion. Still another pattern was found in a shallow, gracefully shaped tray 5 feet 6 inches long, and about one-third as wide. The ends of this were obtusely pointed and overhung, while above, a flat space between each extremity and the end of the hollow within, bore a complicated pattern in incised lines.

Large wooden trays and troughs.

The stone mortars already mentioned as having been employed in the preparation of the native tobacco, now seem to be little if at all used for any purpose. They are generally circular in outline and without ornamentation, being in some cases very roughly made. Other examples are ornamented by carving. A plain circular mortar of rather greater size than usual was found to have a width of $9\frac{1}{2}$, a heighth of $6\frac{1}{2}$, and an internal depth of $4\frac{1}{2}$ inches. A second (Fig. 15), carved externally to represent a frog had, disregarding the projecting points of the carving, the following dimensions, in the same order as above,— $6\frac{1}{2}$; $5\frac{1}{2}$; $3\frac{1}{2}$ inches. One mortar of an oval form, with projecting carved ends, was seen (Fig. 11). It represents a frog or some large-mouthed kind of fish like a cottus, but the design is complicated by the introduction of a human face near what should the hinder end of the animal. The extreme length of this mortar is $16\frac{1}{2}$ inches, the width at the middle 8 inches tapering a little from the head to the tail, and the height at the middle, which is

Stone mortars.

slightly lower than the ends, $5\frac{1}{2}$ inches. The dimensions of the interior hollow of this mortar are 8 by $5\frac{3}{4}$, an $3\frac{1}{4}$ inches deep. Another stone utensil obtained at Skidegate is a dish for preparing paint. This is 6 inches long by $2\frac{1}{2}$ wide, in external dimensions, with a trough-shaped bowl $4\frac{1}{2}$ by $1\frac{3}{4}$ inches, in which the paint has evidently been ground by rubbing from end to end with a second stone. When laid with the hollow side downward, the exterior is found to be carved to represent some animal, probably a frog, in a constrained squatting attitude. The carved side is represented in Fig. 12.

Horn dish.

Shells, especially those of the large mussel are frequently used as spoons and small dishes. A very handsome dish, with an oval outline, is also made from part of the larger end of the horn of the mountain sheep. This is probably softened by steaming, and forced into a symmetrical shape, then pared down thin and carved externally. Fig. 18 represents one of these. The mountain sheep horns, with those of the mountain goat, are obtained in barter with the Tshimsians and other Indians of the mainland, neither of the animals occuring in the Queen Charlotte Islands.

Ladles and spoons.

Large serviceable ladles are also made from the mountain sheep horns, the lower part of the horn being widened to form an ample bowl, and the upper straightened out to produce the handle. One of these of the larger sort measures from the end of the handle to the point of the bowl, round its convex surface, 2 feet $3\frac{1}{2}$ inches. The bowl itself is $8\frac{1}{2}$ inches long by 6 inches wide, and $2\frac{1}{4}$ deep. (Fig. 6.) The spoons in ordinary use are six or seven inches long with large flat bowls, made in a single piece from the horn of the mountain goat. The handle may be carved to represent a human or other form. Another kind much prized and cared for, is made by attaching a bowl of the usual form, made from a piece of mountain sheep or goat horn, to the wider extremity of an entire horn of the mountain goat by a couple of rivets. The goat horn, retaining its natural curve, is then elaborately carved with human or other figures, according to the taste of the maker. Such spoons may be about a foot in length. (Fig. 27.)

Knives.

Knives of all sorts are now in use, but some ingenuity is shown in adapting old blades to new handles, manufacturing knives from files, and so on. A knife used in cutting up fish is made by fixing one edge of a thin square or oblong piece of iron in a cylindrical or flattened piece of wood of slightly greater length. This has thus the form of a small mincing knife.

Household boxes.

The boxes in which most of the goods and chattels of the household are packed away are made after a uniform plan. A small one measured $20\frac{1}{2}$ inches high by 15 square. The sides are made of a single wide thin piece of cedar, which is bent three times at a right angle, with very little appearance of breaking at the corners, and pegged together at the fourth angle. The bottom is made of a separate piece of wood. The cover is cut out of a solid slab. It rests by a shoulder on the ledge of the box, and expands slightly upward, so that the upper surface of that of the box above mentioned and represented in Fig. 29 is nearly 17 inches square. These boxes are generally decorated externally by designs in black and dull red paint, and are carefully corded with cedar-bark rope, which is so arranged as to meet and tie over the top of the cover when desired.

Mats, of an oblong form, and plaited rather than woven, from strips of cedar bark, constitute a great part of the household furniture. They vary much in texture, and may be either of the natural brownish or yellowish colour or diversified by black bands. Mats.

One-handed adzes, with the blade fixed at an acute angle to the handle, are very commonly used. (Fig. 14.) The blade is often an old broad file, sharpened at the end. These, no doubt, replace those of stone of a former day. A few of the stone adze-heads are still to be found about the houses, and are very well shaped, and different in form from any I have elsewhere seen. One of these is represented in figure 13. The head somewhat resembles a poll pick in shape, being square in section near the front, but oblong towards the head owing to the increasing breadth, the thickness from side to side remaining the same or nearly so. Near the head, one of the smaller sides is carved into one or two saddle-like hollows to receive the properly shaped end of the handle, which was no doubt lashed firmly to the stone with sinew or bark. The lateral surfaces are sometimes grooved from the head downward for one-third or more of the total length. The dimensions of some specimens are as follows:— Adzes. Stone adzes.

No. 1.—	Length, 1′ 1″.	Breadth, 2″.	Thickness, $1\frac{1}{16}$ inches.
No. 2.—	" $7\frac{1}{4}$″.	" 2″.	" $1\frac{5}{8}$″.
No. 3.—	" 8″ (about)	" 2″.	" $1\frac{8}{15}$″.

The measurements are merely averages, as the sides are not generally strictly parallel, but slope more or less towards the ends. The material of these tools appears to be a matter of indifference, as I have seen them made of hard altered igneous rocks like those so common in the country, of a hard sandy argillite, and of the peculiar greenish jade which the natives of some other parts of the province prize so highly. This latter material is not, according to the Haidas, found in the islands, but has occasionally been obtained in the course of trade.

Large stone hammers are still in use for driving home wedges and similar operations. No stone arrow-heads were found, and it is probable that these people, before they were acquainted with iron, used bone only for this purpose. Hammers.

Fur-seal spear. Spears and harpoons were doubtless in former times made of bone, like those found in the shell heaps of Vancouver Island. At the present day iron has been substituted. A species of harpoon is used in the chase of the fur seal. It is generally made by the Haidas themselves from an old flat file. The extremity is sharpened to a blade-like point, which is succeeded by a series of barbs on each side, sharply thrown backward. The butt of the file is bored through, and a loop of strong copper wire fixed to it so as to move freely. To this is attached a strong cord of plaited sinew, to the extremity of which a bladder or float is affixed. When in use, the butt end of the iron head is fixed in a socket in the extremity of a long, light cedar pole, but easily detaches itself when it is driven into the animal. The head of the harpoon generally fits into a wooden sheath made of two pieces fixed together with bark lashing.

Salmon spear. The head of the salmon spear consists of a sharp blade-like iron tip to the base of which two pointed pieces of horn are lashed, the lashing being thickly covered with spruce gum so as to offer no impediment to the whole entering the fish. The length of the blade, with the horn barbs, is about four inches. Between the pieces of horn fits the sharpened end of a piece of wood, $7\frac{1}{2}$ inches long, which increases gradually in size till at its inner extremity it forms a flat leaf-shaped expansion, which fits into a hollow of similar form in the end of a long light cedar pole. The end of the pole is served with bark to prevent its splitting, and the iron-tipped head is made fast to the intermediate wooden piece, and that to the end of the pole by strong strings. When plunged in the fish, the loose wooden piece no doubt first comes out from the end of the pole, and with a slight increase of strain it comes away from the barbed head, which thus practically remains fixed to the end of the pole by a foot or eighteen inches of cord.

Fish-hooks. The fish hook is made substantially after the pattern general on the west coast, but owing to the want of the yew, it has not the same graceful shape with that of the Ahts and Makah Indians. In its primitive form, among the Haidas, it consists either of a forked branch, of suitable size, or of two pieces of wood lashed together so as to make an acute angle with each other. To the upper piece, about the middle, is fixed the string for the suspension of the whole, to the free or outer end of the lower piece a pointed bone is lashed so as to project obliquely backward, reaching to within a short distance of the upper piece. The bone is now, however, generally replaced by an iron point, and in some cases the whole hook is fashioned out of a piece of thin iron rod, bent round and sharpened (Fig. 9). This hook is more particularly used in halibut fishing. A large sized one in wood (Fig. 10) measures 10 inches in length, with a distance of five and a half inches between the divergent ends of the two pieces of which it is made. When in use, a carved wooden float is fixed about a foot from the hook, and a short distance further up the line a large stone sinker. The whole being lowered to the bottom till the stone comes to rest, the small float drifts out with the tide, and keeps the hook below it at a short distance from the bottom. The wooden parts of the hooks and the floats are sometimes rudely carved. A second form of hook differs slightly from the first, in being formed of a piece of thin iron rod, bent round in a continuous curve of an oval form, but of which the upper side has been somewhat displaced so as to allow the passage of the lip of the fish within the recurved point. These hooks are often made small, and used in catching flounders and such fish.

Float and sinker.

In the small rivers the salmon are generally caught in fish traps or wiers. A wier of split sticks being fixed completely across the river, cylindrical baskets made of the same material, with an orifice formed of sticks converging inward, serves to entrap the fish; or in other cases, flat frames are placed in such a position that the fish in endeavoring to surmount the wier by leaping falls into them.

Wiers.

The canoes of the Indians of the west coast are similar in type through all the tribes, but differ considerably in detail of shape and size. They are made from the giant cedar (*Thuja gigantea*), the wood of which is light, durable and easily worked, but apt to split parallel to the grain. This constitutes the greatest danger to the Indian canoes in rough weather, especially when they are heavily laden. Among the Haidas two patterns of canoes are found. In the first and most commonly used, the stern projects backwards, sloping slightly upward, and forming a long spur, while it is flattened to an edge below. The bow also curves upward, but has no spur, the cutwater forming a regular curve. These canoes (represented on the beach in Plate I) are frequently thirty or thirty-five feet long. The second pattern is that of the larger canoes, intended for longer voyages. In these both bow and stern are provided with a strong spur sloping upward, and generally scarfed to the main body of the canoe. The canoes are often about forty feet long, with a corresponding beam, and were in former days not infrequently constructed to cary forty men besides much baggage. With the exception of the bow and stern pieces, each canoe is made from a single log, which is roughly shaped out where the tree is cut, afterwards floated to a permanent village, and finished at odd hours, during the winter months. The lines of the canoes are very fine, the requisite amount of beam being given to them by steaming with water and hot stones, and the insertion of thwarts. They are smoothed outside and blackened, while inside they generally bear fine and regular tool marks from end to end. The Haidas are great canoe makers, and

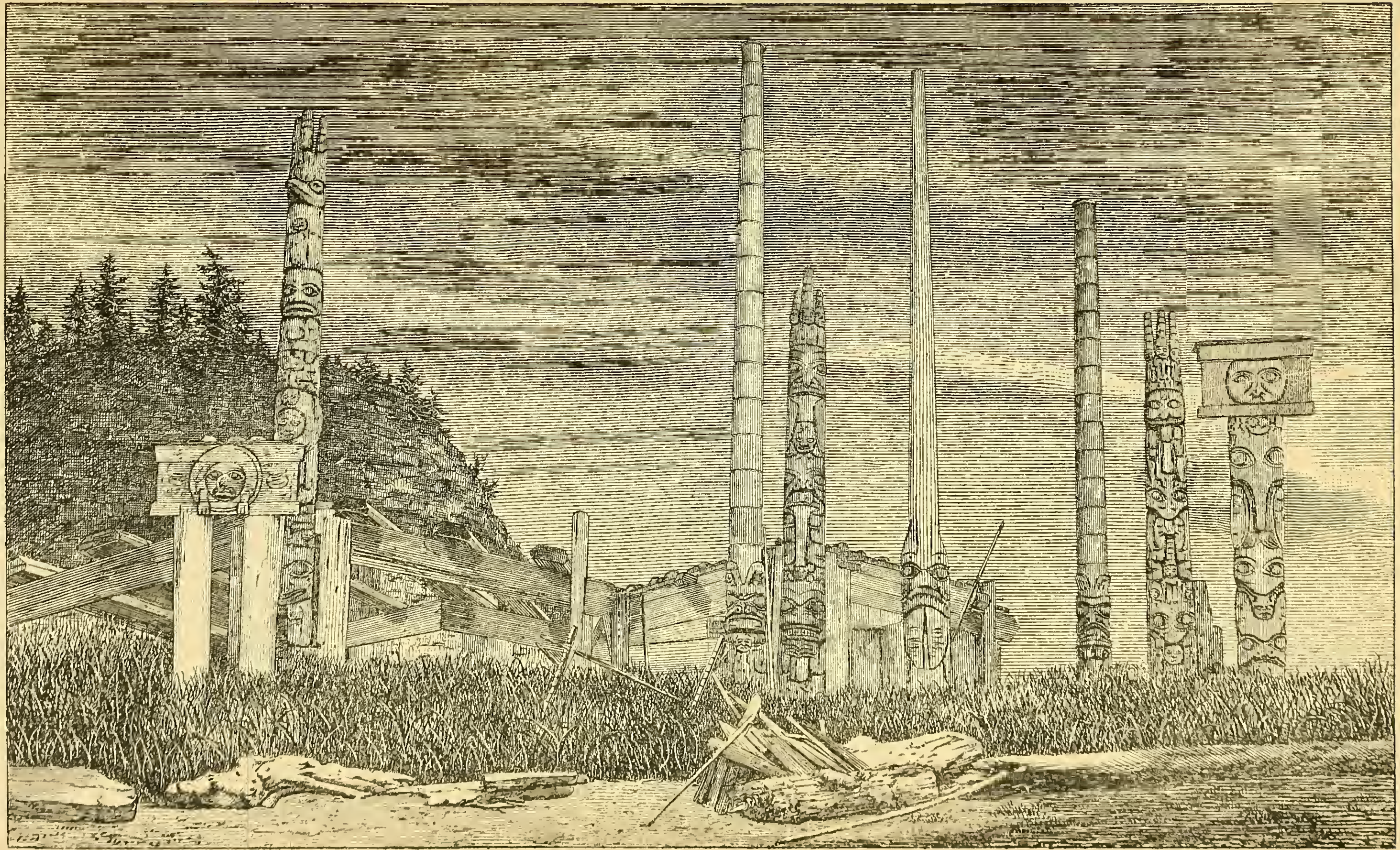
Canoes.

annually take over a large number of canoes to Port Simpson and the Nasse, which are sold, or exchanged there for oolachen grease or other comodities. The canoe paddles are usually made of cedar or the yellow cypress. Balers for the canoes are generally cut out of wood in the form of a scoop, with handle behind (Fig. 7) or made from a piece of cedar bark gathered up at the ends in a fan shape, with a stick secured across the top.

Houses. Various particulars concerning the manner of the Haidas in living in villages and the houses which they construct have already been given. The houses are placed with their gable-ends to the beach, which constitutes the street, the roof sloping down at a moderate angle on each side, with a projecting oblong 'lantern' or erection in the centre intended for the escape of the smoke, and fitted with a movable shutter which may be set against the wind. The houses are oblong or nearly square, and are often from 40 to 50 feet in length of side, and erected to accommodate a great number of people. The older and better built houses are almost invariably partly sunk in the ground. That is to say, the ground has been excavated to a depth of six or eight feet in a square area in the centre of the house, with one or two large steps running round the sides. A small square of bare earth is left in the centre below the smoke-hole, the rest of the floor being generally covered with split cedar planks. The steps which run round the sides are faced and covered above by large hewn slabs of cedar, and serve not only for sleeping and lounging places, but as the depositary of all sorts of boxes and packages of property belonging to the family. Some of the houses stand on the surface of the ground without any excavation. The pattern of the house itself is maintained with little variation in all parts of the islands, and has doubtless been

Main beams. handed down from time immemorial. The first process is to plant firmly in the ground four stout posts of sufficient height at each end. These are called *kwul-skug-it*, and are intended to bear four large beams which run from front to back of the house, and are called *Tsan-skoo-ka-da*. The heads of the posts are hollowed to receive the horizontal beams, which, with the posts, are circular in section. The longitudinal beams do not project beyond the posts which bear them, and in front of them at each end is a frame composed of large flat beams, which support the edge of the roof and the hewn planks of the front of the house. There are generally four flat upright beams, one in front of each of the main upright posts before described. These support a pair of beams which have the same slope with the roof, and are channelled below to receive the upper ends of the hewn boards which close the front of the house. These beams are called *ki-watl-ka*. The two upright beams nearest the centre *ki-stang-o*, the outer *kwul-ki-stung*.

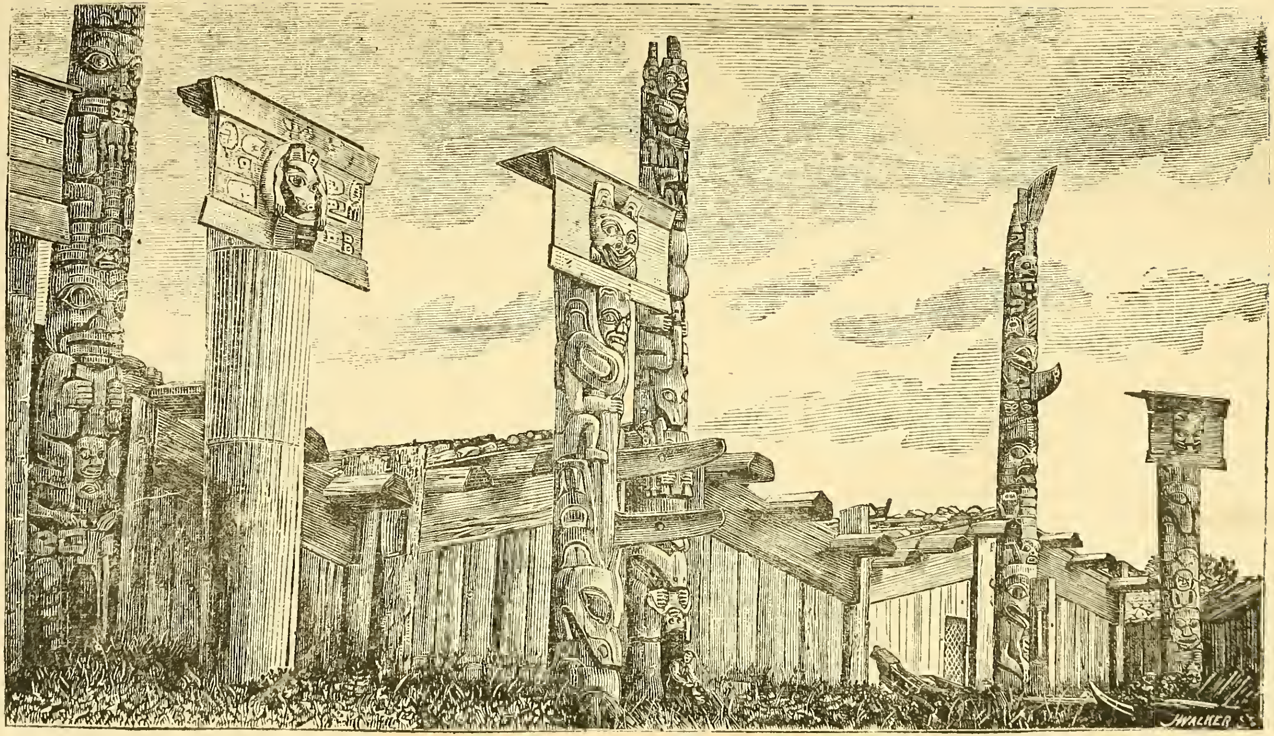
PLATE IV.



G. M. D., Photo. July, 1878.

HOUSES AND CARVED POSTS, SKEDANS VILLAGE.

PLATE V.



HOUSES AND CARVED POSTS, SKEDANS VILLAGE.

The dimensions of the house represented in plan and elevation in figures 35 and 36, of size rather greater than usual, in the Kung Indian Village, Virago Sound, were found to be as follows:—Breadth of front of house, 54′ 6″; depth, from front to back, 47′ 8″; height of ridge of roof, 16′ 6″; height of eaves, 10′ 8″; girth of main vertical posts and horizontal beams, 9′ 9″; width of outer upright beams, 1′ 10″; thickness, about 5″; width of upper sloping beams, 2′ 7″; thickness, 5″; width of carved post in front of house, 3′ 10″. Dimensions of house.

A second, and not unusual, style of house has only a single frame, consisting of four vertical flattened posts at each end, supporting sloping beams. The outer supporting posts are generally morticed out, and the outer ends of the sloping beams passed through them. Stout beams flattened on the lower side, and generally three in number on each side, are then made to rest on the sloping beams, and bear above them the cedar planking of the roof, held in place by stones heaped upon it, or by small beams laid over them above.

In a passage quoted by Mr. J. G. Swan in the Smithsonian Contributions to Knowledge, No. 267, Marchand (1791, see page 11 B.) describes the houses on North Island in the following terms:— Description of house by Marchand.

"The form of these habitations is that of a regular parallelogram, from forty-five to fifty feet in front, by thirty-five in depth. Six, eight, or ten posts, cut and planted in the ground at each front, form the enclosure of a habitation, and are fastened together by planks ten inches in width, by three or four in thickness, which are solidly joined to the posts by tenons and mortices; the enclosures, six or seven feet high, are surmounted by a roof, a little sloped, the summit of which is raised from ten to twelve feet above the ground. These enclosures and the roofing are faced with planks, each of which is about two feet wide. In the middle of the roof is made a large, square opening, which affords, at once, both entrance to the light, and issue to the smoke. There are also a few small windows open on the sides. These houses have two storys, although one only is visible, the second is underground, or rather its upper part or ceiling is even with the surface of the place in which the posts are driven. It consists of a cellar about five feet in depth, dug in the inside of the habitation, at the distance of six feet from the walls throughout the whole of the circumference. The descent to it is by three or four steps made in the platform of earth which is reserved between the foundations of the walls and the cellar; and these steps of earth, well beaten, are cased with planks, which prevent the soil from falling in. Beams laid across, and covered with thick planks, form the upper floor of this subterraneous story, which preserves from moisture the upper story, whose floor is on a level with the ground. This cellar is the winter habitation."

This description is substantially accurate, and so detailed that it is scarcely likely to be erroneous in regard to the division by a floor of the excavated portion of the interior of the house from that above the level of the ground. I have not seen this arrangement, however, in any of the houses now existing on the islands.

Carved posts.

The peculiar carved pillars which have been generally referred to as carved posts are broadly divided into two classes, known as *kexen* and *χat*. One of the former stands at the front of every house, and through the base, in most instances, the oval hole serving as a door passes. The latter are posts erected in memory of the dead.

Doorway posts.

The *kexen* are generally from 30 to 50 feet in height, with a width of three feet or more at the base, and tapering slightly upwards. They are hollowed behind in the manner of a trough, to make them light enough to be set and maintained in place without much difficulty. These posts are generally covered with grotesque figures, closely grouped together, from base to summit. They include the totem of the owner, and a striking similarity is often apparent between the posts of a single village. I am unable to give the precise signification of the carving of the posts, if indeed it has any such, and the forms are illustrated better by the plates than by any description. Human figures, wearing hats of which the crowns run up in a cylindrical form, and are marked round with constrictions at intervals, almost always occur, and either one such figure, or two or three frequently surmount the end of the post. Comparatively little variation from the general type is allowed in the *kexen*, while in those posts erected in memory of the dead, and all I believe called *χat*, much greater diversity of design obtains.

Monumental posts.

These posts are generally in the villages, standing on the narrow border of land between the houses and the beach, but in no determinate relation to the buildings. A common form consists of a stout, plain, upright post, round in section, and generally tapering slightly downwards, with one side of the top flattened and a broad sign-board-like square of hewn cedar planks affixed to it. This may be painted, decorated with some raised design, or to it may be affixed one of the much prized 'coppers' which has belonged to the deceased. In other cases the upright post is carved more or less elaborately. Another form consists of a round, upright post with a carved eagle at the summit. Still others, carved only at the base, run up into a long round post with incised rings at regular intervals. Two round posts are occasionally planted near together, with a large horizontal painted slab between them, or a massive beam, which appears in some instances to be excavated to hold the body. These memorial posts are generally less in height than the door posts.

Stone models of posts.

The carved stone models of posts made by the Skidegate Haidas from the rock of Slate Chuck Creek are generally good representations of the *kexen.* (Several of these are figured by J. G. Swan in the publication already referred to.) Plates, flutes, and other carvings made from the same stone, though evincing in their manufacture some skill and ingenuity, have been produced merely by the demand for such things as curiosities by whites.

The use of copper, and to some extent the method of manufacturing it into various articles by hammering, has been known from time immemorial to most of the Indians of this part of the west coast. The metal has probably been for the most part obtained in trade from the Indians of the Atna or Copper River in latitude 60° 17′. it is probably this familiarity with copper that has enabled the Haidas, with other tribes of the coast, so soon to acquire a proficiency in the art of working silver and iron in a rough way. Copper.

Traditions and Folk-lore.

Of stories connected with localities, or accounting for various circumstances, there are no doubt very many among the Haidas. Of these, such as I have heard are given. The fundamental narrative of the origin of man, and the beginning of the present state of affairs is the most important of their myths. In all its minor details I believe it to be correct; that is to say, unaltered from its original traditional form. Minor shades of meaning may in some instances be indefinite, as it was obtained through the medium of the Chinook, aided by what little English my informant was master of. This, as related to me, is as follows.—

Very long ago there was a great flood by which all men and animals were destroyed, with the exception of a single raven. This creature was not, however, exactly an ordinary bird, but—as with all animals in the old Indian stories—possessed the attributes of a human being to a great extent. His coat of feathers, for instance, could be put on or taken off at will, like a garment. It is even related in one version of the story that he was born of a woman who had no husband, and that she made bows and arrows for him. When old enough, with these he killed birds, and of their skins she sewed a cape or blanket. The birds were the little snow-bird with black head and neck, the large black and red, and the Mexican woodpeckers. The name of this being was *Ne-kil-stlas.* Creation myth.

When the flood had gone down *Ne-kil-stlas* looked about, but could find neither companions nor a mate, and became very lonely. At last he took a cockle (*Cardium Nuttalli*) from the beach, and marrying it, he constantly continued to brood and think earnestly of his wish for a companion. By and bye in the shell he heard a very faint cry, like Flood.

that of a newly born child, which gradually became louder, and at last a little female child was seen, which growing by degrees larger and larger, was finally married by the raven, and from this union all the Indians were produced and the country peopled.*

Origin of water. The people, however, had many wants, and as yet had neither fire, daylight, fresh water, or the oolachen fish.† These things were all in the possession of a great chief or deity called *Setlin-ki-jash*, who lived where the Nasse River now is. Water was first obtained in the following manner by *Ne-kil-stlas*. The chief had a daughter, and to her *Ne-kil-stlas* covertly made love, and became her accepted lover, and visited her by night many times unknown to her father. The girl began to love *Ne-kil-stlas* very much, and trust in him, which was what he desired; and at length when he thought the time ripe, he said that he was very thirsty and wanted a drink of water. This the girl brought him in one of the closely woven baskets in common use. He drank only a little, however, and setting the basket down beside him he waited till the girl was asleep, when, quickly donning his coat of feathers, and lifting the basket in his beak, he flew out by the opening made for the smoke in the top of the lodge. He was in great haste, fearing to be followed by the people of the chief. A little water fell out here and a little there, causing the numerous rivers which are now found, but on the Haida country a few drops only, like rain fell, and so it is that there are no large streams there to this day.

Origin of fire. *Ne-kil-sltas* next wished to obtain fire, which was also in the possession of the same powerful being, or chief. He did not dare, however, to appear again in the chief's house, nor did the chief's daughter longer show him favour. Assuming, therefore, the form of a single needle-like leaf of the spruce tree, he floated on the water near the house, and when the girl—his former lover—came down to draw water, was lifted by her in the vessel she used. The girl drinking the water, swallowed, without noticing it, the little leaf, and shortly afterwards became pregnant, and before long bore a child who was no other than the cunning *Ne-kil-stlas*, who had thus gained an entry into the lodge. Watching his opportunity, he one day picked up a burning brand, and flying out as before by the smoke-hole at the top of the lodge, carried it away and spread fire everywhere. One of the first places where he set fire, was near the north end of Vancouver's Island, and that is the reason why so many of the trees there have black bark.‡

* In another form of the story, it is said that *Ne-kil-stlas* by impregnating two live cockles, and keeping them warm, hatched out both a man and a woman, who were the progenitors of the human race.

† As sometimes related, it is taken for granted that the sun always was, the moon alone being wanting.

‡ Probably refers to the Douglas fir, which here finds its northern limit on the coast, and is very often blackened by fires from the underbrush running up the thick, dry bark of its trunk.

All this time, however, the people were without daylight, and it was next the object of *Ne-kil-stlas* to obtain this for them. This time he tried still another plan. He pretended that he also had light, and continued to assert it, though the chief denied the truth of his statement. He, however, in some way made an object bearing a resemblance to the moon, which, while all the people were out fishing on the sea, in the perpetual night, he allowed to be partly seen from under his coat of feathers. It cast a faint glimmer across the water, which the people and *Setlin-ki-jash* thought was caused by a veritable moon. Disgusted at finding that he was not the sole possessor of light, and losing all conceit of his property, the great chief immediately placed the sun and moon where we now see them. Origin of light.

One thing more much desired still remained in the possession of *Settin-ki-jash;* this was the oolachen fish. Now the shag was a friend or companion of the chief, and had access to his property, including his store of oolachens. *Ne-kil-stlas* contrived that the sea-gull and the shag should quarrel, by telling each that the other had spoken evil of him. At last he got them together, when, after an angry conversation, they followed his advice and began to fight. *Ne-kil-stlas* knew that the shag had an oolachen in its stomach, and so urged the combatants to fight harder, and to lie on their backs and strike out with their feet. This they did, and finally the shag threw up the oolachen, which *Ne-kil-stlas* immediately seized. Making a canoe from a rotten log, he smeared it and himself with the scales of the oolachen, and then coming at night near the great chief's lodge, said that he was very cold, and wished to come in and warm himself, as he had been making a great fishery of oolachens, which he had left somewhere not far off. *Setlin-ki-jash* said this could not be true as he only possessed the fish, but *Ne-kil-stlas* invited the chief to look at his clothes and at his canoe. Finding both covered with oolachen scales, he became convinced that oolachens besides those which he had must exist, and again in disgust at finding he had not the monopoly, he turned all the oolachens loose, saying, at the same time, that every year they would come in vast numbers and continue to show his liberality and be a monument to him. This they have never failed to do since that time. Origin of the oolachen fish.

This Haida story of the origin of things is substantially the same with that which I have been told by Indians of the Tinneh stock in the northern part of the interior of British Columbia. My surprise on hearing it gradually unfolded as a Haida myth was very great. It would be hazardous to theorize on the cause of this similarity of myths in tribes so distant and so dissimilar in habits, but it is certain that both its versions are derived from a common source not very remote. It may indeed be that the Haidas have adopted this story from the Resemblance to Tinneh myths.

Tshimsians, for whose language, as we have already seen, they profess great admiration. I do not know of the existence of the story among the latter people, but they probably have it in some form, as they are supposed to be an offshoot of the great Tinneh stock of the interior country. As is always the case with these aboriginal stories, a local colouring has been given to the narrative by the Haidas, and the story of the oolachen is an addition to that which I have heard from the Tinneh. It shows the great value set upon this fish that it should receive mention among the primary necessaries of existence, such as light, water, and fire.

Ne-kil-stlas of the Haidas is represented in function and name by *Us-tas* of the Carrier Tinneh. Of *Us-tas* an almost endless series of grotesque and often disgusting adventures are related, and analogous tales are repeated about *Ne-kil-stlas.* One of these relates that he disguised himself as a dead raven, and floating on the surface of the sea was swallowed by a whale, which, by violent gripes being then induced to strand itself, became a prey to the Haidas, invisible *Ne-kil-stlas* meanwhile walking out of the whale's belly at the proper moment.

Origin of tobacco.

The story of the origin of the Indian tobacco referred to on a previous page, is as follows.—Long ago the Indians (first people, or ancient people—*thlin-thloo-hait*) had no tobacco, and one plant only existed, growing somewhere far inland in the interior of the Stickeen country. This plant was caused to grow by the deity, and was like a tree, very large and tall. With a bow and arrows, a man shot at its summit, where the seed was, and at last brought down one or two seeds, which he carried away, carefully preserved, and sowed in the following spring. From the plants thus procured all the tobacco afterwards cultivated sprung.

Tradition at Laskeek.

The killer whale, formerly noted as being the representative of the principle of evil, is dreaded by the Haidas, who say that these animals break canoes and drown the Indians, who then themselves become whales. The chief of the whales is the evil one himself, or his nearest analogue in the Haida mind. It is told that in the times of the grandfathers of men now living, two Haidas belonging to Klue's Village went out in a canoe to kill these whales, apparently as a daring adventure. They had paddled far out to sea when the canoe was surrounded by a great number of these evil creatures, which were about to break it in pieces. One of the men, grasping his knife, said to the other that if he was drowned and became as a whale, he would still hold his knife and stab the others. The second man holding to a fragment of the canoe, floated near an island and swam ashore. The first was drowned, but his companion who had escaped, soon heard strange and very loud noises beneath the island, like great guns being fired. Presently a vast number of fish floated up dead, and with them a large whale of the malevolent kind above described. This had a great wound in its side, from which much blood flowed. The medicine-man of the village said afterwards that he knew—or saw—that the whale so killed was the chief among these creatures, and that the Indian who had killed him had now become chief in his stead.

A remarkable hill, called *Tow*, stands on the shore between Rose Point and Masset. One side is a steep cliff, while the other slopes more gradually. On the upper part of the inlet above Masset, is another hill about the same size and also precipitous on one side, called *Tow-us-tas-in*, or 'Tow's Brother.' The story is that the two hills were formerly together where Tow's brother still stands, but that on one occasion Tow's brother devoured the whole of a lot of dog-fish which was in dispute between them, and that Tow being much angered went away to the open coast, where he now is. Story of the hill *Tow*.

It is also related that the summit of the hill called Tow was formerly inhabited by a very great spider, which, when a man passed, would swing itself down by its rope, catch him up, and devour him. After a time a Haida killed this spider with a spear.

Nai-koon or Rose Point (the Haida name meaning long nose) is a place full of real or imagined terrors to the Haidas. It is a dangerous and treacherous point to round at any time but in very fine weather, and many Indians have been drowned there on different occaions. They say that strange (uncanny) marine creatures inhabit its neighbourhood, and believe that if a man laugh never so little in rounding the spit, the are sure to work him evil. The father of my informant, with other Haidas in a canoe, saw one of these creatures. It was like a man, but very large, with hair hanging down to its shoulders. It raised itself out of the water to its middle, and frightened the Indians very much, but caused them no harm. Two vessels belonging to the Hudson Bay Company have been wrecked on this spit, and one of the Haida medicine-men says that the souls of these haunt the place yet. About thirty years ago a great many Indians going in canoes to profit by a dead whale that had been cast up on the spit, were drowned between Masset and that place. Terrors of Rose Point.

There is also told in connection with Rose Point a story of a gigantic beaver. This animal, it is said, inhabits its vicinity, and when it wishes to come to the surface produces a dense fog, the water at the same time becoming very calm. The fog may, perhaps, clear away enough to allow some one watching in a retired nook to see the great beaver; but should the animal catch sight of any human being it instantly strikes the water with its tail and disappears. To laugh at the beaver, or make light of him in any way, is certain to bring bad luck; and Gigantic beaver.

any one seeing him must, on his return to the lodge, throw little offerings on the fire. The Tshimsians have a similar story of an immense beaver which inhabits the vicinity of Dundas Island.

First contact with Europeans.—Fur Trade.

Early trading voyages.

During Captain Cook's last voyage in the Pacific, it was discovered that a lucrative trade in furs might be opened between the north-western coast of America and China, and though the existence of a part of the Queen Charlotte Islands had been known to the Spaniards since the voyage of Juan Perez, who was despatched by the Viceroy of Mexico in 1774, it is to the traders who followed in the track of Cook that we owe most of the earlier discoveries in the vicinity of Queen Charlotte Islands, and it is they who appear first to have come in contact with the Haidas. Before many years a number of vessels were engaged in the fur trade on this part of the west coast. Vancouver in the Notes and Miscellaneous Observations appended to his journal, states that 1792 this trade gave employment to upwards of twenty sail of vessels, of which he gives a list, with the names of the captains. From this it would appear that five of the vessels were owned in London, one in Bristol, two in Bengal, three in Canton, six in Boston, one in New York, two in Portugal, and one in France. Most of these have left no record of their voyages, but in the published narratives of those of Dixon and Meares, already referred to, some account of the method of trade with the natives, and of their appearance, manners and customs is found.

Toward the beginning and during the earlier half of the present century, the Queen Charlotte Islands continued to be not unfrequently visited by these trading vessels, but the sea otter, the skins of which were the most valuable article of trade possessed by the islanders, having, through continuous hunting, become extremely scarce, vessels other than mere coasters have seldom called at any of the ports for many years, and our knowledge of the geography of the islands and home manners and customs of the natives has not been added to.

Dixon's account of the natives.

It is probable that La Perouse, who coasted a part of the Queen Charlotte Islands in 1786, had some intercourse with the natives, but the earliest notice of them I have been able to find is that given by "W. B.," the annonymous author of the letters in which the account of the voyage of the *Queen Charlotte*, of which Captain Dixon was commander, is given. He writes* under date of July 1st, 1787,—"At noon we saw a deep bay,† which bore north-east by east; the entrance point to the northward, north-east by north; and the eastermost

* Op. cit. p. 198.

† Cloak Bay and entrance to Parry Passage.

land south-east, about seven leagues distant. Our latitude was 54° 22″ N.; and the longitude 133° 50″ W. During the afternoon, we had light variable winds, on which we stood to the northward, for fear we should get to leeward of the bay in sight, and we were determined to make it if possible, as there was was every probability of meeting with inhabitants. During the night we had light variable airs in every direction, together with a heavy swell from the south-west; so that in the morning of the 2nd we found our every effort to reach the bay ineffectual; however, a moderate breeze springing up at north-east, we stood in for the land close by the wind with our starboard tacks on board. At seven o'clock, to our very great joy, we saw several canoes full of Indians who appeared to have been out at sea, making toward us. On their coming up with the vessel, we found them to be a fishing party; but some of them wore excellent beaver* cloaks. * * * * The Indians we fell in with in the morning of the 2nd of July, did not seem inclined to dispose of their cloaks, though we endeavored to tempt them by exhibiting various articles of trade, such as toes, hatchets, adzes, howels, tin kettles, pans, &c., their attention seemed entirely taken up with viewing the vessel, which they apparently did with marks of wonder and surprise. This we looked on as a good omen, and the event showed that *for once* we were not mistaken. After their curiosity, in some measure, subsided, they began to trade, and we presently bought what cloaks and skins they had got, in exchange for toes,† which they seemed to like very much. They made signs for us to go in towards the shore, and gave us to understand that we should find more inhabitants, and plenty of furs. By ten o'clock we were within a mile of the shore, and saw the village where these Indians dwelt right abreast of us; it consisted of about six huts, which appeared to be built in a more regular form than any we had yet seen, and the situation very pleasant, but the shore was rocky, and afforded no place for us to anchor in. A bay now opened to the eastward, on which we hauled by the wind, which blew pretty fresh from the northward and eastward, and steered directly for it. During this time several of the people whom we traded with in the morning had been on shore, probably to show their newly acquired bargains; but on seeing us steer for the bay, they presently pushed after us, joined by several other canoes. As we advanced up the bay, there appeared to be an excellent harbour, well land-locked, about a league ahead; we

Enters Cloak Bay.

Opening of trade.

Adverse wind.

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* Beavers do not occur in the Queen Charlotte Islands, but this term appears to be used here, as elsewhere in the narrative, for sea otter cloaks. See p. 228, in statement on which it is implied that no beaver skins were obtained.

† Appears to be a species of adze or chisel, as on p. 244, in connection with another part of the N. W. coast, a "toe made of jasper the same as those used by the New Zealanders," is mentioned.

had soundings from ten to twenty-five fathoms water, over a rocky bottom, but unluckily, the harbour trended right in the wind, and at one o'clock the tide set so strongly against us, that we found it impossible to make the harbour, as we lost ground every board, on which we hove the maintop-sail to the mast, in order to trade with the Indians.

Great abundance of skins.

"A scene now commenced, which absolutely beggars all description, and with which we were so overjoyed, that we could scarcely believe the evidence of our senses. There were ten canoes about the ship, which contained, as nearly as I could estimate, 120 people; many of these brought most beautiful beaver cloaks, others excellent skins, and, in short, none came empty-handed, and the rapidity with which they sold them, was a circumstance additionally pleasing; they fairly quarrelled with each other about which should sell his cloak first; and some actually threw their furs on board, if nobody was at hand to receive them; but we took particular care to let none go from the vessel unpaid. Toes were almost the only article we bartered with on this occasion, and indeed they were taken so very eagerly, that there was not the least occasion to offer anything else. In less than half an hour we purchased near 300 beaver skins, of an excellent quality; a circumstance which greatly raised our spirits, and the more, as both the plenty of fine furs, and the avidity of the natives in parting with them, were convincing proofs, that no traffic whatever had recently been carried on near this place, and consequently we might expect a continuation of this plentiful commerce. That thou mayest form some idea of the cloaks we purchased here, I shall just observe, that they generally contain three good sea-otter skins, one of which is cut in two pieces, afterwards they are neatly sewed together, so as to form a square, and are loosely tied about the shoulders with small leather strings, fastened on each side.

"At three o'clock, our trade being entirely over, and the wind still against us, we made sail, and stood out of the bay, intending to try again for the harbour in the morning. * * * On the morning of the 3rd, we had a fresh easterly breeze, and squally weather, with rain; but as we approached the land it grew calm; and at ten o'clock, being not more than a mile distant from the shore, the tide set us strongly on a rocky point to the northward of the bay, on which the whaleboat and yawl were hoisted out and sent ahead, to tow the vessel clear of the rocks.

Supply of skins exhausted.

"Several canoes came alongside, but we knew them to be our friends whom we had traded with the day before, and found that they were stripped of everything worth purchasing, which made us less anxious of getting into our proposed harbour, as there was a greater probability of our meeting with fresh supplies of furs to the eastward."

Four years later, Captain Douglas, the colleague of Meares, visited this place on his trading voyage. His people were probably the first whites to land on any part of the Queen Charlotte Islands. In the narrative of his voyage, a few details in regard to the coast and behavior of the natives are given. From Meares' volume (p. 364) the following extracts of interest in this connexion are made. The first paragraph refers to June 19, 1789.— Douglas anchors at Masset.

"The weather was moderate and cloudy, with the wind from the south-west. At sun-set, there being the appearance of an inlet, which bore south-south-west, they stood across a deep bay, where they had irregular soundings, from twenty-six to eleven fathoms water, at the distance of two leagues from the shore; the wind dying away they dropped the stream anchor, the two points which form the bay, bearing from west, one quarter north, to north-east half east, distant from the shore four miles. It was now named McIntyre's Bay,* and lies in the latitude of 53° 58′ North, and longitude 218° 6′ East.

"In the morning of the 20th, the long-boat was dispatched to the head of the bay, to discover if there was any passage up the inlet; and the account received on her return was, that toward the head of the bay a bar run across, on which the long-boat got aground; but that within it there was the appearance of a large sound. Several canoes now came along-side the ship, and having purchased their stock of furs, Captain Douglas got under way to look into an inlet which he had observed the preceding year. At noon it was exceedingly hazy, and no observation was made.

"Early in the afternoon the long-boat was sent, well-manned and armed, to examine the inlet and sound for anchorage. At five o'clock they dropped the bower anchor in twenty-five fathoms water, about four miles from the shore, and two from a small barren rocky island, which happened to prove the residence of a chief, named Blakow-Coneehaw, whom Captain Douglas had seen on the coast in his last voyage. He came immediately on board, and welcomed the arrival of the ship with a song, to which two hundred of his people formed a chorus of the most pleasing melody. When the voices ceased, he paid Captain Douglas the compliment of exchanging names with him, after the manner of the chiefs of the Sandwich Islands. Interview with a chief.

"At seven in the morning (June 21st) they stood up the inlet, and at nine came to, in eighteen fathoms water, where they moored the ship † with the stream anchor. Through this channel,‡ which is formed by Charlotte's Islands, and an island that lies off the west end Goes to Parry Passage.

* Now called Masset.

† In Bruin Bay.

‡ Parry Passage.

of it, the tide was found to run very rapid. The passage takes its course east and west about ten or twelve miles, and forms a communication with the open sea. It was now named Cox's Channel. Very soon after the ship was moored, the long-boat was sent to sound in the mid-channel, but no soundings could be obtained with eighty fathoms of line; but near the rocks, on the starboard shore, they had twenty and thirty fathoms water.

Meditated treachery.

"Having been visited the preceding night by two canoes, which lay on their paddles, and dropped down with the tide, as was supposed, in expectation of finding us all asleep, they were desired to keep off, and finding themselves discovered they made hastily for the shore. As no orders had been given to fire at any boat, however suspicious its appearance might be, these people were suffered to retreat without being interrupted. This night, however, there happened to be several women on board, and they gave Captain Douglas to understand, that if he or his crew should fall asleep, all their heads would be cut off, as a plan had been formed by a considerable number of the natives, as soon as the lights were out, to make an attempt on the ship. The gunner therefore received his instructions, in consequence of this information, and soon after the lights were extinguished, on seeing a canoe coming out from among the rocks, he gave the alarm, and fired a gun over her, which was accompanied by the discharge of several muskets, which drove her back again with the utmost precipitation.

Profuse apologies.

"In the morning the old chief Blakow-Coneehaw, made a long speech from the beach; and the long-boat going on shore for wood, there were upwards of forty men issued from behind a rock, and held up a thimble and some other trifling things, which they had stolen from the ship; but when they found that the party did not intend to molest them, they gave a very ready and active assistance in cutting wood, and bringing the water casks down to the boat. Some time after the chief came on board, arrayed, as may be supposed, in a fashion of extraordinary ceremony, having four skins of the ermine hanging from each ear, and one from his nose; when, after Captain Douglas had explained to him the reason of their firing the preceding night, he first made a long speech to his own people, and then assured him that the attempt which had been made, was by some of the tribe who inhabited the opposite shore; and entreated, if they should repeat their nocturnal visit, that they might be killed as they deserved. He added, that he had left his house, in order to live along-side the ship, for the purpose of its protection, and that he himself had commanded the women to give that information which they had communicated. The old man exercised the most friendly services in his power to Captain Douglas, and possessed a degree of authority over his tribe, very superior to that of any other chief whom they had seen on the coast of America.

"In the afternoon Captain Douglas took the long-boat and ran across the channel, to an island* which lay between the ship and the village of Tartanee, and invited the chief to be of the party; who, having seen him pull up the wild parsley and eat it, he was so attentive as to order a large quantity of it, with some salmon, to be sent on board every morning.

"At six o'clock in the morning of the 23rd, finding the ground to be bad, they ran across the channel to a small harbour,† which is named Beale's Harbour, on the Tartanee side; and at ten dropped anchor in nineteen fathoms water, about half a cable's length from the shore; the land locked all round, and the great wooden images of Tartanee, bore east, one quarter north; the village on the opposite shore bearing south half west. This harbour is in the latitude of 54° 18′ North, and longitude 227° 6′ East. It was high-water there at the change, twenty minutes past midnight; and the tide flows from the westward, sixteen feet perpendicular. The night tides were higher by two feet than those of the day. Anchor in Henslung cove.

"The two following days were employed in purchasing skins, and preparing to depart; but as all the stock of iron was expended, they were under the necessity of cutting up the hatch-bars and chain plates.

"On the morning of the 27th, as soon as the chief returned, who had gone on shore the preceding evening, to get a fresh supply of provisions, Captain Douglas gave orders to unmoor, and a breeze springing up, at half-past nine they got under way, and steered through Cox's Channel, with several canoes in tow. At eleven, having got out of the strength of the tide, which runs very rapid, they hove to, and a brisk trade commenced with the natives, who bartered their skins for coats, jackets, trousers, pots, kettles, frying-pans, wash-hand basons, and whatever articles of similar nature could be procured, either from the officers or from the men; but they refused to take any more of the chain plates, as the iron of which they were made proved so brittle that it broke in their manufacturing of it. The loss of the iron and other articles of trade, which had been taken out of the ship by the Spaniards, was now severely felt, as the natives carried back no small quantity of furs, which Captain Douglas had not the means of purchasing. Brisk trade.

"This tribe is very numerous; and the village of Tartanee stands on a very fine spot of ground, round which was some appearance of cultivation; and in one place in particular it was evident that seed had been lately sown. In all probability Captain Gray, in the sloop Gardens.

* Lucy Island of the chart.

† Henslung, or the cove to the east of it.

Washington, had fallen in with this tribe, and employed his considerate friendship in forming this garden; but this is mere matter of conjecture, as the real fact could not be learned from the natives.* From the same benevolent spirit Captain Douglas himself planted some beans, and gave the natives a quantity for the same useful purpose; and there is little doubt but that excellent and wholesome vegetable, at this time, forms an article of luxury in the village of Tartanee. This people, indeed, were so fond of the cooking practiced on board the *Iphigenia*, that they very frequently refused to traffic with their skins, till they had been taken down to the cabin, and regaled with a previous entertainment."

Indian account of meeting with whites.

Such is the first account of these Indians by the Whites. They themselves also preserve some traditions of the meeting. On asking the Chief Edensaw (*It-in-sa*) if he knew the first white man whom the Haidas had seen, he gave me, after thinking a moment, the name of Douglas, very well pronounced. Edensaw is now chief of the *Yā-tza* village, west of Virago Sound, the *Kung* village at Virago Sound, over which he formerly presided, being nearly abandoned for the new site. Ten years or more ago, his village was on the south side of Parry Passage, but this has now been altogether given up, and the houses are rapidly crumbling away. There is little doubt that the chief with whom Captain Douglas is said to have exchanged names was a predecessor of Edensaw's, bearing, as is customary, the same name. This, with the prefix Blakow is given as Coneehaw by Douglas, and it is due to the fact of the ceremonial exchange of names having taken place, that that of Douglas has been handed down to the present Edensaw, while those of Dixon and his people have been forgotten. It may generally be observed, however, that the Indians are particular in enquiring the names of whites who come among them, and it may be noted in this connection that those near the mouth of the Bella Coola River were able to give Sir Alexander McKenzie the name of Vancouver (pronounced by them Macubah) as having lately been among them, when he arrived at the coast after his celebrated journey by the Peace River.

As we have seen, however, Edensaw was wrong in saying that Douglas was the first white man seen by the Haidas, as Dixon, but two years before had been at the same spot. I did not know at the time I asked Edensaw the question, whether his reply was correct or not; and on my pressing him as to his knowledge, he admitted that he thought white men had appeared before Douglas, but he did not know

* A conjecture probably incorrect, for as we have seen, these people were stripped of skins two years before by Dixon, and yet appear to have accumulated a considerable number at the time of Douglas' visit. The ground may have been prepared for the cultivation of the Indian tobacco, referred to on a former page.

their names. It was near winter, he said, a very long time ago, when a ship under sail appeared in the vicinity of North Island. The Indians were all very much afraid. The Chief shared in the general fear, but feeling that it was necessary for the sake of his dignity to act a bold part, he dressed himself in all the finery worn in dancing, went out to sea in his canoe, and on approaching the ship performed a dance (probably the Ska-ga). It would appear that the idea was at first vaguely entertained that the ship was a great bird of some kind, but on approaching it, the men on board were seen, and likened, from their dark clothing and the general sound and unintelligible character of their talk, to shags,—which sometimes indeed look almost human as they sit upon the rocks. It was observed that one man would speak whereupon all the others would immediately go aloft, till, something more being said, they would as rapidly descend. The Haidas further relate various childish stories of the surprise of those who, in a former generation, first became acquainted with many things with which they are now familiar, and profess to look upon these, their immediate predecessors, with much contempt. They say, for instance, that an axe having been given to one it pleased his fancy on account of its metallic brightness, which he likened to the skin of a silver salmon. He did not know its use, but taking the handle out, hung it round his neck as an ornament. A biscuit being given to another, he supposed it to be made of wood, and being after some time induced to eat it, finds it altogether too dry. Molasses, tasted for the first time by an adventurous Haida, pronounced very bad and his friends warned against it.

Haida accounts of first knowledge of Europeans.

On questioning another Haida of the north part of the island, he also affirmed that the first whites had been seen near the North Island, and added that they arrived at the season when almost all the people were away at various rivers making their salmon fishery. This would be about the month of September, which agrees pretty well with Edensaw's account, and shows that the story above given cannot refer either to Douglas or Dixon, who arrived in June and July. It agrees well with the date at which Bodega and Maurelle must have passed this part of the coast on their way southward in 1775, but it appears improbable that they had any intercourse with the Haidas at this time.

Date of arrival of first whites.

Villages.

It is here proposed to note the various villages now inhabited by the Haidas, or of which traces still remain, beginning with those of the vicinity of North Island. It must be premised, however, that owing to the prevalent custom by which a village is spoken of by the hereditary family name of the chief, while it has besides a proper local name, and very frequently a Tshimsian equivalent for the latter by which it is also in some cases familiarly called by the Haidas themselves, much difficulty is found in correlating the villages now found with those mentioned by others.

Villages of Parry Passage. In Parry Passage there are three village sites, two of which are on the south side, and completely abandoned. The outer or western of these shows the remains of several houses and carved posts, and is called *Kāk-oh.* The second, about half a mile further East, is named *Kioo-sta*, and has been a place of great importance. This, as already mentioned, seems to have been Edensaw's place of residence at the time of Douglas' visit, and has probably been deserted for about ten years. It is nearly in the same state with the first mentioned, the houses, about twelve in number, and carved posts still standing, though completely surrounded by rank grass and young bushes, overgrown with moss, and rapidly falling into decay. It is difficult to imagine on what account this village has been abandoned, unless from sheer lack of inhabitants, as it seems admirably situated for the purposes of the natives. Many of the larger articles of property, including boxes, troughs, and other wooden vessels and stone mortars have not been removed from the houses.

Tartanee of Douglas. On the opposite side of Parry Passage, facing a narrow channel between North Island and Lucy Island is the village which Douglas calls Tartanee. It now consists of but six houses, small and of inferior construction; and a single carved post stands a little apart from the village, but is not very old. We were informed that anciently a very large village stood here, but did not ascertain whether its inhabitants were driven away as a consequence of war with other Haidas, whether they migrated, or whether the village was simply abandoned owing to the great decrease in numbers. The present village is said to have been built after the destruction of the earlier one, a statement borne out by the fact that none of the old carved posts referred to by Douglas, and no substantial houses are now seen. There would doubtless have been propped or patched up, and thus preserved, had the spot been continuously inhabited. Douglas' account is somewhat confused, and has probably been communicatod to Meares some time after the date of the events to which it relates; he mentions, however, no other chief but Blakow-Coneehaw, which would seem to show that the whole vicinity of Parry Passage was embraced in a single chieftancy at the time of his visit.

New village. In the first bay east of Klas-kwun Point, between North Island and the entrance of Virago Sound, the *Ya-tza*, or knife village, is situated. Like many of the Haida villages, its position is much exposed, and it must be difficult to land at it with strong northerly and north-easterly winds. This village site is quite new, having been occupied only a few years. There are at present eight or ten roughly built houses, with few and poorly carved posts. The people who formerly lived at the entrance to Virago Sound are abandoning that place for this, because, as was explained to me by their chief, Edensaw, they can get more trade here, as many Indians come across from the north. The traverse from Cape Kygane or Muzon to Klas-kwun is about forty miles, and there is a rather prominent hill behind the point by which the canoemen doubtless direct their course. At the time of our visit, in August 1878, a great part of the population of the northern portion of the Queen Charlotte Islands was collected here preparatory to the erection of carved posts and giving away of property, for which the arrival of the Kai-ga-ni Haidas was waited, these people being unable to cross owing to the prevalent fog and rough weather.

Kung village.

The village just within the narrow entrance to Virago Sound, from which these people are removing, is called *Kung*, it has been a substantial and well-constructed one, but is now rather decayed, though some of the houses are still inhabited. The houses arranged along the edge of a low bank, facing a fine sandy beach, are eight or ten in number, some of them quite large. The carved posts are not very numerous, though in a few instances elaborate. In J. F. Imray's North Pacific Pilot, a few notes on harbours, &c., in the Queen Charlotte Islands are given, and it is stated, in mentioning Virago Sound that the Indian village "is to be built" inside a point on the western side of the narrowest part of the entrance. This is where the Kung village now stands. The date of the note is not given, but it is probably 1860 when the sketch map of the Sound was made.

Villages of Masset Inlet.

About the entrance to Masset Inlet there are three villages, two on the east side and one on the west. The latter is called *Yān*, and shows about twenty houses new and old, with thirty carved posts. The outer of these, on the east side, at which the Hudson Bay Post is situated, is named *Ut-te-was*, the inner *Kā-yung*. The *Ut-te-was* village is now the most populous, and there are in it about twenty houses, counting both large and small, with some from which the split cedar planks have been carried away, leaving only the massive frames standing. Of carved posts there are over forty in all, and these, with those of the northern part of the islands generally, show a considerable difference as compared with those of Skidegate, and other southern villages.

The styles of the northern posts are somewhat more varied, and the short, stout form, with a sign-board-like square formed of split planks at the top, is comparatively rare. Some of the Masset posts are merely stout poles, with very little carving, and at this place a thick, short post with a conical roof was observed, none like which were elsewhere seen. At the south end of the *Ut-te-was* Village is a little hill, the houses on and beyond which appear to be considered as properly forming a distinct village, though generally included in the former. The remaining Masset village (*Ka-yung*) is smaller than this one, and was not particularly examined. The principal chief of this vicinity is named *Wē-he;* he is an old man, rather stout, and with nearly white hair and beard. I did not learn the precise extent of his authority, or whether, or in what degree, it may embrace the villages beyond that in which he resides.

Origin of the name Masset.

The name Masset is of uncertain origin. Some of the natives when questioned about it, said that it has been given by the whites; while others believe that it has been extended to the whole inlet by the whites, but was the same with that of a small island which lies a little higher up the channel than the villages, and is said to be called *Maast* by the Haidas. It is unfortunate that so many places on this part of the west coast have been frequently renamed, owing to the ignorance of the names given by former explorers, but not widely published by them. The name Massette occurs, evidently denoting the place now so called in Mr. Work's table given on a following page, and constructed between 1836 and 1841. It is also found on the map illustrating Greenhow's Northwest Coast of North America, dated 1840, as Massette, but is attached to a supposed village between the positions of Masset Inlet and Virago Sound. It is suspiciously like Mazaredo, a name given by Caamano in 1793; but this, according to Greenhow's identification, is the same place known to the American traders as Craft's Sound, which is identical with Virago Sound of the modern charts; and this identification appears also to be borne out by Vancouver's chart.

Temporary villages.

A number of small houses, occupied during the summer, or salmon-fishing season, are scattered about the shores of the southern expansion of Masset Inlet. Of these, two are situated on the Ain River near its mouth, and several near the mouth of the Ya-koun. These summer houses are always small and slightly built compared with those of the permanent villages, and no attempt is made to erect any carved posts or symbols such as are appropriate at the main seat of the family.

On the north shore of Graham Island, east of Masset, and about a mile and a half from Tow Hill, is a temporary village also belonging to the Masset Indians, and occupied during the dog-fish and halibut fishery. A few small potato gardens surround the houses, which are of the unpretentious character above described, and about half a dozen in number.

Abandoned village.

Just east of Tow Hill, and on low ground on the east bank of the Hi-ellen River, a few much-decayed carved posts and beams of former houses are still standing, where, according to the Indians, a large village formerly existed. Its disappearance is partly accounted for by the fact that the sea has washed away much of the ground on which it stood. As the subsoil is only sand and gravel, this might easily have occurred during a single heavy storm coming from an unusual direction, or otherwise under exceptional conditions. It is probably that called *Ne-coon*, and credited with five houses in Mr. Works table given further on. *Ne-coon* or *Nai-koon* is, however, the name of the whole north-east point of the island. North of Cape Ball, or Kul-tow-sis, on the east coast of Graham Island, the ruins of still another village yet remain. It is said to have been populous, and is near some excellent halibut banks. It is doubtless that called *A-se-guang* in Mr. Work's list, and said to have nine houses.

Large old house

Tl-ell is the name of a tract of country north of the entrance to Skidegate, between Boulder Point and the mouth of a large stream twelve miles beyond it. About nine miles from Boulder Point, some posts are still standing, of an old house which must have been of great size and built of very heavy timbers. This was erected by the Skidegate chief of one or two generations back, concerning whose great size and powers many stories are current among the Haidas. The region came into the possession of Skidegate as the property of his wife, but was afterwards given by him to the Skedans of that day as a peace-offering for the wounding or killing of one of his (Skedans) women. The tract thus now belongs to Skedans, and is valued as a berry ground.

Skidegate village.

Skit-ei-get, or Skidegate Village as it is ordinarily called, situated in the inlet of the same name, and extended along the shore of a wide bay with sandy beach, is still one of the most populous Haida villages, and has always been a place of great importance. It has suffered more than most places, however, from the habit of its people in resorting to Victoria and other towns to the south. There are many unoccupied and ruinous houses, and fully one-half of those who still claim it as their residence are generally absent. The true name of the town is, I believe, *Hyo-hai-ka*, while *Skit-ei-get* is that of the hereditary chief. It is called *Kil-hai-oo* by the Tshimsians. There are now standing in this village about twenty-five houses, counting some of which the beams only remain, and several which are uninhabited. Of carved posts there are in all about fifty-three, making on an average two for each house, which was found also to be about the proportion in several other places. Nearly one-half of these are monumental posts or *x-at*, it being rare to find more than a single door-post or *ke-xen* for each house. Mr. Work assigns forty-eight houses to this place, which is not improbably correct for the date to which he refers, as there are signs that the village has formerly been much more extensive, and the Skidegate Haidas themselves never cease to dwell on the deplorable decrease of the

Decrease in population.

population and ruin of the town. One intelligent man told me that he could remember a time—which by his age could not have been more than thirty years ago—when there was not room to launch all the canoes of the village in a single row the whole length of the beach, when the people set out on one of their periodical trading expeditions to Port Simpson. The beach is about half a mile long, and there must have been from five to eight persons in each canoe. It is not improbable that this is a somewhat exaggerated statement, but it serves to show the idea of the natives themselves as to the extent of the diminution they have suffered.

Dixon's account.

Dixon cruised northward along the east coast of the Queen Charlotte Islands about as far as Skidegate, in July, 1787, whence he turned southward for Nootka. He did not come to an anchor, but gives the following particulars, probably relating to the people of this place* :—

"Early in the afternoon (July 29th) we saw several canoes coming from shore, and by three o'clock we had no less than eighteen alongside, containing more than 200 people, chiefly men; this was not only the greatest concourse of traders we had seen, but what rendered the circumstance additionally pleasing was the quantity of excellent furs they brought us, our trade now being equal, if not superior to what we had met with in Cloak Bay, both in the number of skins, and the facility with which the natives traded, so that all of us were busily employed, and our articles of traffic exhibited in the greatest variety; toes, hatchets, howels, tin kettles, pewter basons, brass pans, buckles, knives, rings, &c., being preferred by turns, according to the fancy of our numerous visitants. Amongst these traders was the old chief, whom we had seen on the other side of the islands, and who now appearing to be a person of the first consequence, Captain Dixon permitted him to come on board.† * * * On our pointing to the eastward and asking the old man whether we should meet with any furs there, he gave us to understand that it was a different nation from his, and that he did not even understand the language, but was always at war with them; that he had killed great numbers and had many of them in his possession.

"The old fellow seemed to take particular pleasure in relating these circumstances, and took uncommon pains to make us comprehend his meaning; he closed his relation with advising us not to come near that part of the coast, for that the inhabitants would certainly destroy us. I endeavoured to learn how they disposed of the bodies of their

* Possibly to those of Cumshewa Inlet. His latitudes for the southern part of the islands are inexact, as Vancouver remarks.

† This man may have been the Skidegate chief, and was probably only on a visit when seen on the west coast. He had no skins to sell at that time.

enemies who were slain in battle; and though I could not understand the chief clearly enough *positively* to assert, that they are feasted on by the victors; yet there is too much reason to fear, that this horrid custom is practised on this part of the coast; [!] the heads are always preserved as standing trophies of victory.

"Of all the Indians we had seen, this chief had the most savage aspect, and his whole appearance sufficiently marked him as a proper person to lead a tribe of cannibals. His stature was above the common size; his body spare and thin, and though at first sight he appeared lank and emaciated, yet his step was bold and firm, and his limbs apparently strong and muscular; his eyes were large and goggling, and seemed ready to start out of their sockets; his forehead deeply wrinkled, not merely by age, but from a continual frown; all this, joined to a long visage, hollow cheeks, high, elevated cheek bones, and a natural ferocity of temper, formed a countenance not easily beheld without some degree of emotion. However, he proved very useful in conducting our traffic with his people, and the intelligence he gave us, and the methods he took to make himself understood, shewed him to possess a strong natural capacity. Chief of remarkable appearance.

"Besides the large quantity of furs we got from this party, (at least 350 skins) they brought several racoon cloaks, each cloak consisting of seven racoon skins, neatly sewed together; they had also a good quantity of oil in bladders of various sizes, from a pint to near a gallon, which we purchased for rings and buttons. This oil appeared to be of a most excellent kind for the lamp, was perfectly sweet, and chiefly collected from the fat of animals."

On the following day some of the same people, in eight canoes, again came alongside, but had very few and inferior skins, their store being nearly exhausted. An attempt was made to steal some of the skins already purchased, on which several shots were fired after the offending canoe. On the day following, while endeavouring to make southward with baffling winds, the vessel was followed by a canoe containing fourteen people, who said that one of their companions had since died from a wound inflicted. No resentment was, however, shown toward the ship's company on that account, nor any fear exhibited on approaching the ship. The old chief, who seems so much to have impressed the narrator, may very probably have been the same before referred to, and described by the Haidas as of great size and striking appearance. It is unnecessary to say that no evidence of cannibalism properly so called is found among these people, though as a part of the ceremony of certain religious rites flesh was bitten from the naked arm; and in some cases it is said old people have been torn limb from limb and partly eaten, or pretended to be eaten, by several Attempted theft. No cannibalism of the coast tribes. No trace now remains in the Queen Charlotte Islands of the custom of taking heads. It was formerly common on the west coast of Vancouver Island. The oil above mentioned was probably dog-fish oil, and contained in the hollow bulb-shaped heads of the gigantic sea-tangle (*Macrocystis*) of the coast.

New village of Gold Harbour Indians.

On the west end of Maude Island, a few miles only from the Skidegate village, is now situated what may be called the New Gold Harbour Village. This has been in existence a few years only, having been built by the Haidas formerly inhabiting Gold Harbour, or Port Kuper, on ground amicably purchased from the Skidegate Haidas for that purpose. The inlet generally known as Gold Harbour, is situated on the west coast, and can be reached from Skidegate by the narrow channel separating Graham from Moresby Island. The voyage, however, includes a certain length of exposed coast, often difficult to pass in stormy weather, and the Indians, though still preserving their rights over the Gold Harbour region, and living there much of the summer, find it more convenient to have their permanent houses near Skidegate. The population of the place is about equal to that of the Skidegate village, though its appearance is much less imposing, as the houses which have been erected, are comparatively few and of small size, and there are as yet few carved posts. The two villages on the west coast, now almost abandoned by these people, are called *Kai-shun* and *Cha-atl*,—the former situated near the entrance to Gold Harbour, or *Skai-to*, the latter not far from the south-western or narrow entrance to Skidegate Channel. From one or both of these villages five canoes, with thirty-eight or forty people, came off to the *Queen Charlotte*. A few women were in the canoes, from one of whom Dixon purchased the ornamental labret which he figures in the plate opposite page 208 of his volume.

Abandoned villages.

Cumshewa.

The village generally known as Cumshewa, is situated in a small bay facing toward the open sea, but about two miles within the inlet to which the same name has been applied. The outer point of the bay is formed by a little rocky islet, which is connected with the main shore by a beach at low tide. The name Cumshewa or Kumshewa is that of the hereditary chief, the village being properly called *Tlkinool*, or by Tshimsians *Kit-ta-wās*. There are now standing here twelve or fourteen houses, several of them quite ruinous, with over twenty-five carved posts. The population is quite small, this place having suffered much from the causes to which the decrease in numbers of the natives have already been referred.

The decayed ruins of a few houses, representing a former village, which does not appear to have been large, stand just outside Cumshewa Inlet, beyond the north entrance point.

At the entrance to Cumshewa Inlet, on the opposite or south side, is the *Skedans* village, so called, as in former cases, from the chief, but of which I did not learn the proper name.* This is a place of more importance than the Cumshewa village proper, and appears always to have been so. Many of the houses are still inhabited, but most look old and moss-grown, and the carved posts have the same aspect. Of houses there are now about sixteen, of posts forty-four. At the time of our visit, an old woman was having a new post erected in memory of a daughter who had died some years before in Victoria. The mother having amassed considerable property for the purpose, was prepared to make a distribution when the post had been fairly put up. The village borders the shore of a semicircular bay, which forms one side of a narrow, shingly neck of land connecting two remarkable little conical hills with the main. Skedans village

Klue's Village, properly called *Tanoo*, or by the Tshimsians *Laχ-skīk*, is situated fourteen miles southward from the last, on the outer side of the inner of two exposed islands. The channel between the islands is so open as to afford little shelter, while the neighbourhood of the village is very rocky, and must be dangerous of approach in bad weather. There are about thirty carved posts here, of all heights and styles, with sixteen houses. The village, extending round a little rocky point, faces two ways, and cannot easily be wholly seen from any one point of view, which causes it to look less important than the last, though really possessing a larger population than it, and being in a more flourishing state than any elsewhere seen in the islands. There were a considerable number of strangers here at the time of our visit in July, 1878, engaged in the erection of a carved post and house for the chief. The nights are given to dancing, while sleep and gambling divided the portions of the day which were not employed in the business in hand. Cedar planks of great size, hewn out long ago in anticipation, had been towed to the spot, and were now being dragged up the beach by the united efforts of the throng, dressed for the most part in gaily-coloured blankets. They harnessed themselves in clusters to the ropes, as the Egyptians are represented to have done, in their pictures, shouting and ye-hooing in strange tones to encourage themselves in the work. Klue village.

The *Kun-χit* Village is the most southern in the Queen Charlotte Islands. It is generally known as Ninstance or Nin-stints, from the name of the chief, and is situated on the inner side of Anthony Island of the Admiralty sketch of Houston Stewart Channel. The villages marked as occuring in Houston Stewart Channel. on the same sketch, Ninstance village.

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* Mr. J. G. Swan incedentally refers to it as *Koona*, p. 5, *op. cit.*

do not exist; they have been little collections of rude houses for temporary use in summer, and have now disappeared. There are still a good many Indians here, but I have seen the place only from a distance, and know little about it. When off this place on July 23rd, Dixon was visited by eight canoes containing "near one hundred people," probably for the most part men, as it is mentioned, on the next day, that about 180 people, men, women, and children, came out to the ship.

Villages on west coast.

Besides the last mentioned, and the two villages near Gold Harbour, there were formerly two or three other places where Haidas were resident on the west coast of the islands. One of these was at Tasoo Harbour, which is reported to be a large sheet of water. I could not learn whether the village here was a permanent one, but think it must have been so. It is not improbably that designated *Too* in Mr. Work's list, and is marked on an old sketch of the islands as standing on the north-west side of the harbour. A village was situated on the island called Hippa by Dixon, of which the Haida name was, I believe, *Mus-too.* Dixon gives a sketch of the island and village in the volume already referred to. Under date July 7th, 1787, he writes of this place.—

Hippah Island.

"About two o'clock in the afternoon, being close in shore, we saw several canoes putting off, on which we shortened sail, and lay too for them, as the wind blew pretty fresh. The place these people came from had a very singular appearance, and on examining it narrowly, we plainly perceived that they lived in a very large hut, built on a small island, and well fortified after the manner of an hippah, on which account we distinguished this place by the name of *Hippah Island.*

"The tribe who inhabit this hippah seem well defended by nature from any sudden assault of their enemies; for the ascent to it from the beach is steep, and difficult of access; and the other sides are well barricadoed with pines and brush wood; notwithstanding which, they have been at infinite pains in raising additional fences of rails and boards; so that I should think they cannot fail to repel any tribe that should dare to attack their fortification.

"A number of circumstances had occurred, since our first trade in Cloak Bay, which convinced us, that the natives at this place were of a more savage disposition, and had less intercourse with each other, than any Indians we had met with on the coast, and we began to suspect that they were cannibals in some degree. Captain Dixon no sooner saw the fortified hut just mentioned, than this suspicion was strengthened, as it was, he said, built exactly on the plan of the hippah of the savages at New Zealand. We purchased a number of excellent cloaks, and some good skins from the Indians, for which we gave a variety of articles, some choosing toes, and others pewter basons, tin kettles, knives, &c. This tribe appeared the least we had yet seen; I could not reckon more than thirty-four or thirty-six people in the whole party; but then it should be considered that these were probably chosen men, who perhaps expected to meet with their enemies, as they were equally prepared for war or trade."

Village on Frederick Island.

It is possible that the 'fortified hut' seen by Dixon was a pallisaded enclosure intended for times of danger only, and not the village usually inhabited. Such a retreat formerly existed on the little island opposite Skidegate Village, though no trace of it now remains.

The last village of which I have any knowledge, stood formerly on or very near Frederick Island of the maps. Its name, or that of the island, was *Susk* or *Sīsk*. It is reputed to have been populous, but may never have been very important. Haidas belonging to this tribe came off to the *Queen Charlotte* on the 5th and 6th of July, "bringing a number of good cloaks, which they disposed of very eagerly." It is remarked further that:—"These people were evidently a different tribe from that we met with in Cloak Bay, and not so numerous; I could not reckon up more than seventy-five or eighty persons alongside at one time. The furs in each canoe seemed to be a distinct property, and the people were particularly careful to prevent their neighbours from seeing what articles they bartered for."

Population of the Queen Charlotte Islands.

As the population of the Queen Charlotte Islands has decreased, the smaller and less advantageously situated towns have been abandoned by the survivors, who have taken up their abode among the larger tribes to which they have happened to be related by marriage or otherwise. When the Indians are questioned as to why these places have been given up, they invariably say that all the people are dead, which may not be absolutely correct. Not any of the inhabited villages, however, now contain a tithe of the people for whom houses are yet standing.

Estimate in Dixon's narrative.

It is very difficult in all cases to form estimates of the number of the aboriginal tribes when first discovered, and it is a common error, from the too literal acceptance of the half fabulous stories of the survivors, to greatly over-estimate the former population. The writer of the narrative of Captain Dixon's voyage has certainly not fallen into this mistake. He writes (p. 224):—"The number of people we saw during the whole of our traffic, was about eight hundred and fifty; and if we suppose an equal number to be left on shore, it will amount to one thousand seven hundred inhabitants, which, I have reason to think, will be found the extreme number of people inhabiting these islands, including women and children." It is to be remembered that Dixon not only did not anchor in any of the ports, but that most of the time he kept so far from the shore as to render it improbable that more than a small proportion of the able-bodied men of each tribe should visit the ship.

The number of sea-otter skins obtained by Dixon during the cruise about the Queen Charlotte Islands was 1821, "many of them very fine; other furs we found in less variety here than in many other parts of the coast, the few racoons before mentioned, a few pine-martin, and some seals, being the only kinds we saw."

Table of population by Mr. John Work.

I have been so fortunate as to obtain from Dr. W. F. Tolmie the subjoined estimates of the numbers of the Haida tribes. These were made between the years 1836 and 1841 by the late Mr. John Work, and, though not framed from personal acquaintance with the Haida country, are supposed to be based on the most reliable sources, with which Mr. Work's long residence on the northern part of the coast of British Columbia had made him familiar. It is likely that even at this date the population of the islands had somewhat decreased, but in all probability not very materially. On examining the table it will be found that the villages are grouped under the common names in some instances, and that it is at times difficult to recognise what place is referred to. I have, however, endeavoured to test the table in regard to those places with which I am familiar, by comparing the relative importance of the different localities at present with that assigned to them here, and otherwise, and am persuaded that the figures are substantially correct, and probably rather an under than an over-estimate if taken to represent the population when first brought into contact with the whites.

Totals.

The total number of Haidas living in the Queen Charlotte Islands, as given by Mr. Work, is 6593. The whole number of the Haida nation, including the Kai-ga-ni Haidas, 8328. The number of people assigned to each house in the Queen Charlotte Islands, according to Mr. Work's table, is found to be about thirteen, which, taking into consideration the size of the houses and manner of living, is very moderate.

Estimate of the Number of Haida and Kai-ga-ni Indians, made between the years 1836 *and* 1841, *by John Work, Esq.*

	Name.	Men.	Women.	Boys.	Girls.	Houses.
Kai-ga-ni.	You-ah-noe	68	70	44	52	18
	Click-ass	98	105	102	112	26
	Qui-a-hanless	30	35	42	41	8
	How-a-guan	117	121	113	107	27
	Shaw-a-gan	53	61	54	61	14
	Chat-chee-nie	65	62	59	63	18
	Totals	431	454	414	436	111
Haida.	Lu-lan-na	80	76	69	71	20
	Nigh-tasis	70	69	72	69	15
	Massette	630	650	589	604	160
	Ne-coon	24	27	29	42	5
	A-se-guang	34	31	27	28	9
	Skid-de-gates	191	182	176	189	48
	Cum-sha-was	80	74	63	69	20
	Skee-dans	115	121	98	105	30
	Quee-ah	87	79	68	74	20
	Cloo	169	164	105	107	40
	Kish-a-win	80	74	85	90	18
	Kow-welth	131	146	145	139	35
	Too	45	49	50	52	10
	Totals	1736	1742	1476	1639	430

Present population of the islands.

The present population of the northern end of the Queen Charlotte Islands is roughly estimated by Mr. Collison, the missionary there, to number about 800. In Skidegate Inlet about 500 Haidas now remain, and are probably nearly equally divided between the two villages above described. Without referring in detail to the other villages, for which no sufficiently precise information was obtained, it is probable that the total population of the islands at the present time is from 1700 to 2000. In this estimate it is intended to include all the Haidas belonging to the islands, even those who live most of the time away from their native villages. From Skidegate Inlet and places south of it, a large proportion of the natives are always absent, generally in Victoria. From the north end of the islands comparatively few go to Victoria, while a good many resort to Fort Wrangel and other northern settlements.

Number of the Kai-ga-ni.

The number of the people of the same stock in the southern part of Alaska, who may be classed together as Kai-ga-ni, is estimated by Mr. W. H. Dall at 300.*

Ultimate destiny of the Haidas.

Notwithstanding the alarmingly rapid decrease of the Haida people during the century, it is not probable that the nation is fated to utter extinction. Like other tribes brought suddenly in contact with the whites, they will reach, if they have not already arrived at, a certain critical point, having passed which they will continue to maintain their own, or even to grow in numbers. As already indicated, the Haidas show a special aptitude in construction, carving, and other forms of handiwork; and it should be the endeavour of those interested in their welfare to promote their education in the simpler mechanical arts, by the practice of which they may be able to earn an honest livelihood. When the fisheries of the coast are properly developed, they will also be found of great service as fishermen; and were there a ready sale for cured fish, they might be taught so to improve their native methods as to ensure a marketable product. Saw-mills must soon spring up in the Queen Charlotte Islands to utilize their magnificent timber, and it is probable that in the course of years broad acres of fertile farms will extend where now unbroken forest stands. In such industries as these the natives may also doubtless be enlisted, but before they can be prosecuted justly the Indian title must be disposed of. This, in the case of these people, will be a matter of considerable difficulty, for as we have already seen, they hold their lands not in any loose general way, but have the whole of the islands divided and apportioned off as the property of certain families, with

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* United States Geological and Geographical Survey of the Rocky Mountain Region; Contributions to North American Ethnology. Vol. I., p. 40.

customs fully developed as to the inheritance and transfer of lands. The authority of the chiefs is now so small that it is more than doubtful whether the people generally would acquiesce in any bargain between the chiefs in an official capacity and the whites, while the process of extinguishing by purchase the rights of each family would be a very tedious and expensive one. The negotiations will need to be conducted with skill and care. At present, anyone requiring a spot of ground for any purpose, must make what bargain he can with the person to whom it belongs, and will probably have to pay dearly for it.

APPENDIX B.

VOCABULARY OF THE HAIDA INDIANS

OF THE

QUEEN CHARLOTTE ISLANDS.

The following vocabulary, though by no means complete, may serve to represent the Haida language for purposes of linguistic comparison. Most of the words were obtained by myself from intelligent natives, often through the medium of the Chinook jargon, aided by drawings or explanations, and in some cases by a slight knowledge of English in my informant. While generally correct, it may therefore in some cases be in error, and in occasional instances phrases or short sentences seem pretty obviously to have been given in place of single words. It is also to be observed that the Masset and Skidegate dialects are not so diverse as they might appear to be on a slight examination of the lists, for while in most cases the same word has been obtained in each locality, but with some degree of modification, not infrequently a different word with the same or similar meaning has been substituted, though that set down in the other dialect may also be well understood. It may further be remarked that the syllable *tl* or *hl* prefixed to many words, probably in most cases represents the article, but where I have not been sure of this I have hesitated to remove it. The words, before being written down, were invariably repeated by myself till I succeeded in pronouncing them to the satisfaction of my instructor.

The indefinite character of the pronunciation of an unwritten language is so marked, in most of those with which I have had to do, that in the absence of personal familiarity with the language, the use of a complete and highly elaborated system of orthography is in practice almost impossible. I have therefore employed, with little alteration, that suggested in No. 160 of the Smithsonian Miscellaneous Collections, entitled *Instructions for Research relative to the Ethnology* *and Philology of America.* The value of the principal characters used, according to the scheme adopted, is as follows:—

a as long in *father*, short in German *hat* (nearly as in English *what*).
e as long in *they*, short in *met*.
i as long in *marine*, short in *pin*.
o as long in *note*, short in *home* or French *mot*.
oo as long in *fool*, *pool*.
u as in *but*.
ai as in *aisle*.
oi as in *oil*.
ow as in *how*.
eu as in *plume*.
y as in *you*.

χ represents the guttural sound sometimes indicated by *ch* or *gh*.

The long value of vowels is distinguished by the *macron*, thus *ā*, *ē*; the short value by the *breve*, thus *ă*, *ĕ*.

The words are arranged nearly in the order of those in the *Introduction to the Study of Indian Languages* by J. W. Powell. I am indebted to Mr. Powell for copies of this publication, which have been of essential service.

G. M. D.

English.	Skidegate Dialect.	Masset Dialect.
Man	*i-hling-a.*	
Woman	*χa-da*	
Old man	*kei-a*	*kā-ă.*
Old woman	*kei-a*	*nun-kēa-tza-da.*
Young man	*ka-ha*	*ā-i-tling-a.*
Young woman	*he-tot-i-na-ha*	*ā-tzed-a.*
Boy		*hā-tlel-a.*
Girl		*χa-da-hīt-zoo.*
Infant	*koo-del*	*na-ā-tzoo-tzoo.*
Widower	*tl-hung-ut-a*	*a-wāh-tl-tza-koo-tl.*
Widow	"	*tl-klāl-koo-tlh.*
Bachelor (old)	*skung-un-ta*	*kum-il-χā-dn-ang.*
Maid (old)	"	*kum-lā-in-a-ing.*
Head	*kād-ze*	*kātz.*
Hair	*ka-skai-tl*	*katl-kāi-tl.*
Crown of the head	*tl-had-ze*	*kling-ootz.*
Scalp	*kas-il.*	*kātz-kul.*
Face	*hoang-a*	*hang-ē.*
Forehead	*kwul.*	*kwul.*
Eye	*hung-ē*	*hung-ē.*
Pupil of the eye	*hung-ihl-tan-gai*	*hung-kōn.*
Eyelash	*hung-ihl-ta-gut-se*	*hung-il-tā-kwutz.*

English.	Skidegate Dialect.	Masset Dialect.
Eyebrow	*skēts-how*	*skiātz.*
Upper eyelid	*hung-a-kāl*	*hung-kūl.*
Lower eyelid	*hung-kwa-ul*	*hung-kwa-ūl.*
Ear-lobe	*gēu-tun-gai*	*gēu-stāi.*
Ear	*gēu*	*gēu.*
Perforation in ear	*gēu-hēl*	*gēu-stai-ktl.*
External opening of ear	*gēu-katlē*	*gēu-hēl.*
Nose	*kwun*	*kwun.*
Ridge of nose	*kwun-ō-na*	*kwun-il-kōn.*
Nostril	*kwun-katlē*	*kwun-zool.*
Septum of nose	*kwun-tun-gai*	*kwun-īhl-tātz.*
Perforation of septum of nose	*kwun-hēl*	*kwun-kī-tl-ā.*
Cheek	*kun-tse-da*	*tl-tzut.*
Beard	*skow-rē.*	*kāi-ow-ā.*
Mouth	*het-lē*	*hat-lē.*
Upper lip	*kut-sī-run*	*kwoo-se-oon.*
Lower lip	"	*kwoot-had-goo-sē.*
Tooth	*tsing-a*	*tsing.*
Tongue	*tang-il*	*tāng-il.*
Saliva	*klān-a*	*klān* or *tltā.*
Palate	*shīng-i-je*	*sīng-itz.*
Throat	*ka-gin-zoo*	*ka-gin-zoo.*
Chin	*tl-kai*	*tl-kai.*
Neck	*hīl*	*hīl.*
Adam's apple		*tsis-tāng-a.*
Body	*ka-tlē*	*hloo.*
Shoulder	*skul*	*skul.*
Shoulder-blade	*skul-ka-ul-ting-e*	*skul-ā-ul.*
Breast of a man	*klin-ē-wē*	*tlin-oo-a.*
Breast of a woman	"	*tlin-loo-ē.*
Nipples	*klun-e-wē-kun-a*	*klin-oo-e-hoot-zoo.*
Hip		*anl-kwan.*
Waist	*kool-tung-ē*	
Belly	*ki-χi*	*kītz.*
Navel	*skil*	
Right arm	*hie*	*sol-goost.*
Left arm	"	*slan-goost.*
Arm-pits	*skwt-a-ka-tli*	*skwut-kā-tle.*
Arm above elbow	*hie-kwul*	*hie-kwul.*
Elbow	*hie-tsi-kwe*	*hī-kwus-ē.*
Arm below elbow	*hea-kow*	*hea-kow.*
Wrist	*slaī-kwul-ting-e*	*slē-kwōl-tung-ē.*
Hand	*slai*	*stlai.*
Palm of hand	*stl-ka-gun*	*stlai-kān.*
Back of hand	*stl-oona*	*stlai-skwai.*
Fingers	*slai*	*stlē-kung-ē.*
Thumb	*stl-kwō-da*	*stlē-kwai.*
Point of finger	*stl-koon-a*	

English.	Skidegate Dialect.	Masset Dialect.
Second finger		*stlai-ok-sē.*
Little finger	*stl-kwo-da*	*stla-ōt.*
Finger-nail	*stl-kwun*	*stla-kwun.*
Knuckle	*stl-tam-i-rē*	*stl-tum-ai.*
Space between knuckles	*stl-ke-ta-sē*	
Rump	*stl-hul*	*stlool.*
Leg	*kial*	*kwul-o.*
Leg above knee	*til*	*tēl.*
Knee	*kwul-lo*	*kwul-o-kutz.*
Knee-pan	*kwul-oo-ka-run-gē*	*kwul-o-hāl.*
Leg below knee	*kiatl-ka-run*	
Calf of leg	*kiatl-kow*	*kiatl-kow.*
Ankle	*sta-kwul-ting-ē*	*stai-kwool-ting-ai.*
Ankle-bone	*tam-a-rē*	*tum-ai.*
Instep	*sta-oona*	*sta-oon.*
Foot	*stai*	*kl-stai.*
Sole of foot	*stuk-a-run*	*stai-kān.*
Heel	*sta-kwai*	*sta-kwo-sē.*
Toe	*sta-kung-e*	*stuk-ung-e.*
Large toe	*sta-kwun-e*	*sta-kwai.*
Fourth toe	*sta-kwo-ta*	*sta-ōt.*
Toe-nail	*sta-kwun*	
Blood	*kai*	*āi.*
Vein or artery	*kai-ins-ki-a*	*ai-ins-ki-ā.*
Brain	*ka-sin-tsin-a*	*ka-sin-tzung.*
Heart	*kou-ga*	*kook.*
Kidney		*tl-xai.*
Lung	*hl-koo-hoo-whē*	*tl-koo-whē.*
Liver	*tl-kwul*	
Stomach	*ke-tzi.*	*kitz.*
Rib	*he-wē*	*hĕ-wĕ.*
Pulse		*stlai-hai-hīl-tung.*
Vertebræ		*tsoo-i.*
Spine	*tsoo-i*	*kē-tzāt.*
Foot-print	*stā-sil.*	*sai-sil-e.*
Intestine	*lan-ē.*	*slan.*

The following words expressing relationships, were obtained for me by the Rev. Mr. Collison, of Masset, and were written down by him in conformity with the usual English mode of pronouncing the vowels. I have thought it best not to attempt to bring it into uniformity with the rest of the vocabulary by transliteration.—

English.	Masset Dialect.
Wife said by husband	*cha* or *sha.*
Husband said by wife	*tla-hal.*

English.	Masset Dialect.
Son said by father	*keet.*
Father said by son	*haung.*
Son said by mother	*kin.*
Mother said by son	*oway.*
Daughter said by father	*keet.*
Father said by daughter	*hah-ta.*
Daughter said by mother	*keet.*
Mother said by daughter	*oway.*
Younger sister said by elder brother	*chas-toon.*
Elder brother said by younger sister	*da-i.*
Younger brother said by elder brother	*toon.*
Elder brother said by younger brother	*quia.*
Younger brother said by elder sister	*toon.*
Elder sister said by younger brother	*chas-i.*
Younger sister said by elder sister	*toon-ay.*
Elder sister said by younger sister	*qui-ay.*
Elder son's wife said by father	*keet-cha.*
Husband's father said by wife	*tlah-al-haung.*
Elder son's wife said by mother	*keet-quia-cha.*
Husband's mother said by wife	*tlah-al-ow.*
Elder daughter's husband said by father	*keet-quia-tlahal.*
Wife's father said by husband	*cha-haht.*
Elder daughter's husband said by mother	*keet-quia-tlahal.*
Wife's mother said by husband	*cha-ow.*
Younger son's wife said by father	*keet-toon-cha.*
Husband's father said by wife	*tlahal-haung.*
Younger son's wife said by mother	*keet-toon-cha.*
Husband's mother said by wife	*ow-tlah-al.* [*hal.*
Younger daughter's husband said by father	*n-chada-keet-toon-tla-*
Wife's father said by husband	*cha-haung.* [*hal.*
Younger daughter's husband said by mother	*n-chada-keet-toon-tla-*

English.	Skidegate Dialect.	Masset Dialect.
Orphan	*tl-kin-git-ā.*	
Father whose children have all died	*ge-tul-ing-hai-loo-a.*	
Still-born child	*kō-da-ka-tlug-a.*	
God	*sun-ī-a-tlai-dus.*	
Soul	*ka-tlun-dai.*	
Devil	*hai-de-tān-a.*	
Medicine-man	*skā-ga.*	
Dead body	*tl-kō-da.*	
Tomb-house	*sa-tling-un-nai.*	
Box for the dead	*sa-tling-un.*	
Hat (any covering for head)	*ta-tsung.*	
Head-dress of feathers	*hl-tun-wā.*	

English.	Skidegate Dialect.
Mask	*nī-xung-wa.*
Medicine-man's necklace of bone	*hl-ki-stā-ge.*
Loin-cloth, or breech-cloth	*hl-kit-ki-kl-gē.*
Moccasin	*stal-kun-gi.*
Blanket	*giāt.*
Paint, black	*hai-da-mas-a.*
" red	*mesh.*
" yellow	*kun-tlulh.*
Tattoo marks	*ki-dā.*
Tattoo marks on arms	*hia-ki-da.*
Buckskin	*whoon.*
Beaver skin	*tsoon-kul.*
Otter skin	*nai-ke.*
Awl, of bone	*kit-ul-kow* or *kwo-stlin*
Sinew	*hai.*
Thread, of sinew	*hai-thul-ga.*
Thread, of skin	*kai-tlul.*
Pole lodge	*nas-koo-sil.*
Slab lodge	*na.*
Doorway of lodge	*kiu.*
Smoke-hole	*ki-nit.*
Mat	*il-gush.*
Bed	*tai-dun.*
Fire	*tsa-no.*
Blaze	*ko-ha-gung.*
Living coals	*tas.*
Dead "	*stun.*
Ashes	*hl-tul-hait.*
Smoke	*kai-ow.*
Soot	*hul-kat.*
Fire-place	*tsan-oo-dan.*
Fire-wood	*tsan-oo.*
Poker	*kin-i-hl-tow.*
Half-burnt brands	*kōt-hul.*
Bow of wood	*tl-kēt.*
Bow-string	*slan.*
Arrow	*kung-al.*
Notch in end of arrow (for bow-string)	*slo-sta-rai.*
Arrow-head of bone	*skoods-i-ta-lung.*
Glue	*xa-tl.*
Quiver	*how-it-kwo-de.*
War-club	*shid-ze.*
War-spear	*xatl.*
Fish-spear	*ki-to.*
Armour of sea-lion's skin	*xit-as-ko.*
Helmet of same material	*skutl-tad-zung.*

English.	Skidegate Dialect.
Canoe	*kloo.*
Drum	*kow-χa.*
Fish-line	*gin.*
Line, of kelp	*tl-gai.*
Fish-net	*ka-tlioo.*
Fish-hook	*ta-whul.*
Pipe, of stone	*skads-oot-la.*
Pipe-stem, of wood	*kwai-skads-ow.*
Cup	*skadl-ho.*
Large wooden dish	*kai-tla.*
Bowl	*ka-nil-o.*
Stone mortar	*ta-ro.*
Stone pestle	*ta-ro-tsung.*
Fire-drill	*hl-kai-ge.*
Horn ladle	*skood-sla-gul.*
Axe	*kitl-χow.*
Adze	*ho-ta.*
Knife	*skow.*
Knife-handle	*skow-gi-guē.*
Knife-point	*skow-kai.*
Knife-edge	*skow-ko-na.*
Knife-back	*skow-skwe.*
Scraper	*katl-ka-tla.*
Borer	*ka-tul-o.*
Woman's fish-knife	*ta-ka-do.*
Flour	*hul-kwa-his-ta.*
Meat	*ki-ra.*
Native tobacco	*hai-da-kwul-ra.*
Stew	*ki-a-huls-a-goo-da.*
Doll	*gīt.*
Wooden rattle	*shi-sha.*
Song	*ska-lung.*
Beaver	*tsung.*
Bear, (grizzly)	*hoots.*
" (black)	*tan.*
Caribou	*χis-koo.*
Dog	*ha.*
Deer	*kat.*
Ermine	*klik-a.*
Goat (mountain)	*mut.*
Mouse (wood)	*si-ang.*
Mole	*ka-gun.*
Marten	*koo-hoo.*
Otter	*sli-goo.*
Sea-otter	*koh.*
Porcupine	*owh-te.*
Squirrel (red)	*tas-ga.*
Wolf	*koo-dze.*

English.	Skidegate Dialect.
Weasel	*klig-a-ski-da.* [*hās.*
Frog	*tl-kun-ko-stal,* or *wuh-*
Whale (whale-bone)	*kwoon.*
Whale (killer)	*ska-goot.*
Porpoise	*skwul.*
Seal	*hoot.*
Fur-seal	*kwoun.*
Antlers	*kwa-i-hil-kian.*
Bone (of animal)	*skood-ze.*
Claw "	*stl-kwun.*
Dung "	*na-re.*
Entrails "	*stlan-e.*
Fat "	*kai-joo.*
Gullet "	*ka-gin-zoo.*
Hoof "	*sta-koon.*
Hair "	*tl-kow.*
Heart "	*koo-ga.*
Joint "	*koo-lo.*
Lungs "	*tl-koo-hoo-whe.*
Bluejay	*klai-tlai.*
Crow	*kaltz-da.*
Raven	*ho-ya.*
Crane	*hl-ko.*
Duck (mallard)	*ha-ha.*
Eagle (white-headed)	*koot.*
Grouse (blue)	*skow.*
Goose (Canada)	*hl-ki-toon.*
Gull	*skin.*
Humming-bird	*ka-tsi-ta-tsoo-a.*
Loon	*tā-tl.*
Owl	*kut-kwun-ēs.*
Pelican	*skai.*
Pigeon (sea)	*ska-tung-a.*
Swan	*tl-whoon.*
Shag	*kel-o.*
Teal (green-winged)	*chi-goots-rid.*
Woodpecker	*sloots-a-da.*
Beak or bill	*koo-da.*
Mouth (of bird)	*het-lē.*
Tongue (of bird)	*tang-il.*
Wings	*hiai.*
Claws	*ta-koon.*
Egg	*kow.*
Shell of egg	*hl-tul-ga-re.*
Yolk of egg	*χis-kai-de-gai.*
White of egg	*χik-a-de-gai.*
Dog-fish	*ka-hud-a.*
Halibut	*hah-ko.*

English.	Skidegate Dialect.
Salmon, (hook-bill)	*tai-e.*
" (small red)	*tā-hīt.*
" (dog-tooth)	*ska-gi.*
" (largest)	*ta-run.*
Trout	*ta-tlut.*
Shark	*ka-hut-ta-ow-ga.*
Herring	*ī-nung.*
Flounder	*tāl.*
Oolachen	*sa-ow.*
Pollock	*skill.*
Mackerel	*skill-te-ga.*
Cod	*stai-dai.*
Large-headed cod	*ska-gai.*
Sculpin	*kai-yē* and *kla-ma.*
Cardium	*skial.*
Clams (small species)	*ka-ga.*
Clams (large species)	*skow.*
Mussel	*kul.*
" (large)	*ta-haow.*
Rock cod (red)	*skun.*
" (black)	*kits-ha-lang.*
Crab (common)	*ko-stan.*
" (large rough)	*hoo-ga.*
Octopus	*noo.*
Sea-urchin (large)	*kī-un-ga.*
" (small)	*kai-oots-ai-ool-ta.*
Star-fish	*ska-um.*
Skate	*xī-tra.*
Mouth (of fish)	*xin-e-he-tli.*
Eye (of fish)	*kin-e-hung-e.*
Gills	*xī-in.*
Breast fin	*xin-i-hia.*
Belly fin	*hun-i-luri.*
Back fin	*tl-koon-a.*
Tail fin	*stai.*
Scales	*hull.*
Herring eggs	*kow.*
Salmon "	*xī.*
Halibut "	*hah-ko-kled-a.*
Ant	*koot-īs-ka-how.*
Bee	*skāl.*
Flee	*skai.*
Fly	*kwul-hai-gwun.*
Mosquito	*tshī-kul-di-gwa.*
Spider	*kwot-zē-a.*
Bud of tree	*skans-a-skin-an.*
Leaf	*hīl.*
Branch	*klas.*

English.	Skidegate Dialect.
Outside bark	*hits-gun-tīl.*
Inner "	*kī-na.*
Trunk	*tsoo-e.*
Stump	*kwul-re.*
Root	*hlīng-a.*
Main roots.	*skoos-run-da.*
Leaves of spruce	*hl-kung-wa.*
Clouds	*kai-ow.*
Sky	*yēn.*
Horizon	*kwaist-sin-wash.*
Sun	*tzoo-rē.*
Moon	*kung.*
Half moon	*kung-in-wē.*
Crescent moon	*kung-hi-hatl-a.*
Stars	*kai-tza.*
Shooting star	*kai-tzoon-a-re.*
Aurora	*yun-ko-ka.*
Rainbow	*kwot-sa-kwo-kun.*
Fog	*yēn-in-tung-wa-ta.*
Frost	*kul-oong-tal.*
Snow	*ta-ow.*
Hail	*ka-tsa-lung.*
Ice	*kul-i-ga.*
Icicle	*ta-di-stil-goon.*
Water	*kun-tl.*
Image reflected by water	*klig-a-hons-ē.*
Foam	*skwul-rō.*
Wave	*loo.*
Current	*tzoo-a* and *kwoh-ying.*
Eddy	*tzoo-kwē-tlul.*
Rain	*tūll.*
Thunder	*hī-ling-a.*
Lightning	*skut-ka-ul-ta.*
Wind	*ta-jow.*
North wind	*hiow.*
North-east wind	*kwo-still.*
East wind	*ka-di-sta-ka-doo.*
South-east wind	*hīw.*
West wind	*kā-hoost-a-ga.*
North-west wind	*klī-gist-koonst.*
Whirlwind	*ta-dzo-kai-re.*
The ground	*tl-ga.*
Dust	*kin-whoo-lung.*
Mud	*χan.*
Sand	*tās.*
Salt	*tang-a.*
Stone	*hl-kā.*
North	*kla-hoos-ti-ga.*

English.	Skidegate Dialect.	Masset Dialect.
East	*sun-dlung-hil-ga.*	
South	*xioo*	
West	*je-we-kai-geun.*	
Black		*hlā-hl.*
Blue		*kin-hlilh.*
Brown		*sus-īn-dil.*
Grey		*hlal-kīn-dil.*
Green		*ohlh.*
Red		*si-ēt.*
Vermilion		*mus.*
White		*ut-ta.*
Striped		*ses-a-ki-dung.*
Check		*tsā-um-a.*
Spots		*hlal-kā-dis.*
One		*swān-sung.*
Two		*stoong-a.*
Three		*tl-kwun-ihl.*
Four		*stan-sung.*
Five		*klē-lhā.*
Six		*kloo-un-ihl.*
Seven		*sik-wā.*
Eight		*sta-ēn-sung-a.*
Nine		*klā-al-swan-sin-goo.*
Ten		*klāl.*
Eleven		*klāl-wok-swān-sung.*
Twelve		*klāl-wok-stoong.*
Thirteen		*klāl-wok-tl-kwun-ihl.*
Nineteen		*klāl-wok-stan-sung-a.*
Twenty		*lug-ws-wān-go.*
Twenty-one		*lug-ws-wān-wok-swan-sung.*
Twenty-two		*lug-ws-wān-wok-stoong.*
Twenty-three		*lug-ws-wān-wok-tl-kwul-ihl.*
Twenty-four		*lug-ws-wan-wok-stan-sung.*
A year		*sim-kīna.*
A moon		*kung-kais-gh.*
Half of the moon		*kung-kais-kin-oe.*
New moon		*kung-kē-dlāng.*
Half moon		*kung-in-oe.*
Day		*ut-ka-gun.*
Night		*al-gā.*
A day (twenty-four hours)		*sin-swān-sin.*
Dawn		*sand-lin-hait.*
Sunrise		*sing-āi.*
Noon		*sin-tut-zā.*

English.	Skidegate Dialect.	Masset Dialect.
Sunset	....	*sing-i-a.*
Midnight	....	*āl-yak.*
Day before yesterday	....	*ā-dahl-tal-ist.*
Yesterday	....	*ā-dahl.*
To-day	....	*āi-yut.*
Now	....	*et-ān.*
Past time	....	*a-wahl.*
Future time	....	*kwai.*
One man	....	*hai-da-swān-sung.*
Three men	....	*hai-da-kwun-ihl.*
Few men	....	*hai-da-kow-ga.*
Many men	....	*hai-da-hwan-ga.*
One woman	....	*nish-wa-da-swan-sung.*
One dog	....	*ha-swan-sung.*
Two dogs	....	*ha-stin-ga.*
Three dogs	....	*ha-whun-ihl.*
Few dogs	....	*ha-ge-ki-whit-zoo.*
Many dogs	....	*ha-kwan-ga.*
All the dogs	....	*ha-ge-wa-tloo-gun.*

English.	Masset Dialect.	Remarks.
Cat	*toos.*	Corruption of puss.
Horse	*kaiu-tin.*	Chinook.
Saddle	*wohl-git-lān-oo.*	
Axe	*kiutl-tzow.*	Long handle.
Auger	*klal-kow.*	
Awl (of metal)	*kīt-il-kow.*	
Hand-drill	*tl-kī-a-ka.*	
Broom	*tl-ki-ak-tālo.*	
Comb	*tl-ki-tlun-ga.*	
Knife (pocket)	*yātz-kwt-kwung-a.*	Knife that folds.
Knife	*yā-tzā.*	
Fork	*kut-tā-ow.*	To lift food.
Hammer	*kl-il-hlā.*	
Iron kettle	*ts-tlang-oo.*	
Tin plate	*ki-klā-tl-tlā.*	
Scissors	*tsai-to.*	
Table	*kit-tā-tin-e.*	
Pistol	*tzook-koo-kwoot-zoo.*	
Flint gun	*tzook-koo-kē-gang-a.*	
Ramrod	*tun-stā-o.*	
Cannon	*kwan-tow.*	
Bullet	*klas-ka-kit-ta.*	
Powder	*ō-kl-tā-ow.*	Burns fast.

English.	Skidegate Dialect.	Remarks.
Iron	*yī-ē-dzi.*	
Lead	*χī-guil-hui.*	
Silver	*tal-hkā.*	
Cap or hat	*ta-tsung.*	
Coat	*χit-is-koo.*	
Vest	*sko-stow.*	
Shirt	*whal-tis-koo.*	
Trousers	*koon.*	
Boots	*ska-tl-koon.*	
Slippers	*stas-kai-gē-tl-ka-dla.*	
Stockings	*hil-a-hul-ta-ow.*	
Shawl	*kun-tai-giat.*	
Dress (gown)	*tl-kit-kie.*	
Match (friction)	*ta-koon-tloo.*	
Tobacco	*kwul.*	
Whiskey	*kīn-tat-kās.*	
Finger-ring	*stil-gie.*	
Mirror	*hans-hang-oo.*	
Saw	*hēo.*	
Picture	*ki-gun-i-ja-go.*	
Paper	*kil-ka-lan-oo.*	Speech written down
Road	*kieu.* [*sha-hi-da.*	
Interpreter	*ha-la-wun-i-shush-ki-*	
Peace-maker between strangers	*kl-kuns-ti-guī-shoo.*	

APPENDIX C.

ON SOME MARINE INVERTEBRATA

FROM THE

QUEEN CHARLOTTE ISLANDS.

BY J. F. WHITEAVES.

The whole of the specimens belonging to the species enumerated in the following lists were collected by Dr. G. M. Dawson and his brother, Mr. Rankine Dawson, in the summer season of 1878, on the eastern coast of the Queen Charlotte Islands, along its whole extent, and off the northern extremity of Graham Island, between Virago Sound and North Island.

With the exception of a few and for the most part common littoral forms, which were found to be very generally distributed, it has been thought desirable to place on record the exact locality and station at which each species was obtained, by dredging or otherwise, although the doing of this has necessarily involved some reiteration which might otherwise have been avoided.

For valuable notes on the echinodermata and corals, and for the descriptions of new species of *Archaster* and *Solaster*, the writer is indebted to Prof. A. E. Verrill, of Yale College. Mr. W. H. Dall, of the Smithsonian Institution, Washington, has kindly examined and identified some of the smaller and more critical species of mollusca.

The crustacea collected by Dr. Dawson on the coast of Vancouver, as well as at the Queen Charlotte Islands, have been reported on separately by Prof. S. I. Smith, of Yale College.

A curious fact, established by these collections, is the occurrence at the Queen Charlotte Islands of several species of marine mollusca previously found only much further to the southwards, and hitherto supposed to be peculiar to the Californian fauna. The most notable of these are *Leda cœlata*, Hinds; *Bryophila setosa*, Carpenter; *Mitromorpha filosa*, Carpenter; *Odostomia straminea*, Carpenter; *Lamellaria Stearnsii*, Dall; *Volutella pyriformis*, Carpenter; *Amphissa versicolor*, Dall.

Among the corals, too, the only locality previously known for *Paracyathus caltha* was Monterey.

The following is a list of all the species recognised so far, but the foraminifera, hydrozoa, and polyzoa, of which a rather extensive series was procured, have yet to be studied:

SPONGIDÆ.

Grantia ciliata, Fabricius. Dredged at moderate depths and at various localities on the coast of the Queen Charlotte Islands, also at Vancouver.

Tethea, Sp. undt. Not yet examined. Houston-Stewart Channel, in from 15 to 20 fathoms, two fine specimens.

HYDROIDA.

Allopora venusta, Verrill. Houston-Stewart Channel, in from 15 to 20 fathoms, five specimens.

This species is placed in this division on the authority of Prof. Verrill.

ANTHOZOA.

Balanophyllia elegans, Verrill. With the preceding; also in 20 fathoms, at the mouth of Cumshewa Harbour, several fine specimens.

Paracyathus caltha, Verrill. Same localities and depths as the last species.

"Numerous specimens, of various sizes and varying considerably in form, from narrow and nearly cylindrical to broad cup-shaped."—Verrill.

OPHIUROIDEA.

Ophioglypha Lutkeni, Lyman. Abundant at Dixon Entrance, in 111 fathoms.

"These are larger than the original specimen described by Lyman, and show some variation. On the basal portion of the arms there are two tentacle-scales. The radial-shields are long oval, with the inner end pointed; they only touch each other in the middle. Mouth-shields broad spear-shaped, the outer end broad and a little prolonged, obtusely rounded; the side angles prominent and rounded; the inner end triangular, with slightly incurved sides. Arm spines three, acute, the upper one considerably longest. The arms, towards the base, are high, with a slight dorsal ridge. Color, ash-gray above, white below."—Verrill.

Ophiopholis Careyi, Lyman. Mouth of Cumshewa Harbour, in 20 fathoms, not very common.

"Agrees with the description of the original type."—Verrill. The correctness of the identification of this and of the preceding species has also been corroborated by Col. Lyman, to whom specimens of both were sent.

Amphiura urtica, Lyman. Virago Sound, in from 8 to 15 fathoms. Several small specimens. Determined by Prof. Verrill, who remarks concerning them :

"They have few small spinules on the plates near the edge of the disk. The under arm-plates are squarish, with a notch on the outer edge, as in the original specimens."

Asterioidea.

Asterias epichlora, Brandt. (?) Littoral, and apparently not very common.

"Rays five. Spines of dorsal surface evenly distributed, nearly equal, rather long, somewhat enlarged and sulcate at the tips, and surrounded, above the base, by a thick wreath of minor pedicellariæ. Adambulacral spines in two rows, slender. Ventral spines longer, stouter, obtuse, sulcated at tips, forming four close rows."—Verrill.

Asterias ochracea, Brandt. The most common of the littoral species collected.

Asterias hexactis, Stimpson. Found sparingly at or near low-water mark.

Leptasterias. ("Near *L. Mulleri* and *L. tenera*.") Virago Sound, in from 8 to 15 fathoms, several small and poorly preserved specimens.

"Rays five, slender. Adambulacral spines slender, mostly two to a plate. Lateral and dorsal spines slender, not crowded."—Verrill.

Pycnopodia helianthoidea, (Brandt.) Stimpson. Below low-water mark in Skidegate Inlet, but rather uncommon.

Solaster Stimpsoni, Verrill. Sp. nov. Beach at Ramsay Island, five or six specimens.

"This species is allied to *S. endeca* of the North Atlantic. It has a smaller disk and longer rays, usually ten in number. One of the larger dried specimens has the radius of the disk 1·25 inches; of the rays 4 to 4·50 inches. Color of the disk and base of rays, above, light red; lower surface yellowish. The rays are long, round, regularly tapered. Upper surface covered with clusters of small blunt spinules or paxillæ, mostly six to eight in a group, on the rays; and ten to twelve on the disk, where they are more crowded. In smaller specimens there are fewer spinules in the clusters. These spinules are larger, stouter, more obtuse and more numerous than in *S. endeca.* On the lower side the interbrachial spaces are smaller than in *S. endeca*, with fewer plates, each of which bears a close group, usually of four or five tapering spinules, rather larger than those of the dorsal surface, and much stouter and fewer than the corresponding spinules of *S. endeca.* The plates forming the lower margin of the disk are less prominent than in *S. endeca;* and each bears a transverse group of about twelve to sixteen spinules, similar to those of the sides and under surface of the rays. Along the grooves each adambulacral plate bears on its inner end two small, short, tapered spines, which form a longitudinal row, and outside of these a transverse row of about eight, much longer and larger, tapered spines, with rough, blunt tips. These are stouter, less acute and less rough than those of *S. endeca.* The oral plates bear six strong and rather long spines at the inner end, the middle ones longest. These are stouter and not so long as those of *S. endeca.*

"This is, possibly, the form called *Asterias endeca, var. decemradiata* by Brandt (*Solaster decemradiatus Stimp*). But Brandt gave no description whatever."—Verrill.

Solaster Dawsoni, Verrill. Sp. nov. Virago Sound, in from 8 to 15 fathoms, one specimen.

"Of this species I have seen but a single dried specimen, with twelve rays. Radius of the disk, ·80 of an inch; of the rays, 2·10. It has the general appearance and proportions of *S. endeca*, as seen from above, but resembles *Crossaster papposus* beneath. The plates of the upper surface and their clusters of spinules are even smaller, more numerous and more crowded than in the former species, there being usually ten to twelve minute and short spinules to each plate. The plates, when denuded of spines, are small, rounded and convex. The marginal plates are prominent, and each bears a prominent transverse group of numerous, small, slender spinules, forming two rows of about twelve to fourteen each. The interbrachial spaces, beneath, are very small and narrow, with few plates, each of which bears a group of three or four slender spinules. These spaces are very much smaller than in *S. decemradiatus*, and still smaller as compared with *S. endeca.* The adambulacral plates bear a longitudinal group of three, rather long, slender spines on the inner end, and outside of these a transverse group of four or five, scarcely larger ones. The oral plates bear six long, blunt spines, the middle ones longest. The adambulacral spines especially the inner ones, are much larger and longer than in *S. endeca* the latter usually having but two very small inner ones.

" *Asterias affinis* and *A. alboverrucosa* Brandt are probably a single species of *Solaster* or *Crossaster*, but the descriptions are very brief and imperfect. The former was described only from a figure of a young specimen. Both are one inch in diameter of disk. Both are described as having ten rays, with large scattered clusters of dorsal spines ("papillæ"), and as resembling *C. papposus*. The number of rays cannot be regarded as a specific character. They may really belong to *C. papposus*."—Verrill.

Cribrella læviuscula, Stimpson. Common, from low-water mark to 15 or 20 fathoms.

Dermaster imbricatus, Perrier.

(=*Asteropsis imbricata*, Grube, 1857. A. Agassiz, North American Starfishes, 1877; p. 106, pl. xv., figs. 1-7.)

A rather common and brilliantly coloured, littoral species, found at several localities.

Asterina miniata, Brandt. (Sp.) Near low-water mark, abundant locally.

Mediaster æqualis, Stimpson. Beach at Ramsay Island, one fine specimen only.

Archaster Dawsoni, Verrill. Sp. nov.

" A large species, in form resembling *A. tenuispinus* of the North Atlantic. Radius of the disk, ·65; of rays, 4 inches. The rays are long, flat, regularly tapered. The upper surface is loosely covered with small tubercles, bearing only circular groups of very minute, short paxillæ toward the margins of the rays; but along the middle region of the rays and over the disk bearing a long, tapering, acute central spine, surrounded at base by a circle of small paxillæ; between the plates there are, over the whole surface, numerous pores. Along each ray, toward the marginal plates, there are, at irregular intervals, singular groups of small incurved spinules; usually three or four clusters, each cluster consisting of a row of three or four spinules, form one group; the ends of all the spinules converge to a pore in the centre of the group. The upper marginal plates are small but prominent, and each bears a long, rather stout, acute, erect spine, surrounded at base by a group of slender, unequal spinules. The lower marginal plates mostly bear three long and large divergent spines, the upper one largest, and rather longer than those of the upper plates; between and around their bases there are slender spinules. The adambulacral plates bear upon the inner edge a rounded group of about six very slender, blunt spines, the two lateral ones very short, the middle ones long; outside of these there is a transverse row, usually of three much longer and larger, blunt spines."—Verrill.

Dixon Entrance, in 111 fathoms, one fine, living specimen.

Echinoidea.

Dendraster excentricus, Valenciennes. (Sp.) Beach in Virago Sound.

Loxechinus purpuratus, Stimpson. (Sp.) Near low-water mark and in shallow water, common. Some of the specimens are six inches and a quarter in diameter.

Strongylocentrotus Drobachiensis (Muller) A. Agassiz. Masset Inlet and elsewhere, at low tides, with the variety *chlorocentrotus*, Brandt. Abundant.

Brachiopoda.

Laqueus Californicus, Koch. Fifty fathoms, mud, off Metla-Katla, a few dead shells.

Terebratella transversa, Sowerby. (*T. caurina*, Gould.) Mouth of Cumshewa Harbour, in 20 fathoms; Houston-Stewart Channel, in 15-20 fathoms. Common, living, and of large size, at both localities.

Lamellibranchiata.

Zirphæa crispata, Linnæus. Beach north of Cumshewa Harbour, a large, worn, right valve.

Saxicava rugosa, Lamarck. Dolomite Narrows and Masset Inlet, first expansion.

Mya truncata, Linnæus. Dolomite Narrows and beach between Virago Sound and North Island.

Cryptomya Californica, Conrad. Virago Sound, in 8 to 15 fathoms, one valve.

Neæra pectinata, Carpenter. Virago Sound, in 8 to 15 fathoms, and Dixon Entrance, in 111 fathoms; one specimen from each locality.

Kennerlia filosa, Carpenter. Virago Sound, in 8 to 15 fathoms, three specimens.

Thracia curta, Conrad. With the preceding, one example.

Lyonsia Californica, Conrad. One young, living specimen, from the same locality as the two last-named species.

Entodesma saxicola, Baird. Rocks at low water.

Mytilimeria Nuttalli, Conrad. With the last species.

Siliqua patula, Dixon. Beach between Masset and Rose Point, several dead but very perfect and well-preserved shells.

Psammobia rubroradiata, Nuttall. Mouth of Cumshewa Harbour, in 20 fathoms, one dead shell.

Macoma inquinata, Deshayes. Virago Sound, in 8 to 15 fathoms, one specimen.

Macoma sabulosa, Spengler, var. Dixon Entrance, Q.C.I., in 111 fathoms, three examples.

Macoma inconspicua, Broderip and Sowerby? Large variety. Virago Sound, in 8 to 15 fathoms, one perfect shell and a single valve.

Macoma Carlottensis, Nov. sp.

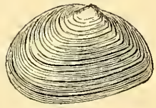

Fig. 1. *Macoma Carlottensis*, left valve, nat. size.

Shell small, moderately inflated, thickness rather more than one-half the height, inequilateral; valves slightly flexed to the right posteriorly; test thin and fragile.

Anterior side produced, evenly rounded at its extremity, and nearly twice as long as the posterior side; posterior side short, much narrower than the anterior, subcuneiform, sloping convexly and abruptly from above downwards, and at last forming a subangular junction with the ventral margin below. Ventral margin gibbous in advance, ascending and much straighter behind. Beaks small, moderately prominent, incurved, and placed considerably behind the middle. Ligament short, external.

Surface glossy, marked by very fine, close-set, concentric striations, and by a few, distant, lines of growth. Colour of young shells translucent and often opalescent white or whitish. The lower portion of adult shells, when in good condition, is covered with a thin, pale ashen-gray epidermis, and the shells themselves are often tinged with a pale grayish or brownish hue.

Right valve with two minute, widely diverging, cardinal teeth; left valve with a single, very small, narrowly triangular tooth, which under the lens appears to be grooved down the middle; lateral teeth obsolete or nearly so. Pallial sinus profound, rounded at its extremity, and reaching beyond the centre of the valves.

Dimensions:—Length of an adult specimen, 6 lines; height of the same, $4\frac{1}{2}$ lines; thickness through the valves, 3 lines.

Virago Sound, in from 8 to 15 fathoms, abundant.

Mœra variegata, Carpenter. Dolomite Narrows, common; mouth of Cumshewa Harbour, in 20 fathoms, several.

Standella falcata, Gould. Shore near camp between Virago and North Island, two single valves.

Clementia subdiaphana, Carpenter. Virago Sound, in 8 to 15 fathoms, a large single valve.

Psephis Lordi, Baird. Dixon Entrance, in 111 fathoms, and Virago Sound, in 8 to 15 fathoms.

Venus Kennerleyi, Reeve. Mouth of Cumshewa Harbour, in 20 fathoms, many, but mostly small; Dolomite Narrows, and Houston-Stewart Channel, in 15-20 fathoms, not so common.

Tapes staminea, Conrad. Shore between Virago and North Island, Dolomite Narrows, and 8 to 15 fathoms in Virago Sound.

Saxidomus squalidus, Deshayes. Common at several localities.

Cardium Nuttalli, Conrad. Abundant, and of very large size.

Cardium blandum, Gould. Mouth of Cumshewa Harbour, in 20 fathoms, and Virago Sound, in 8 to 15 fathoms; mostly small, single valves.

Astarte semisulcata, Leach? One dead valve, in 20 fathoms, off Metla-Katla.

Astarte Esquimalti, Baird. (=*Rhectocyma mirabilis*, Dall.) Mouth of Cumshewa Harbour, in 20 fathoms, several.

Miodon prolongatus, Carpenter. Dolomite Narrows, abundant; mouth of Cumshewa Harbour, in 20 fathoms, several; Houston-Stewart Channel, in 15 to 20 fathoms, three or four specimens.

Venericardia borealis, Conrad, and *var. ventricosa*, Gould. Dixon Entrance, in 111 fathoms, four specimens; mouth of Cumshewa Harbour, in 20 fathoms, many, living; Virago Sound, in 8 to 15 fathoms, three; off Metla-Katla, in 50 fathoms, and Dolomite Narrows; common, but of small size.

Lucina filosa, Stimpson. Dixon Entrance, in 111 fathoms, a large single valve.

Lucina tenuisculpta, Carpenter. Virago Sound, in 8 to 15 fathoms, five small, living specimens.

Cryptodon flexuosus, Montagu. Dixon Entrance, in 111 fathoms, three perfect specimens.

Cryptodon serricatus, Gould. With the last; also mouth of Cumshewa Harbour, in 20 fathoms, and Virago Sound, in from 8 to 15 fathoms; one living shell from each of these localities.

Diplodonta orbella, Gould. Mouth of Cumshewa Harbour, in 20 fathoms, plentiful, but mostly single valves; Houston-Stewart Channel, in 15 to 20 fathoms, one dead but perfect shell.

Kellia suborbicularis, Montagu. Dredged, living, at several localities.

Turtonia minuta, Fabricius. Virago Sound, in from 8 to 15 fathoms, one large, single valve.

Lepton rude, Nov. Sp.

"Lepton rude, Dall" M. S.

Fig. 2. *Lepton rude*, left valve, nat. size.

Shell rather small, equivalve, inequilateral, tumid, but not quite as thick as high, most swollen on the postero-lateral and antero-lateral umbonal slopes, depressed in the middle, the depression extending from the beaks to the ventral margin; test thin and fragile.

General outline subtrapezoidal, length much greater than the height, base concavely and shallowly emarginate; superior border broadly compressed convex, sloping gently downwards posteriorly, and rather more rapidly so in advance; posterior and anterior ends subtruncate more or less obliquely above and rounded below; posterior side somewhat longer than the anterior, and rather more pointed at its extremity below. Umbones broad and depressed; beaks compressed laterally, eroded, moderately prominent, curved forwards, and placed a little in advance of the middle. Posterior area ill-defined, indicated obscurely by an oblique and abrupt compression of the valves above and behind a rounded ridge or swelling, which runs in the direction of a line which might be drawn from the hinder side of the beaks to the posterior termination of the ventral margin. This ridge or prominence is tolerably well defined in the umbonal region, but becomes obsolete in the middle of the shell. Lunule none; lunular region abruptly and obliquely compressed or inflected.

Surface marked by coarse, crowded and irregularly disposed, concentric wrinkles or raised striæ. As viewed under an achromatic microscope, with an inch and a half objective, the shell is seen to be covered in places with an exceedingly minute, angular and irregular network of raised wrinkles and radiating striæ.

Colour:—Dark rusty-brown on the exterior of the valves (possibly due to the ferruginous nature of the mud or sand in which it lived), whitish on the beaks and umbones. Interior, porcellanous white.

Dimensions of the only specimen collected:—Length, 10 lines; height, scarcely 7; thickness, 5 lines.

Locality:—Virago Sound, in from 8 to 15 fathoms. One fine specimen, the largest known, perfect and well-preserved on the outside, but with the interior of the valves much eroded and exfoliated, and the hinge teeth badly broken.

This well-marked and very distinct species has long been known to Mr. W. H. Dall, whose M. S. name for it has been adopted here. The specimens in Mr. Dall's possession are from Alaska and Monterey, so that the species appears to have a wide range on the west coast of North America.

Tellimya tumida, Carpenter. Dolomite Narrows, four good specimens.

Mytilus edulis, Linnæus. Dolomite Narrows, &c.

Mytilus Californianus, Conrad. Beach in Houston-Stewart Channel.

Modiola modiolus, Linnæus. Low-water to 10 fathoms, common.

Crenella decussata, Montagu. Virago Sound, in from 8 to 15 fathoms. A single, very large example which measures nearly three lines in length by two and a half in height.

Axinæa septentrionalis, Middendorf, *var. subobsoleta*, Carpenter. Mouth of Cumshewa Harbour, in 20 fathoms, abundant and alive; also Houston-Stewart Channel, north of Prevost Island, in 15 to 20 fathoms, where many specimens were obtained. At the Queen Charlotte Islands only the smooth form of this species has been observed.

Nucula tenuis, Montagu, *var. lucida*, Gould. Virago Sound, in 8 to 15 fathoms, several living specimens.

Nucula (Acila) Lyalli, Baird. With the preceding; also channel opposite Seal's Head Island, in 70 fathoms.

Leda cœlata, Hinds. Houston-Stewart Channel, in from 15 to 20 fathoms, a single but characteristic left valve. The most northerly locality previously known for this species was the neighbourhood of San Francisco.

Leda minuta, Müller. Channel opposite Seal's Head Island, in 70 fathoms. Several specimens, apparently, of a very large, tumid form of this species. A number of examples of the variety *caudata* were dredged off Metla-Katla, in 20 fathoms of water.

Yoldia lanceolata, J. Sowerby. Virago Sound, in 8 to 15 fathoms, several living, but small; also one valve, in 20 fathoms, off Metla-Katla.

Bryophila setosa, Carpenter. Virago Sound, in 8 to 15 fathoms, four fine living specimens. Hitherto known only from Cape St. Lucas, and between San Diego and San Pedro, California.

Pecten hastatus, Sowerby. With the preceding, also Houston-Stewart Channel, in from 15 to 20 fathoms; a single small specimen from each of these localities.

Hinnites giganteus, Gray. From several localities, common.

Placunanomia macroschisma, Deshayes. Virago Sound, in 8 to 15 fathoms, and elsewhere, common.

GASTEROPODA.

Tornatina eximia, Baird. Virago Sound, in 8 to 15 fathoms, seven specimens; Dixon Entrance, in 111 fathoms, two or three dead shells; Dolomite Narrows, one dead shell.

Cylichna alba, Brown. Dixon Entrance, in 111 fathoms, two specimens.

Siphonaria Thersites, Carpenter, *var.* One living specimen.

Dentalium Indianorum, Carpenter. Virago Sound, in 8 to 15 fathoms, one dead shell.

Mopalia ciliata, Sowerby. A common littoral species, of which two examples of the typical form were collected, and three of the variety, or subspecies, *Hindsii*.

Mopalia Wossnessenskyi, Middendorf. Two examples from low-water mark.

Cryptochiton Stelleri, Middendorf. Beach at Skincuttle Inlet, also rocks at low-water in Houston-Stewart Channel.

Katherina tunicata, Wood. Common at several places, living on rocks at or near low-water mark.

Tonicella marmorea, Fabricius. Houston-Stewart Channel, in 15 to 20 fathoms, two specimens.

Tonicella lineata, Wood. Low-water, at several localities.

Chætopleura Hartwegii, Carpenter. Mouth of Cumshewa Harbour, in 20 fathoms, one small specimen.

Ischnochiton interstinctus, Gould. With the preceding, also Virago Sound, in 8 to 15 fathoms, and Houston-Stewart Channel, in 15 to 20 fathoms.

Ischnoradsia trifida, Carpenter. Mouth of Cumshewa Harbour, in 29 fathoms, one specimen.

Lepidopleurus Mertensii, Middendorf. Frequent, living, in Houston-Stewart Channel, in 15 to 20 fathoms, and at the mouth of Cumshewa Harbour, in 20 fathoms.

Acmæa mitra, Escholtz. *Acmæa* (*Collisella*) *pelta*, Escholtz. *Acmæa* (*Collisella*) *persona*, Escholtz. *Acmæa* (*Collisella*) *patina*, Escholtz. *Acmæa* (*Collisella*) *patina, var. scutum.*	Abundant, living, at and below low-water mark, in several localities.

Cryptobranchia concentrica, Middendorf. (=*Lepeta cæcoides.*) Two living specimens, in 20 fathoms, off Metla-Katla.

Glyphis aspera, Escholtz. Cumshewa Harbour, in 50 fathoms, two living and three dead shells.

Fissurellidæa bimaculata, Dall. Houston-Stewart Channel, in 15 to 20 fathoms, two dead examples.

Puncturella cucullata, Gould. Virago Sound, in 8 to 15 fathoms; mouth of Cumshewa Harbour, in 20 fathoms, and Houston-Stewart Channel, in 15 to 20 fathoms.

Puncturella galeata, Gould. With the preceding species.

Haliotis Kamtschatkana, Jonas. On rocks at low-water at Houston-Stewart Channel and elsewhere. This species was collected also by Mr. James Richardson at the Queen Charlotte Islands in 1872.

Pachypoma gibberosum, Chemnitz. Common on rocks at low-water mark.

Leptothyra sanguinea, Linnæus. Houston-Stewart Channel, in 15 to 20 fathoms, several; mouth of Cumshewa Harbour, in 20 fathoms, common; Dolomite Narrows, a few.

Chlorostoma brunneum, Philippi. Carpenter Bay, on fronds of *Macrocystis*, common.

Calliostoma canaliculatum, Martyn. Virago Sound, in 8 to 15 fathoms, four living but small specimens.

Calliostoma costatum, Martyn. Houston-Stewart Channel, in 15 to 20 fathoms; Virago Sound, in 8 to 15 fathoms, and elsewhere; very common.

Calliostoma annulatum, Martyn. Houston-Stewart Channel, in 15 to 20 fathoms, two specimens.

Phorcus pulligo, Martyn. Adult and common on fronds of *Macrocystis* in Carpenter Bay. Young but living shells of this species were dredged also in 15 to 30 fathoms in Houston-Stewart Channel and in Dolomite Narrows.

Gibbula funiculata, Carpenter. One living specimen, the exact locality of which has been forgotten.

Margarita pupilla, Gould. Houston-Stewart Channel, in 15 to 20 fathoms, and mouth of Cumshewa Harbour, in 20 fathoms.

Margarita lirulata, Carpenter. Dolomite Narrows, five living shells; and Virago Sound, in 8 to 15 fathoms, three examples.

Margarita helicina, Montagu. One young, living specimen; exact locality and station unknown.

Crepidula navicelloides, Nuttall; *var. nummaria*, Gould. Mouth of Cumshewa Harbour, in 20 fathoms, on dead shells, &c., frequent.

Crepidula adunca, Sowerby. Two living specimens; exact locality and station unknown.

Galerus contortus, Carpenter (fide Dall). Mouth of Cumshewa Harbour, in 20 fathoms, common; and Virago Sound, in from 8 to 15 fathoms, rather scarce.

Hipponyx cranioides, Carpenter. One living adult specimen; exact locality not known.

Cœcum crebricinctum, Carpenter. Dolomite Narrows, one; dead.

Mesalia reticulata, Mighels. Off Metla-Katla, in 50 fathoms, five specimens.

Bittium filosum, Gould. Common.

Littorina Sitchana, Philippi. Rocks at low-water, at Hot Spring Island; also shore between Virago Sound and North Island.

Littorina scutulata, Gould. Virago Sound, in 8 to 15 fathoms, two dead shells.

Lacuna porrecta, Carpenter. Shore between Virago Sound and North Island, one dead shell.

Lacuna? var. exæquata, Carpenter. Beach at Virago Sound, one small specimen.

Alvania reticulata, Carpenter. Virago Sound, in 8 to 15 fathoms, rare.

Alvania compacta? Carpenter. Dolomite Narrows. "Found also in Japan."—Dall.

Fenella pupoidea, Carpenter? (or *Rissoa*, Nov. Sp.) Mouth of Cumshewa Harbour, in 20 fathoms, one live adult shell.

Drillia incisa, Carpenter. Virago Sound, in 8 to 15 fathoms, two specimens; one very large. "The most northern locality yet known for this species."—Dall.

Mangelia sculpturata, Dall. M. S. S. With the last-named species, but very rare.

Bela fidicula, Gould. Virago Sound, in 8 to 15 fathoms, three specimens; channel opposite Seal's Head Island, in 70 fathoms, one large, living shell; and Dixon Entrance, in 111 fathoms, one dead specimen.

Bela Trevelyana, Turton (teste Dall). Virago Sound, in 8 to 15 fathoms, one dead shell.

Mitromorpha filosa, Carpenter. Mouth of Cumshewa Harbour, in 20 fathoms, three fine specimens. The only previously recorded localities for this species are Santa Barbara and Lower California.

Odostomia straminea, Carpenter. From the same locality and station as the species last named. One young example.

Odostomia Sitkensis, Dall. M. S. ("but this may=*O. inflata Cpr.*," Dall), Dolomite Narrows.

Scalaria Indianorum, Carpenter. Shore between Virago and North Island, one dead adult shell.

Cerithiopsis tuberculata, Montagu (teste Dall). Dolomite Narrows, one dead shell; Virago Sound, in 8 to 15 fathoms, three specimens.

Trichotropis cancellata, Hinds. Off Metla-Katla, in 20 fathoms, three live shells; also dead on the beach of the coast between Virago Sound and North Island.

Lamellaria Stearnsii, Dall. Houston-Stewart Channel, in 15 to 20 fathoms, one dead shell. The only specimens known besides this are the two types of the species which were collected by Mr. Dall on the beach at Monterey in 1866.

Natica clausa, Broderip and Sowerby. Virago Sound, in from 8 to 15 fathoms, two dead shells.

Lunatia Lewisii, Gould. Frequent, living, and of largesize, at several localities on the eastern, and especially near the northern end of the islands.

Priene Oregonensis, Redfield. Two specimens, the exact locality of which has been forgotten.

Volutella pyriformis, Carpenter. Virago Sound, in 8 to 15 fathoms, three living shells. Not hitherto recorded to the north of San Francisco.

Olivella biplicata, Sowerby. Beach between Virago Sound and North Island, dead shells only.

Olivella bœtica, Carpenter. With the preceding, and in the same worn and bleached condition.

Nassa (Niotha) mendica, Gould. Virago Sound, in 8 to 15 fathoms, abundant; Houston-Stewart Channel, in 15 to 20 fathoms, two dead shells. Beach between Virago Sound and North Island.

Amphissa versicolor, Dall. Houston-Stewart Channel, in 15 to 20 fathoms, seven specimens; mouth of Cumshewa Harbour, in 20 fathoms, three dead shells. In describing this species, Mr. Dall says:—*"I have not seen specimens from north of San Francisco, and Monterey is its headquarters."

Amphissa corrugata, Reeve. Houston-Stewart Channel, in 15 to 20 fathoms, abundant and alive.

Purpura crispata, Chemnitz. Common everywhere, and very variable both in form and sculpture.

Purpura canaliculata, Duclos. Same station and locality as the preceding, but much scarcer.

Purpura saxicola, Valenciennes. With the last species, apparently not common.

Ocinebra lurida, Middendorf. Mouth of Cumshewa Harbour, in 20 fathoms, and Houston-Stewart Channel, in 15 to 20 fathoms.

Ocinebra interfossa, Carpenter. Virago Sound, in 8 to 15 fathoms, and mouth of Cumshewa Harbour, in 20 fathoms.

Cerostoma foliatum, Gmelin. Fine living specimens of this species were obtained on the rocks, near low-water mark, at many places.

Nitidella Gouldii, Carpenter. Virago Sound, in 8 to 15 fathoms, five specimens.

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* American Journal of Conchology. Vol. vii., 1872; p. 114.

Trophon tenniscultpus, Carpenter. Houston-Stewart Channel, in 15 to 20 fathoms; also Virago Sound, in 8 to 15 fathoms.

Trophon Orpheus? Gould. (Young.) Mouth of Cumshewa Harbour, in 20 fathoms.

Chrysodomus dirus, Reeve. Rocks at low-water mark in Houston-Stewart Channel, eight living shells.

Chrysodomus Harfordii, Stearns. One adult, living specimen from the same locality and station as the last-mentioned species.

Annelida.

Nicomache lumbricalis, Malmgren. Dixon Entrance, in 111 fathoms.—(Verrill.)

Sternaspis, Sp. ("Very much like *S. fossor.*"—Verrill.) Virago Sound, in from 8 to 15 fathoms.

APPENDIX D.

NOTES ON CRUSTACEA

COLLECTED BY

DR. G. M. DAWSON AT VANCOUVER AND THE QUEEN CHARLOTTE ISLANDS,

BY S. I. SMITH.

BRACHYURA.

Heterograpsus nudus Stimpson.

Pseudograpsus nudus Dana, Proceedings Acad. Nat. Sci., Philadelphia, 1851, p. 249 (3); United States Exploring Expedition, Crust., p. 335, pl. 20, fig. 7, 1852.—Stimpson, Journal Boston Soc. Nat. Hist., vi., p. 469 (29), 1857.

Cyclograpsus marmoratus White, List of Crust. British Museum, p. 41, 1847 (no description).

Heterograpsus marmoratus Milne-Edwards, Annales Sci. Nat., III., xx., p. 193 (159), 1853.

Heterograpsus nudus Stimpson, Proceedings Acad. Nat. Sci., Philadelphia, 1858, p. 104 (50).

A fine male specimen from near Victoria, Vancouver Island. Sitka is given by White as the locality for one of the specimens in the British Museum. It is abundant upon the Oregon and California coast.

Fabia subquadrata Dana.

Two specimens from the Queen Charlotte Islands, shore; and one from "Houston Stewart Channel, Q.C.I., June, 1878, inhabiting cavity of large mussel."

Cancer magister Dana.

Cancer irroratus Randall, Jour. Acad. Nat. Sci., Philadelphia, viii., p. 116, 1839 (not of Say).

Cancer magister Dana, United States Exploring Expedition, Crust., p. 151, pl. 7, fig. 1, 1852.—Stimpson, Jour. Boston Soc. Nat. Hist., vi., p. 458 (18), 1857.

Metacarcinus magister A. Milne-Edwards, Annales Sci. Nat., IV., xviii., p. 33, 1862; op. cit., V., i., p. 67, 1864; Nouvelle Archives Mus. Hist. Nat., Paris, i., p. 201, pl. 19, fig. 1, 1865.

A large carapax from the Queen Charlotte Islands.

Cancer productus Randall.

Randall, Jour. Acad. Nat. Sci., Philadelphia, viii., p 116, 1839.—Dana, United States Exploring Expedition, Crust., p. 156, pl. 7, fig. 3.—Stimpson, Jour. Bost. Soc. Nat. Hist., vi., p. 461 (21), 1857.

Cancer perlatus Stimpson, Proceedings California Acad. Nat. Sci., i., p. 88, 1856.

Virago Sound, 15 to 8 fath.; mouth of Cumshewa Harbour, 20 fath.; and shallow dredging; all from the Queen Charlotte Islands.

Cancer antennarius Stimpson.

Stimpson, Proceedings California Acad. Sci., i., p. 88, 1856; Jour. Bos. Soc. Nat. Hist., vi., p. 442 (22), pl. 18, 1857.

? *Platycarcinus recurvidens* Bate, in J. K. Lord, Naturalist in Vancouver Island, ii., p. 269, 1866.

Small alcoholic specimens from Virago Sound, 15 to 8 fath., aud 20 fath., mouth of Cumshewa Harbour, Q.C.I. A dry carapax from the same group of islands (no special locality given) is 83 $^{mm.}$ long and 133 broad.

Trichocarcinus Oregonensis Miers.

Tricocera Oregonensis Dana, United States Exploring Expedition, Crust., p. 299, pl. 18, fig. 5, 1852.

Trichocarcinus Oregonensis Miers, Proceedings Zool. Soc. London, 1879, p. 34 (*Tricocera* De Haan, 1833, preoccupied).

A young specimen from Vancouver Island, and the carapax and chelipeds of a larger specimen from the Queen Charlotte Islands. These specimens agree with Dana's description and figure, except that the teeth of the postero-lateral margin are more indistinct than shown in his figure, some of them being nearly or quite obsolete. In all the larger specimens which I have examined, the dorsal surface of the carapax is rougher and the areolets more protuberant than in small specimens, and in very small specimens the carapax is nearly smooth and regularly convex.

A small specimen, dredged by Mr. J. Richardson in the Gulf of Georgia in 1875, and referred to by Mr. Whiteaves as *Trichocera Oregonensis?* on my authority (*Canadian Naturalist*, Vol. viii., No. 8, 1878), appears to represent a distinct species. I have seen another and much larger specimen of the same form from Washington Territory, collected by J. G. Swan (Smithsonian Institution). In this species the antero-lateral margin of the carapax is strongly upturned, and its teeth are broad and in contact at their bases. The frontal and hepatic regions and the anterior part of the branchial are smooth and flat or concave, but there are three very high, wart-like prominences on the gastric region, of which the two anterior are larger and mark the protogastric lobes, while the smaller is in the median line and behind them; there are similar, but posteriorly less distinctly circumscribed protuberences on the posterior part of the branchial region; and the tops of all the protuberances are ornamented with smooth mammillary granules, which are large anteriorly but gradually loose the mammillary character in the rough and granular posterior regions of the carapax, which differ much from the anterior and middle regions, which are very smooth, except on the flattened summits of the gastric protuberances just described.

Telmessus serratus White.

White, Annals Mag. Nat. Hist., xvii., p. 497, 1846; Voyage of Samarang, Crust., p. 14, pl. 3, 1848.—Dana, United States Exploring Expedition, p. 303, pl. 18, fig. 8, 1852.

There are three specimens of *Telmessus* from the Queen Charlotte Islands: two small males, in alcohol, from shallow dredging, and a dry and broken female much larger than the males. The female agrees very well with White's figure and is about the same size as White's specimen, though of the opposite sex. The larger of the two males agrees with Dana's figure and description, except that the median teeth of the front are not quite as acute and prominent, projecting only very little beyond the lateral. The tooth forming the lateral angle of the carapax is much more prominent than in the female. The smaller male differs from the larger in having the antero-lateral margins of the carapax nearly parallel, and the tooth forming the lateral angle relatively even much more prominent than in the larger male. These differences are shown in the following measurements of the carapaces of the three specimens:—

	♂	♂	♀
Length, including frontal spines.......	6·6 mm	20·3	66·5
Breadth in front of lateral teeth........	5·7	19·4	66·0
Breadth, including lateral teeth........	8·9	25·3	82·2

The differences are apparently due to the age of the specimens, and I think there can be little doubt that White's specimen and Dana's were of the same species. Whether the *T. cheiragonus* described by Tilesius and by Brandt, and *T. acutidens* Miers (ex Stimpson), are also of the same species, I am uncertain. The synonymy in this genus is still in great confusion, and the relations of the different forms can be made out satisfactorily only by careful examination of a large series of specimens.

Oregonia gracilis Dana.

Oregonia gracilis Dana, United States Exploring Expedition, Crust., p. 106, pl. 3, fig. 2, 1852 (♂).

Oregonia hirta Dana, ibid., p. 107, pl. 3, fig. 3, 1852 (♀).

? *Oregonia longimana* Bate, Proceedings Zoological Society London, 1864, p. 663, 1865; in J. K. Lord, Naturalist in Vancouver Island, ii., p. 267, 1866.

Virago Sound, Q.C.I., 15 to 8 fath., also Vancouver Island.

The series of specimens is sufficient to show that the two forms described by Dana are sexual and belong to one species, the *gracilis* being based on the adult male and the *hirta* on the two forms of the female. In the characters of the rostral spines and the rest of the carapax, all the larger males before me agree with the description and figures of *gracilis*, while in the same characters the females agree with *hirta*, and the smaller males are more or less intermediate between the two forms. But among the females themselves there are two forms: all the adult and fertile specimens having the abdomen very broad and nearly orbicular, while in other specimens (most of them small, but some of them as large as the smaller of those with orbicular abdomens) the abdomen is much narrower and elliptical, as shown in Dana's fig. 3 b. The smaller of these latter females are, perhaps, merely immature individuals, but the larger are apparently truly dimorphic, sterile females, such as are found in many genera of Brachyura, and here, as in most similar cases, the larger of the sterile individuals show considerable approach to the male in the form of the carapax, etc.

In the largest male before me the merus of the chelipeds reaches very nearly or quite to the tips of the rostrum, and, in this respect, agrees with Bate's *O. longimana*, though the chelipeds are not nearly twice as long as the carapax, if the rostrum is, as it is usually, included in the length. Bate makes no allusion to the size of his specimen, and describes it so imperfectly that it is not easy to determine its affinities with certainty.*

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* It may be well to remark here that there had apparently been an admixture of specimens from some region or regions far south of Vancouver Island, in the collection which served as the basis of Bate's chapter on "Vancouver Island Crabs" in the work above referred to, and that this fact also adds to the difficulty of determining the species there described. Bate himself remarked upon the mingling of northern and southern forms in the collection, but he does not seem to have suspected any mistake in regard to the localities from which the specimens came. I am aware that many tropical and subtropical marine species extend far north along the Pacific American coast, but it is scarcely conceivable that such an assemblage of species as Bate's list indicates should exist in any one faunal region. The list contains not only tropical Pacific American species but also Central and South Pacific, and even tropical Atlantic species. Some of the incongruities may, however, be due to wrong identifications, as in the case of the *Clibanarius* about to be mentioned; but, making all reasonably supposable allowance for mistakes of this kind, there is still sufficient evidence of a mixture of specimens from different faunæ, to throw doubt upon the authenticity of the supposed habitats of many of the new species in Mr. Lord's collection. The existence in the region of Vancouver Island of any of the following species (all of which are enumerated among the Decapoda in Bate's list) is, at least, very doubtful:—*Eriphia gonagra*, "*Panopœus*" *crenatus*, *Xantho dispar*, *Ocypode Urvulii*, *Grapsus lividus*, *Hemigrapsus* "*sedentatus*," *Gelasimus annulipes*, *Porcellana Edwardsii*, *Eupagurus perlatus*,

Pugettia gracilis Dana.

Queen Charlotte Islands, shore; and shallow dredging, Port Simpson to north end of Vancouver Island.

Scyra acutifrons Dana.

Two males from near Victoria, Vancouver Island. Another male specimen agreeing well with these was collected at the same locality by Mr. R. Middleton in 1875, and is referred to by Mr. Whiteaves, on my authority, as "Scyra, sp. undt." (*Canadian Naturalist*, Vol. viii., No. 8, 1878.) All these specimens are much larger than the ones described by Dana, and differ much from his description and figures. The specimen collected by Mr. Middleton differed so much that I at first supposed it must represent a new species, but the specimens collected by Dr. Dawson show a nearer approach to Dana's figures, and I now think there is little doubt that Dana's description and figures were based on females and young males, and that the specimens before me are the fully adult males of the same species.

In the specimens before me, the lamelliform rostrum is very much expanded laterally, so that it is as wide, or even considerably wider than, the width of the front between the præocular spines, and the lobes are much less divergent anteriorly than shown in Dana's figure. The protuberance upon each branchial region is elongated and excessively developed, and posteriorly it projects so much as to overhang the lateral margin of the carapax. The anterior cardiac protuberance is tubercular and obtuse and fully as high as the branchial protuberances, but separated from them and from the large gastric protuberance by a broad and deep depression; the posterior cardiac protuberance is small, but conical and conspicuous. The whole gastric region is protuberant, and separated from the branchial region, on each side, by a deep and narrow cervical groove. The posterior gastric elevation is large and obtusely tubercular, while the anterior is small and conical. The chelipeds are proportionably much larger every way than in Dana's specimens, and the lamelliform crest on the propodus is much broader. The differences in the chelipeds, and partially also those in the carapax, are shown by the following measurements of the specimens collected by Dr. Dawson:—

"*Cenobites*" *Diogenes*. *Clibanarius lineatus* (Milne-Edwards) is also given, but there is now plain evidence of a mistake in the identification, for Miers (Proceedings Zoological Society, London, 1877, p. 658, pl. 66, fig. 4) has described and figured a species, as *Clibanarius Lordi*, said to have been collected at the same locality as Bate's *C. lineatus*, and presented to the British Museum by Mr. Lord, and Miers states that the specimen was labelled *Clibanarius lineatus*, but that it is certainly not the species described under that name by Milne-Edwards and figured by Dana.

Length of carapax, including rostrum.........	36·8 mm	39·0
Greatest breadth between margins............	24·7	26·8
" " " branchial protuberances	27·3	29·5
Length of rostrum from base of præocular spine..	9·0	10·3
Greatest breadth of rostrum..................	7·7	9·0
Length of merus in chelipeds................	22·0	28·5
Length of propodus.........................	31·0	37·0
Length of dactylus.........................	15·0	16·5
Breadth of dactylus.........................	10·5	12·5

Anomura.

Hapalogaster inermis Stimpson.

Stimpson, Annals Lyceum Nat. Hist. New York, vii., p. 243 (115), 1860.

I refer to this species, with some doubt, a single female from the shores of the Queen Charlotte Islands. The chelipeds are not described by Stimpson, but in the specimen before me they are very unequal, the right being twice as stout as the left, very much less setose, and the excavated fingers are entirely without horny tips.

Eupagurus granosimanus Stimpson.

Stimpson, Annals Lyceum Nat. Hist. New York, vii., p. 90 (44), 1859.

Several dry specimens, most of them very small, from near Victoria, V.I. I think it not improbable that this species will prove to be synonymous with *E. Middendorffii* Brandt. Brandt's species was described and figured from a specimen considerably larger than the specimens examined by Stimpson or those before me, and it very likely is only the fully adult form of Stimpson's species.

Eupagurus tenuimanus Stimpson (ex Dana).

One specimen from shallow dredgings, Port Simpson to the north end of Vancouver Island. The propodus of the larger cheliped is fully as broad as in Dana's specimens, but the inner edge is less sharply dentate and the outer edge less strongly curved. There is no doubt of its identity with Dana's species, however.

There are several small specimens of *Eupagurus* from 15 to 8 fath., Virago Sound, 20 fath., mouth of Cumshewa Harbour, and from Houston Stewart Channel, Q.C.I., which are distinct from either of the above species, but they appear to be immature and are not easily determined.

Paguristes turgidus Stimpson.

Eupagurus turgidus Stimpson, Proceedings Boston Soc. Nat. Hist., vi., p. 86, 1857.

Clibanarius turgidus Stimpson, Journal Boston Soc. Nat. Hist., vi., p. 484 (44), pl. 21, fig. 1, 1857.

Paguristes turgidus Stimpson, Proceedings Acad. Nat. Sci., Philadelphia, 1858, p. 236 (74), 1859; Annals Lyceum Nat. Hist., New York, vii., p. 86 (40), 1859.

Not in Dr. Dawson's collection, but a large male was dredged in the Gulf of Georgia by Mr. J. Richardson in 1875.

Macrura.

Gebia Pugettensis Dana.

A male 85 mm. long, shore, Queen Charlotte Islands.

Crangon vulgaris J. C. Fabricius ex Linné.

Crangon nigricauda Stimpson.

Crangon nigromaculata Lockington.

Crangon Alaskensis Lockington.

A single dry and broken specimen from Vancouver Island.

Nectocrangon lar Brandt (ex Owen).

Two males and three females from Vancouver Island.

The specimens are all dry and in rather bad condition for a careful comparison, but they all differ considerably from any Atlantic specimens which I have seen. In the specimens from Vancouver, the rostrum and the spines of the dorsal carina of the carapax are longer and more slender than in specimens from off Nova Scotia and from the Gulf of St. Lawrence. In the Vancouver specimens, the dorsal carina on the third, fourth and fifth segments of the abdomen is broad and rounded, or flattened, and scarcely reaches the posterior edges of the segments, and the two carinæ upon the sixth segment are rounded and fade out in the same way before reaching the posterior extremity of the segment; while in the Atlantic specimens referred to, the carina upon the third, fourth and fifth segments is acute, and on the fifth segment projects from the posterior margin in a more or less conspicuous triangular tooth, and the carinæ on the sixth segment are acute and continue to or a little over the posterior extremity of the segment. These differences may possibly indicate distinct geographical species.

Paracrangon echinatus Dana.

Vancouver Island.

Hippolyte Gaimardii Milne-Edwards.

Hippolyte Gaimardii Milne-Edwards, Hist. nat. des Crust., ii., p. 378, 1837.

Hippolyte pandaliformis Bell, History of British Stalk-eyed Crustacea, p. 294. [1850 ?]

Hippolyte Belcheri Bell, in Belcher, Last of the Arctic Voyages in Search of Sir John Franklin, vol. ii., p. 402, pl. 34, fig. 1, 1855.

A single dry female specimen from Vancouver Island appears unquestionably of this species. It is about 33mm. long; the carapax, including the rostrum, 13·8mm.; the rostrum, 7·3. The dorsal carina is armed with six teeth, of which three are on the rostrum, and there are three teeth in the lower edge of the rostrum.

Hippolyte spinus White.

Cancer spinus Sowerby, British Miscellany, p. 47, pl. 23, 1805.

Alphœus spinus Leach, "Edinburgh Encyclopedia, vii., p. 431, 1813-14," (Miers), American edit., vii., p. 271; Transactions Linnean Soc. London, xi., p. 347, 1815.

Hippolyte Sowerbœi Leach, Malacostraca Podophthalmata Britanniæ, pl. 39, 1817.

Hippolyte spinus White, List Crust. British Museum, p. 76, 1847.—Bell, History of British Crustacea, p. 284 [1847?].

Hippolyte spina Stimpson, Proceedings Acad. Nat. Sci. Philadelphia, xii., p. 34 (103), 1860; Annals Lyceum Nat. Hist. New York, x., p. 126, 1871.

There are seven dry specimens from Vancouver Island, and two in alcohol from shallow dredging, Queen Charlotte Islands, which agree well with Atlantic specimens of this species.

Hippolyte Phippsii Kröyer.

Hippolyte Phippsii Kröyer, Naturhistorisk Tidsskrift, iii., p. 575, 1841 (♂).

Hippolyte turgida Kröyer, ibid., p. 575, 1841 (♀).

Hippolyte vibrans Stimpson, Annals Lyceum Nat. Hist. New York, x., p. 125, 1871 (♂, *var*).

Hippolyte Ochotensis Brandt, Middendorff's Sibirische Reise, ii., p. 120, pl. 5, fig. 17, 1849 (♀).

A female from 15 to 8 fath., Virago Sound, Q.C.I. Length, 32mm.; length of carapax, including rostrum, 11·6; rostrum, 5·2. The dorsal carina of the carapax and rostrum is armed with eleven teeth, of which the three posterior are the larger, situated near the middle of the carapax and separated considerably from the one next in front, which is just over the base of the rostrum; the remaining teeth are successively nearer to each other toward the tip, which is itself tridentate. There are in addition four teeth on the oblique anterior part of the inferior edge of the rostrum. The dentition of the carapax and rostrum is thus seen to approach pretty closely to Brandt's *H. Ochotensis,* and yet the specimen appears to be unquestionably specifically identical with the well-known Atlantic species, so that I have little doubt that Brandt's species is only a variety of the female of *H. Phippsii.*

Hippolyte brevirostris Dana.

Dana, United States Exploring Expedition, Crust., p. 566, pl. 36, fig. 5, 1852 (given as *H. curvirostris* on plate).

A dry female specimen about $24^{mm.}$ long, from Vancouver Island, agrees well with Dana's figure and description.

Hippolyte Grœnlandica Miers.

Astacus Grœnlandicus J. C. Fabricius, Systema Entomologiæ, p. 416, 1775; Entomologia systematica, ii., p. 484, 1793.

Cancer aculeatus O. Fabricius, Fauna Grœnlandica, p. 239, 1780.

Alpheus aculeatus Sabine, in Supplement to Appendix of Parry's (first) Voyage, p. ccxxxviii., pl. 2, figs. 5-8, 1824.

Hippolyte aculeata J. C. Ross, in John Ross, Appendix to Narrative of a Second Voyage in Search of the North-west Passage, p. lxxxiii., 1835.

Hippolyte armata Owen, Voyage of the Blossom, p. 88, pl. 27, fig. 2, 1839 (♀).

Hippolyte cornuta Owen, op. cit., p. 89, pl. 28, fig. 2, 1839 (♂).

Hippolyte Grœnlandica Miers, Annals and Magazine Nat. Hist., IV., xx., p. 62 (12), 1877.

A female, $44^{mm.}$ long, from shallow dredging, Queen Charlotte Islands.

Pandalus Danæ Stimpson.

Stimpson, Proceedings Boston Soc. Nat. Hist., vi., p. 87, 1857; Journal Boston Soc. Nat. Hist., vi., p. 502 (62), pl. 21, figs. 6-7, 1857.

Several small dry specimens from Vancouver Island, and an alcoholic specimen from shallow dredgings, Queen Charlotte Islands. The last specimen is $74^{mm.}$ long; the carapax including rostrum, $33^{mm.}$; rostrum, $17{\cdot}5^{mm.}$; there are ten teeth in the dorsal crest, half being on the rostrum and half upon the carapax, and in addition there are three at the tip and five beneath the rostrum.

In general appearance, and particularly in the form and dentition of the carapax and rostrum, this species approaches very near to *P. platyceros* Brandt (Middendorff's Sibirische Reise, ii., p. 123, pl. 5, fig. 20, 1851). But, according to Brandt's description, the carapax of the *platyceros* is clothed with short hairs, while in the *Danæ* the carapax and abdomen are smooth and entirely naked.

Pandalus pubescentulus Dana.

An alcoholic specimen from "shallow dredging, Port Simpson to north end of Vancouver Island." The specimen is $49^{mm.}$ long; the carapax including rostrum, 25; rostrum, 14. There are fourteen teeth in the dorsal crest, five on the carapax and nine on the rostrum; the extremity of the rostrum is unarmed above except at the tip, which is bidentate; beneath it is armed with eight teeth, which extend to the tip.

CUMACEA.

Diastylopsis, gen. nov.

The species for which this genus is proposed is very closely allied to *Diastylis* in the structure of the appendages of the cephaloperæon and in the structure of the pleon, but it differs from *Diastylis*, and, as far as I know, from the heretofore described genera of Cumacea, in the consolidation and great expansion of the tergal and epimeral portions of the third and fourth free segments of the peræon, which forms an arched shield-like plate nearly half as large as the carapax. The basal segments of the second pair of gnathopods (third maxillipeds) are more expanded distally and form a much more complete oral operculum than in *Diastylis*. The cephaloperæon, also, is much more elongated and more compressed laterally than in any described species of *Diastylis*.

Diastylopsis Dawsoni, sp. nov.

Female.—The cephaloperæon is considerably longer than the pleon, compressed laterally so that the breadth is little more than a fourth of the length, and the part made up of the free segments is fully as wide and as high as the carapax. The carapax is more than twice as long as high and smoothly rounded above, though the dorsum is compressed somewhat anteriorly. The eye is obscure or wanting, and the anterior lobes of the carapax extend far in front of the ophthalmic lobe and form a prominent and acute rostrum. There is a deep antennal sinus (much deeper than in the species of *Diastylis*) in the anterior margin below the rostrum and bounded inferiorly by the prominent dentiform antero-lateral angle, back of which the lateral margin is dentated for a short distance. The entire surface of the carapax, as well as the dorsal surface of the free segments of the peræon, is perfectly smooth, naked and highly polished, but there are four nearly equidistant, faintly indicated transverse lines crossing the anterior half of the carapax and evidently marking the areolation so conspicuous in some species of *Diastylis*. The first and second of the five free segments of the peræon are short and nearly or quite covered each side by the third segment, which is itself short above but greatly expanded each side into a large plate a third as long as the carapax; the dorsal part of the fourth segment is greatly elongated, and lies between and above the lateral prolongations of the third segment; and the tergal and epimeral portions of these two segments are anchylosed or closely united together, so that the U-shaped suture between them is only faintly indicated. The fifth segment is small, and nearly covered each side by the lateral expansions of the fourth. There are two slender submedian spines upon the ventral side of the fifth segment, and there is a similar single median spine on the first segment of the pleon.

The antennulæ are short, the peduncle reaching scarcely beyond the rostrum; the first segment is stout and about as long as the second and third together, the second is short and stout, and the third, or ultimate, about half the diameter of the second but longer than it; the major flagellum is slender and about half as long as the peduncle; the minor flagellum is little longer than the first segment of the major, and is apparently triarticulate. The rudimentary antenna is scarcely longer than the first segment of the antennula, but has the penultimate segment elongated to about four times its diameter, while all the other segments are very short.

The first gnathopods (second maxillipeds) are nearly as in *Diastylis*, but are very long and slender, and the basal segments are but little stouter than the terminal. The second gnathopods reach a little beyond the tip of the rostrum: the basal segment in each reaches to the antero-lateral angle of the carapax and is very much expanded distally, so that the two together completely close the space between the lateral margins of the carapax; the inner angle of the distal end projects in a very prominent and acute tooth, and the inner edge is margined with short plumose setæ, but the outer surface is smooth and naked like the carapax; the ischium is very short and fully twice as broad as long; the merus is about twice as long as the ischium, not more than half as broad, and bears on the middle of its outer margin a very long plumose seta; the three distal segments are very slender, subequal in length, and each is considerably longer than the merus. The tip of the flagellum of the exognath reaches slightly beyond the middle of the basis of the endopod itself.

The first peræopods are slender and scarcely as long as the second gnathopods, the tip of the carpus not quite reaching the distal end of the basis of the gnathopod; the ischium is scarcely longer than broad, the merus twice as long as the ischium, and the three distal segments subequal in length and each a little longer than the merus. The tip of the flagellum of the exopod does not reach the extremity of the basis of the endopod. The second peræopods reach but little beyond the middle of the basis of the first pair, and the exopod is about as long as the endopod. The sternum of the third free segment of the peræon is broad and greatly elongated to correspond with the lateral portions of the segment, so that the two anterior pairs of peræopods are separated by a considerable space from the succeeding pairs. The third, fourth and fifth pairs of peræopods are short and as in the species of *Diastylis*, except that the coxal segments of the third pair are very broad, about four times as broad as high, and closely fitted to the corresponding segment of the peræon.

The pleon is cylindrical and slender throughout, very much narrower than the cephaloperæon, and the segments increase slightly and regularly from the first to the sixth. The telson is shorter than the sixth segment, swollen for the proximal half its length, then suddenly narrowed into a slender terminal portion which is armed either side with about five or six very slender spiniform setæ, and at the tip with two styliform setæ nearly half as long as the telson itself. The peduncles of the uropods are slender, not quite twice as long as the telson and armed along the distal half of the inner margin with approximately ten very long setæ. The inner ramus is narrow, about half as long as the peduncle, composed of three segments, armed along the inner edge with approximately twelve slender spines, at the tip with a larger spine, and along the outer edge with a few setæ. The outer ramus is a little longer than the inner, slender, and armed along the outer edge and at the tip with setiform spinules. The telson and uropods are more or less imperfect in all the specimens examined, and do not admit of very exact description.

All the *males* examined are immature and of about the same size as the females. They differ from the females, as in the species of *Diastylis*, in having rudimentary exopods on the third and fourth peræopods and in having rudimentary appendages upon the first and second segments of the pleon. The specimens examined show scarcely any differences in the telson and uropods, but these differences would probably be developed in more mature individuals.

A female gives the following measurements:—

Length from rostrum to tip of telson..................	12·2mm.
Length of cephaloperæon along dorsum..................	6·7
Length of carapax along dorsum......................	4·2
Greatest height of carapax..........................	2·0
Greatest breadth of carapax.........................	1·8
Length of 3rd and 4th free segments of peræon along dorsum..	1·8
Length of pleon to tip of telson......................	5·6

The few specimens of this very interesting and pretty species were all from 111 fath., Dixon Entrance, Q.C.I. It is interesting to notice that it was associated with *Synidotea nodulosa*, a species before known only from the Atlantic.

ISOPODA.

Lygia dilatata Stimpson.

One specimen from near Victoria, V.I.

Synidotea nodulosa Harger.

Idothea nodulosa Kröyer, Naturhist. Tidssk., II., ii., p. 100, 1846; in Gaimard, Voyage en Scandinavie, pl. 26, fig. 2, 1849.

Synidotea nodulosa Harger, Amer. Jour. Sci., III., xv., p. 374, 1878; Proceedings United States National Museum, 1879, p. 160, 1879.

Two specimens from 111 fath., Dixon Entrance, Q.C.I. It has been found in the Atlantic from George's Banks and Nova Scotia to Greenland, but has not been recorded heretofore from the Pacific. The specimens were determined by Mr. Harger.

Sphæroma sp.

A small species from Dolomite Narrows, Q.C.I. It is apparently quite distinct from *S. Oregonensis* Dana and from *S. amplicauda* Stimpson, the only species, as far as I know, described from the north-west coast of America.

Tanais? sp.

There are two dry specimens of a small Tanaid from 15 to 18 fath., Virago Sound, Q.C.I.

CIRRIPEDIA.

Tetraclita porosa Darwin

Near Victoria, V.I.

Lepas anatifera Linné

Near Victoria, V.I.

APPENDIX E.

PLANTS COLLECTED IN THE QUEEN CHARLOTTE ISLANDS, 1878.

The following list of plants has been prepared by Prof. J. Macoun, of Albert College, Belleville, who has kindly examined the specimens collected:—

RANUNCULACEÆ.

Ranunculus Nelsoni, Gray.
" occidentalis, Nutt.
Coptis asplenifolia, Salisb.
Aquilegia formosa, Fisch.

CRUCIFERÆ.

Arabis hirsuta, Scop.
Cochlearia Angelica, L.

CARYOPHYLLACEÆ.

Arenaria peploides, L.; var. oblongifolia, Fenzl.
Sagina procumbens, L.

PORTULACACEÆ.

Claytonia Sibirica, L.
" parvifolia, Mocino.

LEGUMINOSÆ.

Lupinus Nootkatensis, Donn.
Trifolium involucratum, Willd.
Vicia gigantea, Hook.
Lathyrus maritimus, Bigel.

ROSACEÆ.

Spiræa Aruncus, L.
Geum macrophyllum, Willd.
Fragaria Chilensis, Duchesne.

Potentilla fragiformis, Willd; var. villosa, Regel.
Rubus ursinus, Cham.
" Nutkanus, Mocino.
" spectabilis, Pursh.
Rosa Nutkana, Presl.

Saxifragaceæ.

Saxifraga leucanthemifolia, Michx.; var. Brunoniana, T. & G.
" sileniflora, Sternb.
Heuchera micrantha, Dougl.
Tiarella trifoliata, L.

Crassulaceæ.

Sedum Rhodiola, D C.
" spathulifolium, Hook.

Onagraceæ.

Epilobium angustifolium, L.
" tetragonum, L.

Umbelliferæ.

Archangelica Gmelini, D C.

Rubiaceæ.

Galium triflorum, Mx.

Compositæ.

Aster salsuginosus, Rich.
Solidago Canadensis, L.
Grindelia integrifolia, D C.
Achillæa millefolium, L.; var. lanata, Hook.
Tanacetum Huronense, Nutt.
Nabalus alatus, Hook.
Franseria bipinnatifida, Nutt.

Campanulaceæ.

Campanula Scheuchzeri; var. heterodon, Gray.

Ericaceæ.

Vaccinium parviflorum, Smith.
Gaultheria Shallon, Pursh.
Andromeda polifolia, L.
Menziesia glabella, Gray.
Kalmia glauca, Ait.
Moneses uniflora, Gray.

Plantaginaceæ.

Plantago maritima, L.

Primulaceæ.

Trientalis Europæa, L.

Scrophulariaceæ.

Mimulus luteus, Willd.
Castilleia pallida, Kunth.
Rhinanthus Crista-galli, L.
Brunella vulgaris, L.
Stachys ciliata, Dougl.; var. pubens, Gray.

Borraginaceæ.

Mertensiana maritima, Don.

Gentianaceæ.

Gentiana Amarella, L., var. acuta, Hook.

Chenopodiaceæ.

Atriplex Alaskensis, Wat.

Betulaceæ.

Betula sp.

Coniferæ.

Pinus contorta, Dougl.
Abies Englemanni, Parry. ?
" amabilis, Forbes. ?
Thuja gigantea, Nutt.
Cupressus Nutkatensis, Lamb.

Orchidaceæ.

Goodyera Menziesii, Lindl.
Spiranthes Romanzoviana, Cham.
Corallorhiza Mertensiana, Bong.

Lilliaceæ.

Smilacina bifolia, Ker; var. Canadensis, Gray.
Fritillaria lanceolata, Hook.

Cyperaceæ.

Carex alpina, Swartz.
" atrata, L.

Gramineæ.

Agrostis eqivalvis, Trin.
Festuca ovina, L.
Elymus mollis, Trin.
Aira caryophyllea, L.
" cæspitosa, L.

Filices.

Adiantum pedatum, L,
Lomaria Spicant, Den.

Lycopodiaceæ.

Selaginella rupestris; var. tropica, Spring.

Musci.

Dicranum scoparium, Hedw.
Mnium punctatum, Hedw.
Funaria hygrometrica, L.
Meesia uliginosa, Hedw.
Bartramia pomiformis, L.
Hypnum loreum, L.
" plumifera, Mutt.
" splendens, Hedw.
" undulatum, L.

Hepaticæ.

Chiloscyphus polyanthus, L.
Jungermannia sphærocarpa, Hook.

Lichenes.

Cladonia gracilis, Fr.
Sphærophorus globiferis, D C.

APPENDIX F.

METEOROLOGICAL OBSERVATIONS ON THE COAST OF BRITISH COLUMBIA—MAY 28 TO OCTOBER 17, 1878.

The following Meteorological Record, kept during the period occupied by the researches of 1878, while leaving much to be desired, is as complete as the circumstances and time at disposal allowed. As our knowledge of the climatology of this part of the west coast is very slight, it may be of some importance.

The barometer readings are those of a small aneroid, and therefore to be depended on only as indicating relative changes of pressure. The readings given are uncorrected, though it is known that the error of the instrument increased during the summer, being on May 28th 0·12 inch too high—on October 17th 0·24 inch too high.

The temperature is stated in degrees Farenheit.

The force of the wind is estimated according to Beaufort's scale. Those observations of its force or direction marked thus (*) are uncertain, owing to local circumstances.

Victoria to Milbank Sound.

PLACE.	Date.	Hour.	Barometer,	Temperature of Air.	Maximum.	Minimum.	Direction of Wind.	Force of Wind.	Amount of Cloud.	Kind of Cloud.	Temperature Surface Water.	Weather at Time.	Weather during Last Interval.
				°	°	°					°		
Near Dodd Narrows	May 28.	7 p.m.	29.85	54	....	....	E.	3	10	S.	53	Fair	Showers during day.
Nanaimo	29.	7 a.m.	29.925	55	61	50.5	Var.	1	9	S. K.	....	"	Showery.
Off Lasqueti Island	29.	7 p.m.	29.95	55	....	....	E.	4	9	C. S.	54		Cloudy, with showers; light S.E. winds.
Off Comox	30.	7 a.m.	29.965	56	61	51	W.	2	10	S.	....		Easterly wind dies away at 5 a.m.
Seymour Narrows	30.	7 p.m.	29.94	58	....	....	Var.	2	5	C. K.	51.5		Morning calm; p.m., S.E. wind, clearing.
Plumper Bay	31.	7 a.m.	29.975	55.5	69	52.5	——	0	7	S. & C. K.	....		Calm; generally cloudy.
Johnstone Strait, off Ripple Point.	31.	7 p.m.	29·35	62.5	....	....	Var.	2	3	C.K.&C.S	49.5		Morning calm; p.m., S.E. wind, light.
" " off Port Neville	June 1.	7 a.m.	30.09	55.5	69	53.5	N. W.	5	7	C. K, & S.	....		N.W. winds and calm; partly cloudy.
" " off Robson Bight	1.	7 p.m.	30·18	53	....	....	W.	4	9	C. K. & S.	50		Westerly winds force 4 to 5; cloudy.
" " off Beaver Har.	2.	7 a.m.	30.22	58	57.5	50	Var.	1	9	S. & C. K.	....		Light westerly wind till 3 a.m., then calm.
Broughton Strait, off Port McNeil	2.	7 p.m.	30.22	54	....	....	W.	6	7	C. K. & S.	49		Westerly wind freshening from 1 p.m.
Queen Charlotte Sd., off Suquash	3.	7 a.m.	30.20	52.5	....	....	Var.	1	1	S. & K.	....		Nearly calm; partly cloudy.
Goletas Channel	3.	7 p.m.	30.22	55	....	....	W.N.W	3	6	C. & C, S.	52		Westerly wind rose at 1 p.m.: freshened to 6; now falling, and generally clear.
" "	4.	7 a.m.	30.28	55	72.5	50.5	E.	3	10	S.	....		Calm and partly cloudy till 3 a.m.

Queen Charlotte Sd., off Smith Sd.	June 4.	7 p.m.	30.33	56	....	....	N.	3	4	C. K. & S.	54	....	Calm till 2.30, then light breeze from West; veering N.; drizzling from 10 a.m to 3 p.m.
" " " off "	5.	7 a.m.	30.29	56	62	53.5	N.	3	10	....	....	Fog	Nearly calm; fog from 1 a.m.
Entrance to Fitzhugh Sound	5.	7 p.m.	30.16	69	....	....	Var.	1 to 2	1	C.S.	60.5	....	W. & N.W light breezes; clear since noon.
" " "	6.	7 a.m.	30.09	60	81	55	S.W.	2	0	——	....	Mist	Calm or light westerly airs; clear.
Safety Cove, " "	6.	7 p.m.	29.97	62.5	....	....	N.N.W	3	3	C.K.&C.S.	59	Fog	Nearly calm till 3 p.m., then northly winds.
" " " "	7.	7 a.m.	30.00	58	86	55.5	Var.	1	10	S.	....	....	Nearly calm all night; clouding over; showers early this morning.
Fitzhugh Sound	7.	7 p.m.	30.07	55.5	....	....	W.	5	7	K. & C. K,	58	....	Morning showery; southerly wind; veering.
Lama Passage	8.	7 a.m.	30.10	53	....	50	Var,	1	10	C. K, & S.	....	....	Nearly calm all night; cloudy.
Kynumpt Harbor, Milbank Sound.	8.	7.45 pm	30.10	53	....	....	....	0	10	S & K.	58	Showery.	Showery & clouded since noon; S.E. lt. wds.
Near Kynumpt Harbor	9.	7.45 a m	30.145	53	61	50	E.	2	10	C. K. & S.	....	S...........	Showery, calm and cloudy during night.
Off Day Point	9.	7 p.m.	30.17	55	....	....	S.E.	4	7	K.S&C.K.	55	....	Morning showery; afternoon clearing.

Queen Charlotte Islands and Vicinity.

At sea between Day Pt. & Q. C. I's.	J'ne 10.	7 a.m.	30.18	62.5	63	50	S.E.	3	6	C.K.	....	....	Nearly calm till about 6 a.m.
" " "	10.	7 p.m.	30.22	54	....	....	W.N.W	4	1	S.	54	....	Light S. E. wind falling calm; from 11.30 N.W. wind rising to 5.
" " "	11.	7 a.m.	30.28	53	65	....	W.N.W	8	2	C.K.	....	....	Blowing hard fm. N. W & W N.W. s'ce dark.
" " "	11.	7 p.m.	30.28	61	....	....	N.	2	0	——	55	....	Calm since 2.30 p.m.; breeze now stirring.
E. entrance Houston-Stewart	12.	7 a.m.	30.325	55	66	51	N.W.	2	0	——	....	....	Light E.N.E. airs; clear.
Houston-Stewart Channel	12.	7 p.m.	30.28	63	....	....	Var.	2	3	C.	52	....	Clear; light variable winds.
" " "	13.	7 a.m.	30.265	59	....	46.5	S.W.	3	9	S. & C. K.	....	....	Cloudy; some wind.
" " "	13.	7 p.m.	30.15	55.5	....	....	S.W.	1 to 2	9	N.	51	Raining ...	Cloudy; raining steadily since 10 a.m.
" " "	14.	7 a.m.	30.17	51	55.5	47..	W.S.W.	3	10	C.K.	....	....	Showery during early part of night; cl'ded.
" " "	14.	8 p.m.	30.19	52.5	....	....	S.W.	2	3	K.	51	....	S.W. wd.; showers dur'g day; partly cl'ded.
" " "	15.	7 a.m.	30.22	48	....	42	W.	2	3	C.K.&C.S.	....	....	Fine during night; partly clouded.
" " "	15	7 p.m.	30.17	51.5	....	....	S.W.	2	10	S, & C. K.	51.5	....	South-westerly winds; passing showers.
" " "	16.	7 a.m.	30.03	53	63	47	S.W.	2	10	C.K.&C.S.	....	....	Light winds; clouded.
South Cove	16.	7 p.m.	29.87	57	....	....	S.	2	10	C. K. & S.	51	Showery...	Light winds; southerly, drizzling showers.
" "	17.	7 a.m.	29.725	54.5	58.5	51	S.	3 to 4	10	N.	....	" ...	Heavy rain and s'therly wind during night.
" "	17.	7 p.m.	29.97?	60.5	....	....	S.S.W.	2	9	K.S.	51.5	....	Southerly wind, with showers; partly clear.
" "	18.	7 a.m.	30.04	52	59	50	S.W.	2	10	S. & K. S.	....	....	Cloudy, but without rain.
Harriet Harbour	18.	7 p.m.	30.03	55.5	....	....	S.E.	2 to 5	10	N.	53.5	Raining ...	Showers & drizz'g rn. with squalls; cloudy.
" "	19.	7 a.m.	29.91	55	57.5	52.5	Var.	1	10	N.	....	" ..	Light wind, with heavy showers dur. night.
" "	19.	7 p.m	29.74	51.5	....	....	S.S.E.	7 to 10	10	N.	51.5	Squalls, rn.	Heavy rain all day; wind rising about noon.
" "	20.	7 a.m.	30.045	53	59.5	48	S.W.	3	5	C.K.	....	Fair, clr'g.	Gale abating from 1.30 a.m.
" "	20.	7 p.m.	30.10	52	....	....	W.S.W.	2	8	C K.	51.5	Pass'g sh's.	Showery, with moderate south-west winds.
" "	21.	7 a.m.	30.13	48.5	56.5	45.5	S.S.W.	2	10	C. K. & S.	....	Showery...	Showery; partly clear at times.
" "	21.	7.30 p m	30.00	51.5	....	...	S.E.	3	10	N.	51.5	Raining ...	Heavy showers; almost continu's dur. day.
" "	22.	7 a.m.	29.83	53	53	50	S.	3 to 4	10	N.	....	" ...	Rains heavily all night.
" "	22.	7.30 p m	29.84	52	....	....	S.W.	2 to 3	3	K. & C. K.	51.5	Fair, clr'g.	Heavy rain and squally till 3.30 p.m.
" "	23.	7 a.m.	29.90	49.5	56	46	S.W.	2	10	C. K.	....	Showery...	Partly clear, and fair during night.
Tangle Cove, Burnaby Strait	23.	7 p.m.	30.06	49.5	....	....	W.S.W.	4	10	C. K.	51.5	Squalls, rn.	Almost continuous rain, with squalls.

Queen Charlotte Islands and Vicinity.

PLACE.	Date.	Hour.	Barometer.	Temperature of Air. °	Maximum. °	Minimum. °	Direction of Wind.	Force of Wind.	Amount of Cloud.	Kind of Cloud.	Temperature Surface Water. °	Weather at Time.	Weather during Last Interval.
Tangle Cove, Burnaby Strait	J'ne 24.	7 a.m.	30·14	48.5	52	47	S.S.W.	2	10	C. K. & S.		B'ze above.	Heavy showers and squalls.
" " " "	24.	7 p.m.	29.88	52			S.W.	3 to 5*	10	N.	50	Sq'lls. & rn,	Morning showery; heavy rain since 1 p.m.
" " " "	25.	8 a.m.	29.605	54	53	50	S.W.	3 to 5*	10	N.		" "	Heavy rain and squalls during the night.
" " " "	25.	7 p.m.	29.67	52			W.S.W	3 to 4*	9	K. & C. K.	50.5	Clearing.	Continuous heavy rain till 6 p.m.
" " " "	26.	7 a.m.	29.86	49.5	55.5	48	N.W.	2 to 5*	9	C.K.		Sq'll's & rn..	Heavy showers at intervals.
Dolomito Narrows	26.	7 p.m.	29.93	51.5			W.	3	9	C.K.	52	" "	Heavy showers at intervals; clearing.
Wanderer Cove	27.	7 a.m.	29.985	48.5	57.5	47	S'th'ly.	2	10	N.		Raining ...	Heavy showers during the night.
Hutton Inlet	27.	7 p.m.											Clearing; westerly wind: occ'nal showers.
Wanderer Cove	28.	7 p.m.	30.24	51.5			W.	2	8	K. & C. K.		Fair	Fine day; westerly winds; showers on hills.
" "	29	7 a.m.	30.23	52		48.5	Var.	2	10	C. K. & N.		Driz'g mist.	Fair; generally clouded: light airs.
" "	29.	7 p.m.	30.09	54			E.S.E.	3	10	C. K. & S.	52	Fair	Showers during morning; mist on hills.
" "	30.	7 a.m.	29.91	54	58.5	51.5	S.W.	2	9	C. K. & S.		Showery...	Showery.
Hot Spring Island	30.	7.45 p m	29.95	58			S.S.W.	3	10	N.	50.5	Raining.	Generally overcast; occasional showers.
" " "	July 1.	7 a.m.	29.94	53	58	47.5	N.W.	1	5	C.S.&C.K.		Fair	Fair; partly clear; light winds.
" " "	1.	7.30 p m	29.955	61.5			—	0	3	C.K & C.S		"	Fair; gen. cloudy; light S.E. & N.W. airs.
" " "	2.	7 a.m.	29.99	60.5	69.5	50.5	S.S.E.	1	2	C. & C. S.			Showery during the night.
Bigsby Inlet	2.	7 p.m.	30.07	60							58.5		Light breeze up inlet during day; clear.
" "	3.	7 a.m.	30.07	44.5					10	Mist.			Clear till near morning; calm.
Hot Spring Island	3.	7 p.m.	30.06	61			Var.	1	0	—	52		Fine cloudless day; breeze up inlet.
" " "	4.	7 a.m.	30.03	56		51.5	E.N.E	2	0	—			Fine starlight night.
Echo Harbour	4.	7 p.m.	30.03	63			—	0	2	C.K.&C.S.		Clouds high	Fine warm day; wind up inlet; clear.
" "	5.	7 a.m.	30.15	56.5	70	50	N.N.W	1	8	C. K.			Fair; generally clear during night.
" "	5.	7 p.m.	30.20	60.5			?	1	10	C. S.			Clearing till 3 p.m.; light airs.
" "	6.	7 a.m.	30.24	56.5	71.5	53	—	0	10	C. K.		Mist	Clouded; light showers; nearly calm.
Logan Inlet	6.	7 p.m.	30.25	59			—	0	0	—	55	Light airs..	Fine warm and clear day.
Echo Harbour	7.	7 a.m.	30.25	54		47	—	0	1	C. K.			Fine clear and calm night.
" "	7.	8.30 p m	30.19	59		47	—	0	1	C. K.		Wind inl'd	Fair day; light landward winds.
" "	8.	7 a.m.	30.16	55		51.5	— —	0	8	C. S.		Clearing...	Showers in night and early morning.
Richardson Inlet	8.	7.30 p m	30.035	60.5			W S W*	2	9	C. K.	56		Lt. showers; lt., var. winds; partly cl'ded.
" "	9.	7 a.m.	29.88	54	67	51.5	S.S.E.	2	10	S. & C. K.		Lt. sh'wers.	Nearly calm; clouded.
" "	9.	7 p.m.	29.82	54			—	0	10	N.	55	Raining.	Nearly steady light rain since noon.
" "	10.	7 a.m.	29.72	53	57.5	51.5	W.	4	2	C. K. & S.		Clearing.	Rain nearly all night.
Rockfish Harbour	10.	9.30 p m	29.80	51			—	0	5	C. K.	54	Wind dy'g.	Westerly wind, showers and mist on hills.
" "	11.	7 a.m.	29.815	56.5	62.5	48.5	W.N.W	3*	10	C. K. & S.		Showers.	Light showers during night, calm.
" "	11.	7.30 p m	29.65	54			S.E.	Sq'ls.	9	C. K.	56	Sq'lls. & rn.	Showers till noon; p.m. rainy and squally.
" "	12.	3.30 a m	29.72	53	57	50	S.	?	10	N.		Raining....	Raining most of night.
" "	12.	7 p.m.	29.90	53			S.E.	2*	10	N.		"	Nearly steady rain till noon; p.m. showery.

Rockfish Harbour	July 13.	7 a.m.	30.195	54	59.5	47.5	S.W.	?	9	C. K.	....	Bay calm...	Rain in showers during night; overcast
" "	13.	8 p.m.	30.28.	53.5	....	....	W.	3 to 4	8	C. K. & S.	56	Mist	Heavy showers, with squalls, during morning; afternoon finer.
" "	14.	7.30 a.m	30.355	60	60.5	48.5	S.S.W.	2	3	K. & C. K.	....	....	Calm and clear during night.
Off Cumshewa Inlet	14.	7.30 pm	30.20	58	....	....	—	0	10	S. & C. S.	....	Lt. show'rs.	Day fine and warm; light, variable winds.
Cumshewa Inlet	15.	7.30 a.m	29.99	53.5	69	51	S.E.	3*	10	Mist.	....	Raining. ..	Overcast and dull; nearly calm.
" "	15.	7 p.m.	30.00	55	....	....	E.N.E.	6	9	C.K.&C.S.	53	Clearing, ..	Showers and mist, with strong wind.
" "	16.	7 a.m.	30.02	59.5	60.5	50	N.N.W	4	0	—	...	Cloudless ..	Light winds; clearing; no rain.
" "	16.	7 p.m.	......	....	....	....	—	0	0	—	....	....	A very fine and warm day.
" "	17.	7 a.m.	30.01	58.5	....	50	—	0	9	C. K. & S.	....	....	Calm; clear till after midnight.
" "	17.	9 p.m.	30.055	63.5	....	....	W.	2	10	S.	55	....	A.M., light showers.; p.m. fair, partly clouded; wind drawing inland.
" "	18.	7 a.m.	30.08	59.5	....	56.5	—	0	9	S. & C. S.	....	Lt. sho'ers.	Clouded; westerly wind and calm.
" "	18.	8 p.m.	30.12	58.5	....	....	S.S.W.	3	10	S.	54	Shrs & mist.	Easterly wind drawing inland till noon.
" "	19.	7.45 a.m	30.13	57	65.5	53.5	S.W.	3	10	S.	...	Mist	Overcast; light winds.
" "	19.	8 p.m.	30.125	59	....	....	—	0	10	S.	56.5	....	Fresh wind drawing inland all day.
" "	20.	7.30 a.m	30.11	58	64.5	55	N.W.	3	9	S. & C. S.	....	....	Calm, clouded, but fair.
" "	20.	8.43 p.m	30.13	60.5	....	....	—	0	7	C. K.	54.5	....	Light, variable winds; generally cloudy.
" "	21.	7 a.m.	30.135	61.5	69.5	58	S.E.	1	7	C. K. & S.	....	Mist	Nearly calm; partly clear; fair.
" "	21.	7.30 p.m	30.18	59	....	....	N.E.	2	10	Mist.	54.5	Lt. drizzle..	Gen'ly clouded; E. wds.; sh'rs since 4 p.m.
" "	22.	7 a.m.	30.18	57	59	55	—	0	10	Fog.	....	....	Clear above; fog during night.
Coast north of Cumshewa	22.	7 p.m.	30.17	59	....	....	N.E.	3	9	C. K. & S.	....	Fair	Rain till 2 p.m.; S.E. wind during aftern'n.
" " "	23.	7 a.m.	30.17	57	....	....	N.E.	2	10	S.			
Skidegate Inlet	23.	7.30 p.m	30.16	63	....	....	N.E.	2	10	S. & C. S.	....	....	N.E. winds and generally clear weather.
" "	24.	7 a.m.	30.20	58	....	....	—	0	10	S. & C. K.	....	Showery...	Calm; showers in early morning.
" "	24.	7 p.m.	30.22	63.5	....	....	—	0	9	C. K. & S.	....	Fair; mist.	Generally fair; clouded; light, var. winds.
" "	25.	7.30 a.m	30.18	59	....	56.5	—	0	10	N.	....	Raining ...	Overcast, calm; showers since morning.
" "	25.	7 p.m.	30.165	62	....	....	S.	2	9	C.K.&C.S.	....	Fair	Showery till p.m.; light winds variable.
" "	26.	7 a.m.	30.11	60.5	66	54	S.	2	3	C.K.&C.S.	....	"	Nearly calm; partly clouded; fair.
" "	26.	8.30 p.m	30.04	60	....	....	—	0	10	C. K. & S.	....	Light rain.	Showers, nearly cl'r; eve'g o'cast; S. wds.
" "	27.	7 a.m.	30.08	65.5	66	55.5	S.	1	2	C. K.	....	H'vy rain..	Heavy rain; nearly calm.
" " Anchor Cove	27.	7 p.m.	30.15	57.5	....	....	W S W	3	4	C. K.	58.5	Fair	Strong S.W. winds; generally clear.
" " " "	28.	7 a.m.	30.17	57.5	65.5	55	S.W.	4	7	K. & C. K.	....	Showers ...	S.W. wind; partly clear; fair.
" " " "	28.	7 p.m.	30.125	56.5	....	....	S.W.	2	10	N.	58.5	Raining ...	A.M., st'g wd., sh'rs; p.m., lt. wd, h'vy. rn.
" " " "	29.	7 a.m.	30.14	56	66.5	53	S.W.	5	9	C. K.	....	Showers ...	Wind, with rain, most of night.
" " " "	29.	7 p.m.	30.09	57.5	....	....	S.W.	3	9	S. & C. K.	....	Dz'ng mist.	Showery and strong S.W. wind; overcast.
" " " "	30.	7 a.m.	30.035	56.5	64	55.5	S.W.	3	10	S. & C. K.	....	" .	Overcast; S.W. wind; no heavy rain.
" " " "	30.	7 p.m.	30.02	59	....	...	S.W.	3	9	S. & C. K.	58	" .	Overcast, with constant showers.
	31.	7 a.m.	29.94	58	60	55.5	—	0	10	S.	....	Mist; fair .	Heavy rain and S.W. wind most of night.
Skidegate Passage	31.	7 p.m.	29.80	56	....	....	—	0	10	S. & C. K.	....	Showers ...	Southerly wind; heavy rain all day.
" "	Aug. 1.	7 a.m.	29.98	58	....	....	S.S.W.	2	10	S. & C. K.	....	....	Morning calm, generally cloudy, lt. sh'rs.
" "	1.	7 p.m.	29.90	54	....	....	S.E.	5 ?	10	C. K. & S.	....	Showery...	Partly clear, but constant showers.
" "	2.	7 a.m.	29.93	54.5	....	....	S.E.	5 ?	10	C. K. & S.			
Skidegate Inlet	2.	7 p.m.	30.02	54	....	....	E.S.E.	3	4	C.K.&C.S.	....	Fair	Showery, with squalls.
" "	3.	7.30 a.m	30.10	53	....	46.5	E.	2	6	C. K.	....	"	Thunder showers 11 p.m., then fair.
" "	3.	8.45 p.m	30.09	59.5	....	....	—	0	10	N.	....	Raining ...	Easterly winds; partly clear; fair.
" "	4.	7.45 a.m	30.04	59.5	67	53.5	E.	2	9	C. K.	....	Fair	H'vy sh'rs in a.m.; after 2 p.m. fair, ptly clr.
" "	4.	7 p.m.	29.93	59	....	....	N.	2	9	C. K. & S.	....	"	Light showers during day; partly clouded.
" "	5.	7 a.m.	29.78	58.5	65	55.5	N.E.	2	10	S. & C. K.	....	"	Showers in early morning.

Queen Charlotte Islands and Vicinity.

PLACE.	Date.	Hour.	Barometer.	Temperature of Air. °	Maximum. °	Minimum. °	Direction of wind.	Force of Wind.	Amount of Cloud.	Kind of Cloud.	Temperature Surface Water. °	Weather at Time.	Weather during Last Interval.
Coast between Skidegate & Masset.	Aug. 5.	7 p.m.	29.845	57.5	...	....	S.S.E.	3	10	S.	....	Fair	P.M.: Heavy showers; generally cloudy.
" " " "	6	6 a.m.	29.97	57.5	....	....	S.S.E.	4	10	N.	....	Steady rain	Showers during night; cloudy.
" " " "	6.	7 p.m.	30.04	55	....	....	S.S.E.	5	10	C. K. & S.	....	Fair	Heavy S.E. wind; continued light rain.
" " " "	7.	7 a.m.	30.01	58	....	....	E.	5	10	S.	....	Drizzling ..	East wind and heavy rain,
" " " "	7.	7.30 p m	30.06	56.5	....	....	E.	4	10	C. K. & S.	....	Fair	Strong wind and almost constant rain till afternoon.
" " " "	8.	6.30 a m	30.16	59	....	....	S.	2	8	C. K. & S.	....	"	Wind falling at sundown; fair, but cloudy during night.
" " " "	8.	7 p.m.	30.30	58	....	....	S.S.E.	4	8	C. K. & S.	....	"	Steady S.E. wind; partly clear; fair.
" " " "	9.	5.30 a m	30.29	56	....	....	S.S.E.	1	9	S.	....	"	Fair; generally clear.
" " " "	9.	7 p.m.	30.30	58.5	....	....	Var.	1	7	C.K.&C.S.	....	"	Fair; gen. clouded; light variable winds.
" " " "	10.	6.30 a m	30.33	60.5	....	....	—	0	7	C.K.	....	"	Fair; generally clouded and calm.
Masset Inlet	10.	7 p.m.	30.34	60.5	....	....	N.	2	2	C.K.	....	"	Fair; generally clear; light variable winds.
" "	11.	8 a.m.	30.34	58	....	52.5	—	0	10	K.C.	....	Fair; misty	Fair; generally clear, calm.
" "	11.	9.30 p m	30.33	55	....	....	N.W.	2	7	C.K.	....	Fair	Misty; showers, generally fair but clouded; nearly calm.
" "	12.	7 a.m.	30 33	54.5	77.5	49.5	W.	1	9	C.K.	....	"	Fair; light winds; partly clouded.
" "	12.	7.30 p m	30.33	61	....	....	—	0	10	S. & C. S.	....	"	Fair; light north-westerly winds.
" "	13.	6 a.m.	30.29	53	....	....	—	0	10	S. & C. K.	....	"	Clear till after midnight; calm.
" "	13.	7 p.m.	30.255	62.5	....	....	—	0	9	S. & C. K.	....	"	Fair and partly clear till afternoon; then overcast and showery.
" "	14.	8 a.m.	30.13	57	....	....	—	0	10	N.	....	Steady rain	Calm; overcast; heavy rain since early a.m.
" "	14.	7.30 p m	30.04	60	....	....	—	0	10	S.	....	Fair	Heavy and frequent showers; overcast.
" "	15.	7 a.m.	29.98	66	....	....	—	0	10	S. & C. S.	....	Showery ..	Showery and overcast.
" "	15.	7 p.m.	30.01	68	....	....	—	0	7	C.S.&C.K.	....	Fair	Generally overcast: heavy rain at interv's.
" "	16.	7 a.m.	30.09	64.5	....	....	—	0	7	C.K.	....	"	Partly clear; fair.
" "	16.	7 p.m.	30.14	59	....	....	S.S.W.	3	8	C. K. & S.	....	"	Overcast; light showers; S.W. winds.
" "	17.	6 a.m.	30.16	60	....	....	—	0	8	C. K. & S.	....	"	Fair; partly clear.
" "	17.	7.30 p m	30.15	56	....	....	—	0	10	N.	....	Heavy rain	Nearly fair; overcast. Afternoon: Heavy showers; wind S.W
" "	18.	8 a.m.	30.02	56.5	....	54	S.E.	2	10	S.	....	Showery ..	Showers during night; overcast.
" "	18.	9 p.m.	30.09	50	....	....	W.	1	1	S.	....	Fair	A.M. heavy rain; p.m. fair; stg. W. wind.
" "	19.	7 a.m.	30.10	52	58	48	W.	2	9	C. K. & S.	....	"	Clear and fair.
Virago Sound and Naden Harbour	19.	7 p.m.	30.02	54.5	...	....	—	0	2	K. & C. K.	54..	"	Gen. cl'ded; h'vy sho'rs; lt. westerly wds,
" "	20.	7 a.m.	29.98	52	....	....	N.W.	4	3	K.C.	....	....	Nearly calm; generally clear, fair.
" "	20.	7 p.m.	30.00	57	....	....	W.	1	1	C.K.	....	Wd falling.	Fine all day; lt. W. wd.; scatt'ed K. cl'ds.
" "	21.	7 a.m.	30.02	51	....	....	—	0	.8	S.	....	Thin clouds	Generally clear; light winds to calm.

Virago Sound and Naden Harbour.	Aug.21.	7 p.m.	30.05	55.5	....	....	S.	3	10	S.	56.5	Fair	S. wind; clouding over; occas. lt. showers.
" "	22	7 a.m.	30.17	56	....	54	S.	2	10	S. & C. S.	....	"	S. wind; clouded; occasional lt. showers.
" "	22.	7 p.m.	30.265	60	....	....	E.	1	10	S.	57	"	S. wind; clouded: showery.
" "	23.	7 a.m.	30.28	56.5	61.5	55.5	—	0	10	Fog.	....	"	Calm; fair; generally clouded.
Jal-un River	23.	11 p.m.	30.12	....	....	....	W.	2	0	—	...	Fog	A.M., calm, clear; P.M., W. wind; clear; fog banks.
" "	24.	7 a.m.	30.135	56	....	....	N.W.	2	4	C. & C. S.	....	Fog banks.	Clear and fog banks: lt. W. & N.E. wind.
Parry Passage	24.	7 p.m.	30.14	56	...	....	W.	3	10	S.	54	Wd. falling	Fog banks coming in from west.
" "	25.	7 a.m.	30.13	55.5	....	...	—	0	3	C. & C. S.	....	Fair	Generally clear; light westerly wind.
" "	25.	8 30 p m	29.935	58.5	....	....	E.	2	10	S. & C. S.	....	"	A.M., clearing, lt, var. winds; P.M., clouding over.
" "	26.	7 a.m.	29.97	58.5	....	....	E.	4	10	"	....	Drizzling	Overcast; wind 2; showery.
" "	26.	7.30 p m	30.02	60	....	....	S.S.E.	3	8	C. K. & S.	....	Fair	Clouded, with heavy showers.
" "	27.	7 a.m.	30.03	58.5	....	55	S.S.E.	3	10	"	....	Raining	Heavy showers; cloudy.
Dixon Entrance	27.	7 p.m.	30.045	59.5	...	....	—	0	10	S. & mist.	54	Drizzling	Overcast; heavy showers; easterly wind.
" "	28.	7 a.m.	30.09	56	62	....	W.	2	7	C. K. & S.	....	Clearing	Overcast; heavy rain.
" "	28.	7 p.m.	30.12	56	....	...	E.	1	10	S. & C. S	56	Fair	Showers; overcast; light E.S.E. breezes.
" "	29.	7.30 a.m	30.17	61	60.5	53.5	W.S.W	2	8	C. K. & S.	....	Clearing	Fair; partly overcast: light S.W. winds.

Port Simpson to Milbank Sound.

Port Simpson	Aug.29.	7 p.m.	30.20	58	....	....	W.S.W.	2	10	S. & C. K.	57.5	Lt. sho'ers.	Steady light wind; generally overc't; fair.
" "	30.	8 a.m.	30.225	57	64	51.5	—	0	6	C. K.	....	Fair	Nearly calm; fair, partly clear.
" "	30.	9 p.m.	30.13	55.5	....	....	S.E.	2	10	N.	....	Raining	Day fair, partly clear; lt. southerly winds.
" "	31.	7 a.m.	30.01	57	63.5	55	S.	4	10	"	....	Rn. squalls.	Squalls, southerly wind and rain.
" "	31.	6.30 p m	29.88	60	....	....	S.E.	4	10	S. & Mist.	....	" "	Strong wind and heavy showers.
" "	Sept. 1.	7 a.m.	29.87	55.5	61.5	54	"	4	8	K.C.&C.S.	....	Showery	Similar wind; frequent heavy rain.
Chatham Sound	1.	7 p.m.	29.92	55	....	....	"	6	10	S.	....	Light sh's.	Cloudy; strong E.S.E. wind; some rain.
" "	2.	7 a.m.	30.13	49	58	....	S.S.W.	4	10	N.	....	Raining	Rain and wind all night.
Metla-Katla Harbour	2.	10 p.m.	30.415	53	....	....	S.E.	1	4	C. K.	....	Partly clear	Heavy showers; overcast.
" "	3.	7.30 a m	30.43	53	59	51	S.S.E.	3	10	N.	....	Raining	Partly clear; little rain.
" "	3.	9 p.m.	30.32		....	....	"	6	10	"	....	Raining	Heavy wind and rain.
" "	4.	7 a.m.	30.315	53.5	55	51.5	S.	2	10	S.	....	Fair	Rain and some heavy squalls.
Chatham Sound	4.	7 p.m.	30.27	55	....	....	"	3	10	K. C. & S.	53	"	Fair; occasional gleams of sun; lt. winds.
" "	5.	7 a.m.	30.24	53.5	58.5	45	S.S.W.	3	9	"	....	Showery	Southerly wind; heavy showers.
Arthur Passage	5.	7 p.m.	30.29	53	....	....	N.*	3	10	K.C.	53	"	Light southerly winds, probably westerly outside; light showers; gen'y overcast.
" "	6.	7 a.m.	30.37	51.5	60.5	50.5	W.	2	4	K.&C.K.	....	Fair	Nearly calm; partly clear; fair.
Grenville Channel	6.	7 p.m.	30.46	56	....	....	N.N.W.	3	3	K.	53.5	"	Morning calm till 10 o'clock, when N.W breeze; generally clear.
" "	7.	7 a.m.	30.555	50	57.5	47.5	N.W.*	Var.	1	C.	....	Mist	Clear; light northerly winds.
Wright Sound	7.	7 p.m.	30.54	59.5	....	....	"	3	1	"	55	....	Southerly wind in passage till 4 p.m., when north-westerly; clear; fair.
McKay Reach	8.	7 a.m.	30.56	52.5	63.5	49	E.*	4	1	"	....	....	Nearly calm during night; clear.
Graham Reach	8.	7 pm.	30.465	60	....	....	N.*	2	3	"	52.5	....	Strong to lt wd., prob. west'y outside; clear.

Port Simpson to Milbank Sound.

PLACE.	Date.	Hour.	Barometer.	Temperature of Air.	Maximum.	Minimum.	Direction of Wind.	Force of Wind.	Amount of Cloud.	Kind of Cloud.	Temperature Surface Water.	Weather at Time.	Weather during Last Interval.
				°	°	°					°		
Klemtoo Passage	Sept. 9.	7 a.m.	30.435	49	68	48	—	0	0	—	....	....	Light winds, northerly in passage; clear.
Milbank Sound	9.	7 p.m.	30.33	53.5	....	....	—	0	0	—	57.5	....	Lt. winds draw'g up channel from southw'd.
" "	10.	7 a.m.	30.285	57	63	55	Var.	1 to 2	0	—	....	....	Calm; clear or light C. clouds.
Kilkite Village, Seaforth Channel	10.	7 p.m.	30.19	66	....	....	W.	2	1	C.K.	....	Wind var.	Morning calm; afternoon, westerly wind.
" " " "	11.	6 a.m.	30.185	51	80	50	Var.	1	1	C.S.	....	......	Nearly calm; clear.
" " " "	11.	7 p.m.	30.17	63.5	....	....	N.W.	3	1	C.	....	W'd. fall'g.	Fresh westerly winds; afternoon, strong puff from N.W.; at sundown, clear.
" " " "	12.	7 a.m.	30.23	53	83.5	48	—	0	6	C.K.	....	Clearing.	Light N.W. wind to calm; generally clear.

Milbank Sound to Quatsino, and thence to Victoria.

PLACE.	Date.	Hour.	Barometer.	Temperature of Air.	Maximum.	Minimum.	Direction of Wind.	Force of Wind.	Amount of Cloud.	Kind of Cloud.	Temperature Surface Water.	Weather at Time.	Weather during Last Interval.
Near Bella Bella	Sept 12.	7 p.m.	30.19	60.5	..	....	—	0	0	—	59	W'd ceased.	Light westerly wind since noon; clear.
Fitzhugh Sound	13.	7 a.m.	30.25	58	68	56.5	N.E.	5	1	C.	....	....	Clear; strong N.E. wind latter part of night.
" "	13.	7 p.m.	30.16	57	....	....	—	0	0	—	54	....	Northerly, then westerly wind; clear.
Queen Charlotte Sound	14.	7 a.m.	30.22	54	68	51	—	0	2	C.K.	....	....	Strong wind out of Fitzhugh Sound for two hours, then calm; clear.
Shadwell Passage	14.	7 p.m.	30.18	53	....	....	Var.	1	0	—	47	....	Calm; afternoon, light westerly wind; clear.
" "	15.	7 a.m.	30.20	47	61	42.5	S.E.	2	1	C.	....	....	Light airs; clear.
Off Cape Commerell	15.	7 p.m.	30.205	51	....	....	W.N.W	3	10	S.	50	Fair	N.W. wind, generally light; clouding.
" "	16.	7 a.m.	30.21.	55.5	59	52	—	0	10	S.	....	"	Nearly calm; generally clouded.
" "	16.	7 p.m.	30.23.	56.5	..	...	N.W.	2	9	S. & K. C.	48.5	"	Nearly calm till 5 p.m.; cloudy.
Off Quatsino	17.	7.30 a m	30.21	57	61.5	53	N.N.W	3	9	S. & K. C.	..	"	Light to fresh N.W. w'ds.; chiefly clouded.
Forward Inlet	17.	7 p.m.	30.16	58	....	....	N.E.	2	7	K.C.	54.5	"	Wind veering to N.E.; fair; generally clouded.
" "	18.	7 a.m.	30.17	55	67	54	N.E.*	1	9	S.	...	"	Nearly calm; partly clear; fair.
" "	18.	7 p.m.	30.18	57	....	....	—	0	10	S.	...	Fair; mist.	Westerly wind; fair; clear.
" "	19.	7 a.m.	30.24	53.5	68	52	—	0	0	—	....	Fog.	Misty and overcast; calm.
Quatsino Sound	19.	7 p.m.	30.22	56	....	....	W.*	3	10	S.	....	Mist	Clouded; misty; fair.
" "	20.	7 a.m.	30.265	53.5	58.5	51.5	—	0	10	S.	....	Fair	Calm; overcast; fair.
" "	20.	7 p.m.	30.21	56	....	....	—	0	10	S.	....	"	Overcast; fair; nearly calm.
" "	21.	7 a.m.	30.07	54.5	....	...	W.	2	5	C. K. & S.	....	Clearing ...	Heavy showers during night.
" "	21.	7 p.m.	30.125	52	....	...	—	0	6	K.C.	....	....	Strong westerly wind; heavy showers.
" "	22.	7 a.m.	30.18	54.5	....	...	—	0	7	K. C. & S.	....	Cl'ds fin W.	Heavy showers; partly clouded; calm.

Quatsino Sound	Sept 22.	7 p.m.	30.175	49.5	....	....	—	0	4	K.C.	....	Fair	Occasional showers; westerly wind.
" "	23.	7 a.m.	30.08	53	....	....	W.	1	8	K. C. & S.	....	"	Heavy rain during night.
" "	23	7 p.m.	30.14	51	....	...	—	0	6.	K.C.	....	Misty	Heavy showers since noon.
" "	24.	7 a.m.	30.275	47	....	43.5	—	0	10	S. & K. C.	....	Fair	Fair; partly clouded; calm.
" "	24.	7 p.m.	30.23	52	.. ..	....	—	0	10	S.	....	"	Calm; clouded; showery.
" "	25.	7 a.m.	29.95	43.5	57.5	43	S.S.E.	3	10	K. C. & S.	....	Showery ..	Heavy rain during night.
Forward Inlet	25.	7 p.m.	29.765	55	....	....	"	9	10	"	....	" ..	Wind generally near 9; clouded, h'vy rain.
" "	26.	7 a.m.	29.70	56	56	53	S.	9	10	N.	....	Rain'g hvy.	Heavy wind and rain; cloudy.
" "	26.	7 p.m.	29.61	54	....	....	S.W.*	3	10	"	....	Raining ...	A.M., h'y rn. & wd.; P.M., S.W. wd., sho'ry.
" "	27.	7 a.m.	29.655	51.5	58	49.5	S.W.	1	7	C.S.&C.K.	....	Fair	Light winds; heavy showers; overcast.
Off Quatsino	27.	7 p.m.	29.78	53	....	....	N.E.	2	3	C.K.	54.5	Fair, mist.	Morning, S.W. veering to N.W.; after dark to N.E., light; clearing, light showers.
"	28	7 a.m.	29.82	53	56	42	N.W.	6	2	"	....	Fair	Nearly calm, clear; wind rising ab't dawn.
Off Cape Commerell	28.	7 p.m.	29.59	51	...	....	S.E.	6	10	K. C. & S.	....	Lt. show'rs.	Wind going round to N.W., then falling lt. and backing round by S. to S.E.; cloud'g.
Bull Harbour	29.	7.30 a m	29.34	50	60.5	46	E.S.E.	8	7	S. & C.	...	Squalls	Wind rising to 9; little rain.
" "	29.	7 p.m.	29.56	51	..	....	S.E.*	2	0	—	.	....	Wind falling; sky clearing.
" "	30.	7 a.m.	29.44	47	56.5	45.5	"	4	10	S.	....	Begin. to rn.	S.E. wind rising; sky cloudy.
" "	30.	7 p.m.	29.43	52	....	....	S.E.	3	10	N.	....	Rn, wd falls	Wind rising to 9 from S.E. P.M., falling, showery; barom. down to 29·32 at 2 p.m.
" "	Oct. 1.	7 a.m.	29.90	49.5	52.5	49.5	W.	5	4	C.K.	....	Clearing ...	Blowing hard from W. since midn't; sho'ry.
Beaver Harbour	1.	7 p.m.	30.16	50	..	....	S.*	1	3	C.S.	....	Fall'g calm.	Westerly wind with showers; partly cl'ded.
" "	2.	7 a.m.	30.33	47.5	55	47	Var.	1	9	S. & C. S.	....	Raining .	Heavy showers; nearly calm.
" "	2.	7 p.m.	30.40	48.5	...	....	—	0	3	C.S.	....	Fair	Wds. prob. W. outside; here var. h'y sho'rs.
" "	3	6 a.m.	30 445	44.5	57.5	43.5	—	0	8	C.S.&K.C	....	"	Calm. showery; partly clear.
McNeil Harbour	3.	7 p.m.	30.365	40	...	....	—	0	0	—	....	....	Morning overcast; clearing; light, variable winds. Afternoon, N.E.; generally clear.
" "	4	7 a.m.	30.23	43.5	....	...	S.E.	4	10	S. & C. K.	....	Fair	Calm till after midn't; clear, clouding, fair.
Alert Bay	4.	7 p.m.	30.11	49	....	..	S.E.*	5	10	S.	....	Lt. show'rs.	Wind rising to 7; showery, overcast.
" "	5.	7 a.m.	30.24	48.5	...	47	E.N.E.*	3	10	S.	....	"	Overcast, showery.
Johnston Strait	5	7 p.m.	30.36	49	....	....	Var.	1 to 2	2	C.	....	....	Clearing; afternoon, westerly wind.
" "	6.	7 a.m.	30.36	49	59.5	46.5	S.E.*	3	8	C.K.&C.S.	....	Fair	Light easterly winds: partly clear.
" "	6.	7 p.m.	30.26	47	....	....	—	0	9	C. K. & S.	47.5	"	Light variable winds; raining most of p.m.
" "	7.	7 a.m.	30.275	44 5	47..	43.5	W.	2	10	S.		Mist on h'ls	Clouded; calm; fair.
" "	7	7 p.m.	30.205	50	....	....	"	3	8	C.K.	48.5	.. ..	A.M. nearly calm. P.M., light breeze from W.; fair; partly clear.
" "	8.	7 a.m.	30.05	45.5	53	45	E.S E.	4	10	S.	....	Lt. show'rs.	Nearly calm: overcast; fair.
" "	8.	7 p.m.	29.70	47	....	....	W S W*	3 ?	3	K.C.	48.5	Clearing ..	Strong S.E. w'd with rain, squalls; overc't.
" "	9.	7 a.m.	29.31	45	48	43	E.S.E.	2	8	"	....	....	Heavy showers.
" "	9	7 p.m.	29.89	47.5	....	....	Var.	lt.	8	S.	49	S.& W., fair.	E.S.E. 4 dying away at 3 p.m.; heavy showers at 5 p.m.; then clear.
Discovery Passage	10	7 a.m.	29.86	46.5	51	45	S.E.	5	10	S. & K. C.	....	Showery .	Light S.E. wind; h'y showers; gen overc't.
" "	10.	7 p m.	29.91	46	....	....	S.W.	?	1	C.S.	....	S. E. lt. wd.	Stg S.E. b'ze t'ning to S.W.; 4 p.m. h'y rn.
" "	11	7 a.m.	29.95	49	51.5	48	S.S.E.	2*	10	S. & K. C.	...	Showery ..	Lt. winds; sky becoming o'cast; showery.
Off Cape Mudge	11.	7 p.m.	29.885	49.5	....	....	N.W.	3	2	S. & K.	50.5	Wn'd-rising	Strong S.E.; heavy showers about noon.
Off Harwood Island	12.	7 a.m.	29.885	46	53.5	45	E.	3	3	S. & C.	....	....	Light winds, generally clear; fair.
Comox	12.	7 p.m.	29.95	46	...	....	Var.	lt.	9	S & K.	....	Mist	Lt. to fsh. E. & S.E. wd.; sho'rs; gen. o'cast.

Milbank Sound to Quatsino, and thence to Victoria.

PLACE.	Date.	Hour.	Barometer.	Temperature of Air.	Maximum.	Minimum.	Direction of Wind.	Force of Wind.	Amount of Cloud.	Kind of Cloud.	Temperature Surface Water.	Weather at Time.	Weather during Last Interval.
				°	°	°					°		
Comox	Oct. 13.	7 a.m.	29.85	44	51	42.5	W.S.W	3	3	C. K. & S.	....	Clearing ...	Showery; generally overcast.
Baynes Sound	13.	7 p.m.	29.86	45	....	.. .	W.	2	3	C. S. & K.	50.5	....	Light variable wind; p'tly o'cast; showers.
" "	14.	7 a.m.	29.71	42	50	39.5	W.N.W	3	6	S. & K.	...	....	Light winds, showery, partly overcast.
Off Qualieum River	14.	8 p.m.	29.76	49	....	....	W.	5	1	S.	50	Wind rising	Generally clear; fresh westerly breeze.
Nanaimo	15.	7 a.m.	30.07	42.5	65	38	——	0	1	S.	....	....	Clear; westerly wind, fresh.
"	15.	7 p.m.	30.27	49	....	....	Var.	lt.	9	C. K. & S.	..	Fair	Clouds coming from N.W.; C. K. fair.
"	16.	7 a.m.	30.28	47	71.5	46	S.E.	4	10	S. & C. K.	....	Showery ..	Calm; overcast; showers.
Trincomalie Channel	16.	8 p.m.	30.26	50	...	....	S.S.E. *	4	10	S.	....	....	Raining; overcast; easterly wind 4 to 5.
Cordova Channel	17.	7 a.m.	30.23	51.5	51.5	49	S.S.W.	4	6	S. & C. S.	...	....	S.E. wd. rising to 6 after midn't; gen o'cast.
Off Victoria Harbour	17.	7 p.m.	30.03	53.5	54	....	S.W.	1	10	S. & C. K.	49.5	Fair	S.W. wind drawing variously in channels; decreasing; partly clouded; fair.

APPENDIX G.

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NOTES ON THE LATITUDES AND LONGITUDES

ADOPTED IN THE

CONSTRUCTION OF THE MAP OF THE QUEEN CHARLOTTE ISLANDS

BY

MESSRS. BOVEY & DAWSON.

The latitudes of Houston-Stewart Channel and Skidegate are adopted from the Admiralty maps. The latitudes of other places depend on the following observations.

In the case of observations on the sun the angle given is the greatest double altitude, *ie.* twice the apparent altitude with the diameter of the sun. With stars the angle noted is also the double altitude. The index error is in all cases allowed for.

LATITUDES.

Observation Cove, Darwin Sound, June 28th, 1878.

Sun at noon	121° 55′ 8″
Resulting latitude	53° 35′ 10″

Observation Point, July 3.

(At 0·15 mile N., 15° W. of south point of Shuttle Island.)

Sun at noon	121° 6′ 30″
Resulting latitude	52° 39′ 23″

The above values of the latitudes of Observation Cove and Observation Point have been compared with each other by means of the track survey between the two places. The result is that the probable true latitude of Observation Cove is found to be

52° 35′ 29″

and that the latitude of Observation Point remains uncertain, but may be taken as correct within a few seconds.

Crescent Inlet, July 6.

Sun at noon	120° 19′ 20″
Resulting latitude	52° 46′ 8″

Boulder Point, Logan Inlet, July 7.

Sun at noon	120° 2′ 20″
Resulting latitude	52° 47′ 53″

These two observations are found to check very satisfactorily with track survey.

Rockfish Harbour, Selwyn Inlet, July 13.

Observation on Pole Star.

Time by watch	11h. 8m. 37s.—	Polaris	105° 26′ 57″
" "	11h. 14m. 0s.—	"	105° 30′ 47″
" "	11h. 18m. 58s.—	"	105° 33′ 27″

As no time observation was obtained, the watch is assumed to have been set at Boulder Point, and a rate is allowed amounting to 1m. 12s. per day up to date. This rate is deduced from a careful comparison instituted between the results of the time observations which follow:—

Resulting latitudes :—52° 54′ 29″
52° 54′ 32″
52° 54′ 9″

Mean—52° 54′ 23″

Mouth of Lagoon, near Fife Point, August 8.

Observation on Pole Star.

Time by watch	10h. 15m. 32s.—	Polaris	108° 56′ 57″
" "	10h. 32m. 57s.—	"	109° 8′ 37″
" "	10h. 44m. 32s.—	"	109° 15′ 57″

For time, on Vega.—

Time by watch	10h. 37m. 40.5s.—	Star	125° 23′ 10″
" "	10h. 39m. 48.5s.—	"	124° 48′ 50″

Latitude assumed	54° 5′ 0″
Resulting error of watch	58m. 9s. slow

Resulting latitudes :—54° 4′ 51″
54° 4′ 51″
54° 4′ 43″

Mean—54° 4′ 48″

Skon-un Point, August 10.

Sun at noon	103° 20′ 57″
Resulting latitude	54° 2′ 24″

This value is rejected, as it does not check satisfactorily with other observations taken along the north coast of the island.

Ut-te-was Village, Masset, August 10.

Observation on Pole Star.

Time by watch........	9h. 25m. 40s.	—Polaris........	107° 42′ 27″
" "	9h. 31m. 30s.	— "	107° 46′ 17″
" "	9h. 39m. 0s.	— "	107° 50′ 27″

For time, on Alkaid:—

Time by watch........	9h. 47m. 11s.	—Star	85° 18′ 17″
" "	9h. 55m. 5s.	— "	83° 27′ 17″

Latitude assumed.. 54° 2′ 0″
Resulting error of watch................................ 1m. 58. slow
Resulting latitudes :—54° 1′ 48″
54° 1′ 39″
54° 1′ 7″

Mean—54° 1′ 31″

Camp, August 12 (on east side of Masset Inlet).

Observation on Pole Star.

Time by watch........	8h. 50m. 40s.	—Polaris........	106° 50′ 37″
" "	8h. 53m. 52s.	— "	106° 52′ 47″

For time, on Alkaid :—

Time by watch........	9h. 30m. 16.5s.	—Star	86° 16′ 47″
" "	9h. 33m. 56s.	— "	85° 20′ 17″

Latitude assumed (deducted from latitude of Masset Village
and measurements on track survey) .... 53° 40′ 38″

Resulting latitude :—

First approximation.................................... 53° 43′ 52″
Second " .... 53° 44′ 14″
Third " .... 53° 43′ 46″
Fourth " .... 53° 43′ 47″

Resulting error in watch .... 6m. 0s. slow

Chitz Island, August 13.

Sun at noon .... 102° 15′ 37″
Resulting latitude.. 53° 40′ 54″

This value seems, by comparison with track survey, to be too far to the North by about 2′.

Head of Tin-in-ow-e Inlet, August 15.

Observation on Pole Star.

Time by watch........	8h. 49m. 44s.	—Polaris........	106° 48′ 17″
" "	8h. 54m. 20s.	— "	106° 51′ 27″

For time, on Alkaid:—

Time by watch........	9h. 0m. 29s.——Star..........	89° 46′ 27″
" "	9h. 5m. 48s.—— "	88° 23′ 27″

Latitude assumed.................................... 53° 40′ 0″

Resulting latitude:—

First approximation.................................... 53° 37′ 26″
Second " .... 53° 37′ 28″

Resulting error in watch....................................10m. 13s. slow

Virago Sound, near Kung Indian Village, August 19.

Observation on Pole Star.

Time by watch........	8h. 38m. 30s.——Polaris........	107° 44′ 42″
" "	8h. 44m. 43s.—— "	107° 49′ 7″
" "	8h. 47m. 50s.—— "	107° 51′ 27″

For time, on Arcturus:—

Time by watch........	8h. 52m. 53.5s —Star	51° 43′ 17″
" "	8h. 56m. 48s.—— "	50° 34′ 17″

Latitude assumed.................................... 54° 4′ 0″

Resulting latitude:—

First approximation.................................... 54° 2′ 20″
Second " .... 54° 2′ 20″

Resulting error of watch....................................15m. 40s. slow

Maden Harbour, August 20.

(At Observation Point.)

On Sun past Meridian.

Time by watch	12h. 3m. 38.5s.
Altitude of sun....................................	96° 58′ 47″
Resulting true altitude at time of observation..........	48° 12′ 47″
Resulting true meridian altitude found by ascertaining hour angle from observed time, and from the error of night previous and known rate of watch	48° 21′ 7″
Resulting latitude....................................	53° 56′ 57″

This result can only be considered correct within 1′ or 2′ on account of the distance of the sun past the meridian, and the comparative uncertainty in the time.

Mouth of Jal-un River, August 23.

On Altair near Meridian.

Time by watch........ 9h. 16m. 0s.——Star .... 88° 51′ 57″
Assuming Altair on the meridian, the resulting latitude = 54° 7′ 48″

Observation on Polaris.

Time by watch........	8h. 31m. 52s.——Polaris........	108° 2′ 17″
" "	8h. 36m. 44s.—— "	108° 6′ 7″

For time, on Alkaid:—

Time by watch........	8h. 48m. 44s.	——Star	82° 59′ 27″
" "	8h. 52m. 33.5s.	— "	82° 01′ 37″
Latitude assumed from observation above, on Altair........			54° 07′ 48″

Resulting latitudes:—

First approximation	54° 7′ 1″ 54° 7′ 13″
Second approximation (with assumed latitude 54° 08′ 30″) .	54° 7′ 0″ 54′ 7′ 12″
Third approximation (with assumed latitude 54′ 07′ 10) ...	54° 7′ 2″ 54° 7′ 14″

A graphic method, based upon these approximations, shows that the values of the third approximation are correct to the nearest second.

Resulting error of watch (deduced from third approximation)..18m. 48s. slow

From this error of watch the observation on Altair is reduced, and a mean aluev of the latitude found as follows:—

Altair past meridian....................................	0m. 35s.
Corresponding hour angle	8′ 45″
True meridian altitude of Altair.........................	44° 25′ 14″
Resulting latitude..	54° 7′ 47″

Mean latitude:—

Pole Star observations....................................	54° 7′ 2″ 54° 7′ 14″
Observation on Altair (deduplicated)........................	54° 7′ 47″ 54° 7′ 47″
	4 | 216° 49′ 50″
	54° 7′ 27″

North Island, August 24.

(One hundred and eighty paces N. 43° E. from south point of island.)

Observation on Pole Star.

Time by watch........	9h. 50m. 22s.	——Polaris........	109° 6′ 52″
" "	9h. 55m. 48s.	—— "	109° 11′ 32″
" "	10h. 1m. 50s.	—— "	109° 15′ 2″
" "	10h. 7m. 25s.	—— "	109° 19′ 22″

The error of watch as deduced from error August 23, and rate, allowing for change of longitude, is 19m. 8s. slow.

Resulting latitude from the four observations:—

54° 10′ 19″
54′ 10′ 48″
54° 10′ 37″
54′ 10′ 53″

Mean..54° 10′ 39″

The difference between observations on Polaris and Altair at Ja-lun River is 40″. Half the difference may therefore be added to the present latitude to correct for errors presumably in instrument, as shown by this discrepancy :—

54°	10′	39″
		20″
54°	10′	59″

LONGITUDES.

Anchor Cove, Skidegate Inlet.

Longitude, 132° 14′ 19″

Determined in 1866 by D. Pender, Master R. N., and given on Admiralty Chart No. 48 of Skidegate Inlet. This is unquestionably the best determined longitude on the islands.

Forsyth Point, Houston-Stewart Channel.

Longitude, 131° 11′ 30″

Determined by examination of track survey and long bearings taken on outlying points proceeding from Skidegate. The scales for the successive parts of the survey are ascertained from the latitude observations taken, and from these, by the method of latitudes and departures, the longitude given above has been worked out.

The values of this longitude, determined in various ways, are given below :

131° 09′ 0″	Messrs. Inskip, Gordon and Knox, of H.M.S. *Virago*, in 1853, as given on Admiralty Chart No. 2168.
131° 11′ 29″	Calculated by ascertaining true departure on track survey, and reducing by scale given by latitude observations.
131° 11′ 33″	Same method. Survey followed round by Bluff Point.
131° 13′ 23″	Calculated from long bearing, north end Burnaby Island to Bluff Point, and by departure on track survey for remainder of distance ; total departure reduced by scale given by latitude observations.

The longitude given by Messrs. Inskip, Gordon and Knox is presumably too far to the east, as the whole of the east coast as fixed by them is 13′ *east* of its true longitude on the average.

Camp, Aug. 8, *near Fife Point.*

Longitude, 131° 38′ 0″.

Determined by bearings on Mount McNeil and mountain at north end of Stephen's Island. The positions of these mountains are given on Admiralty Chart No. 1923, A., from surveys by D. Pender, staff commander, R. N., 1867-70. The bearings have been laid down on this chart, and as the latitude of the camp is known, its longitude as given above has been determined by a method of minimum error.

Jal-un River.

Longitude, 132° 42′ 15″.

Determined by bearing of N. 30° W. (magnetic, August 23, 1878,) to Cape Kaigani, Alaska. The longitude of this cape is 132° 43.8′, as ascertained by the United States Coast Survey (Alaska Coast Pilot). The latitude of Ja-lun River being known, the longitude has been determined from the above observation.

From the above longitudes a scale has been determined for the track survey of the north coast of the Queen Charlotte Islands, and the longitude of North Island and Cape Knox has been ascertained by making use of the same scale for the part of the survey west of Jal-un River.

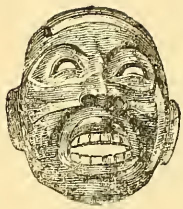
Longitudes on the West Coast.

The longitude of the mouth of Skidegate Channel, which opens on the west coast, has been found from track survey by means of a scale adapted from those found for other parts of the island. The general form of the coast has been determined from bearings given in the works of Vancouver and Dixon. From these data it is found that the position of Port Kuper is too far to the east. The longitude of Sansnm Island, as ascertained by G. Moore, master of H.M.S. *Thetis*, in 1852, and given on Admiralty Chart No. 2168, is 132° 9′ 40″. This now becomes 132° 20′ 0″.

The error in the former value corresponds with that of 13′ which is found to exist along the east coast of the islands in charts made before 1854. The value now given is probably less rather than greater than the true amount; and it corresponds well with Vancouver's and Dixon's bearings along the west coasts when the magnetic variation is correctly allowed for.

Plate VI.

1



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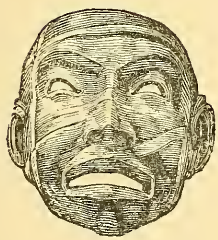

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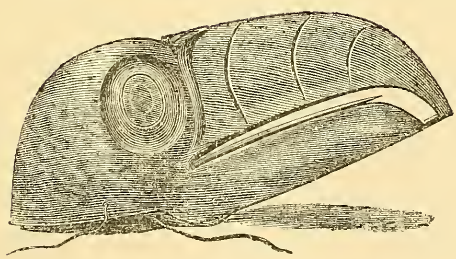


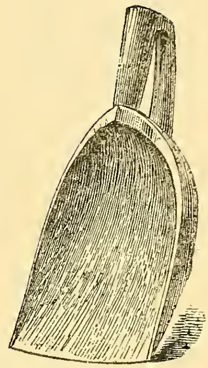
5

$^1/_{10}$ Nat:

1 to 5. MASKS USED IN DANCING.

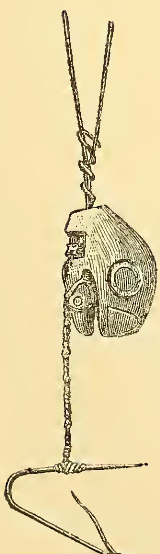
PLATE VII.

6

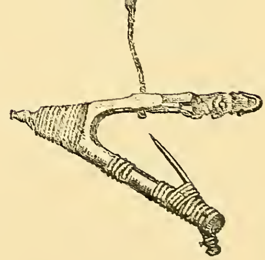


7

8



9

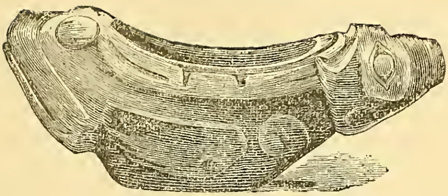


10

⅓ Nat:

6. HORN LADLE.
7. CEDAR CANOE BALER.
8. FISH CLUB.
9. IRON FISH-HOOK AND FLOAT.
10. WOODEN FISH-HOOK.

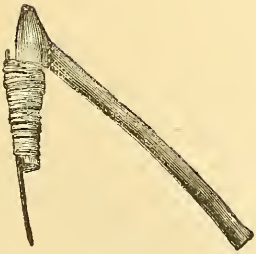
Plate VIII.



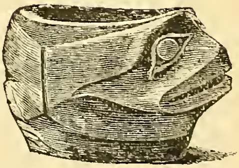
11
⅓ Nat:

12
⅙ Nat:

13
⅓ Nat:



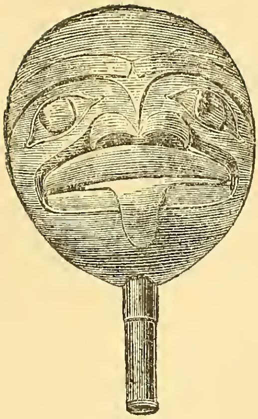
14
⅓ Nat:



15
⅓ Nat:

11. STONE MORTAR.
12. STONE PAINT DISH.
13. STONE ADZE.
14. IRON ADZE.
15. STONE MORTAR.

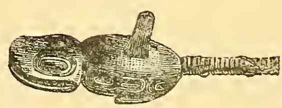
PLATE IX.



16
⅙ Nat:

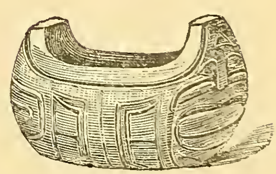
17
⅙ Nat:

18
1/5 Nat:



19
1/5 Nat:

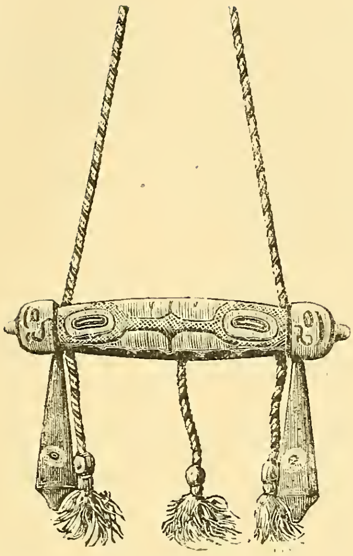
20
1/5 Nat:



21
1/5 Nat:

16, 17. RATTLES.
18. HORN DISH.
19. SMALL RATTLE.
20, 21. SMALL WOODEN DISHES.

Plate X.



22

23

$^1/_9$ Nat:

24

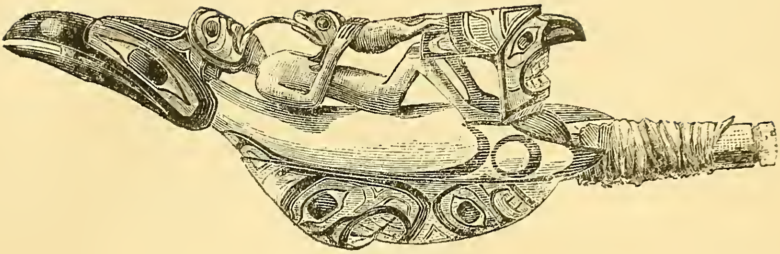
⅙ Nat:

25

$^1/_8$ Nat:

22. DANCING ORNAMENT.
23. SET OF GAMBLING STICKS IN LEATHER BAG.
24. GAMBLING STICKS.
25. CASTANET OF PUFFIN BEAKS.

Plate XI.



26

⅓ Nat:

27

⅓ Nat:

28

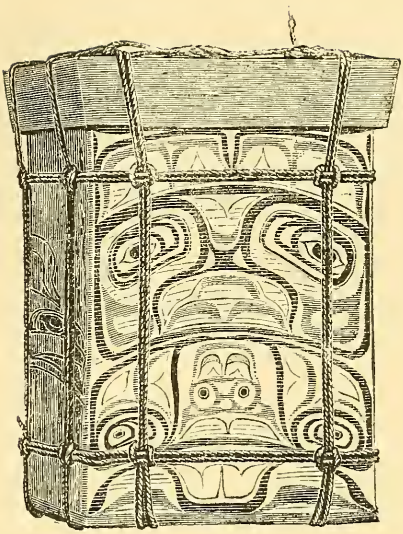
⅓ Nat.

26. RATTLE.

27. HORN SPOON.

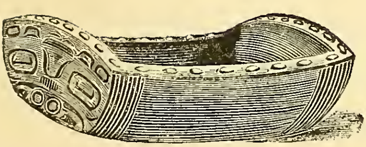
28. MEDICINE MAN'S CHARM

Plate XII.



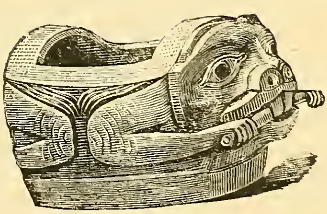
29

$^1/_{10}$ Nat:



30

$^1/_{10}$ Nat:



31

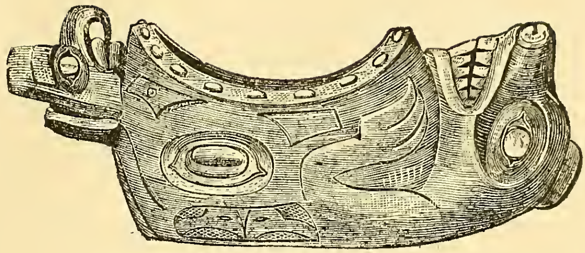
$^1/_8$ Nat:

29. CEDAR BOX.

30. WOODEN TRAY.

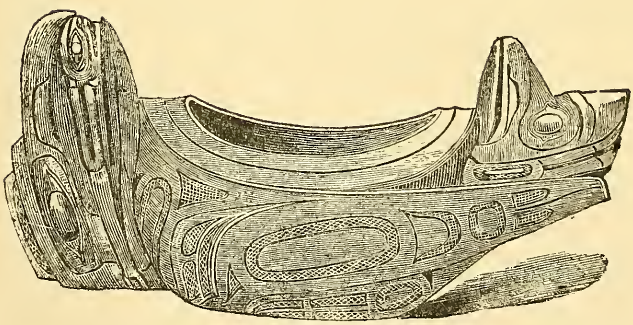
31. WOODEN DISH.

PLATE XIII.



32

¼ Nat:

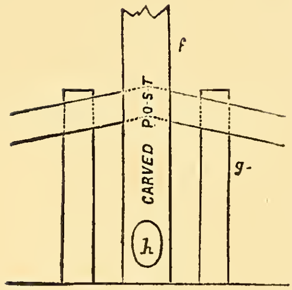


33

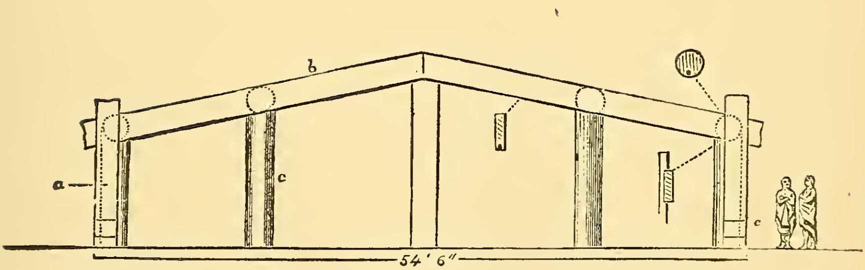
¼ Nat:

32, 33. WOODEN DISHES.

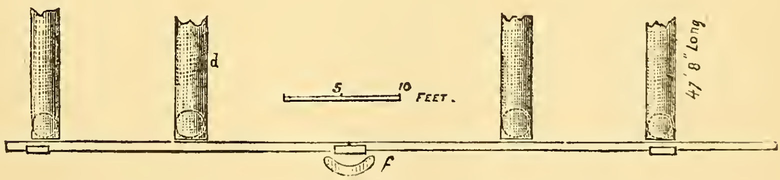
PLATE XIV.



34



35



36

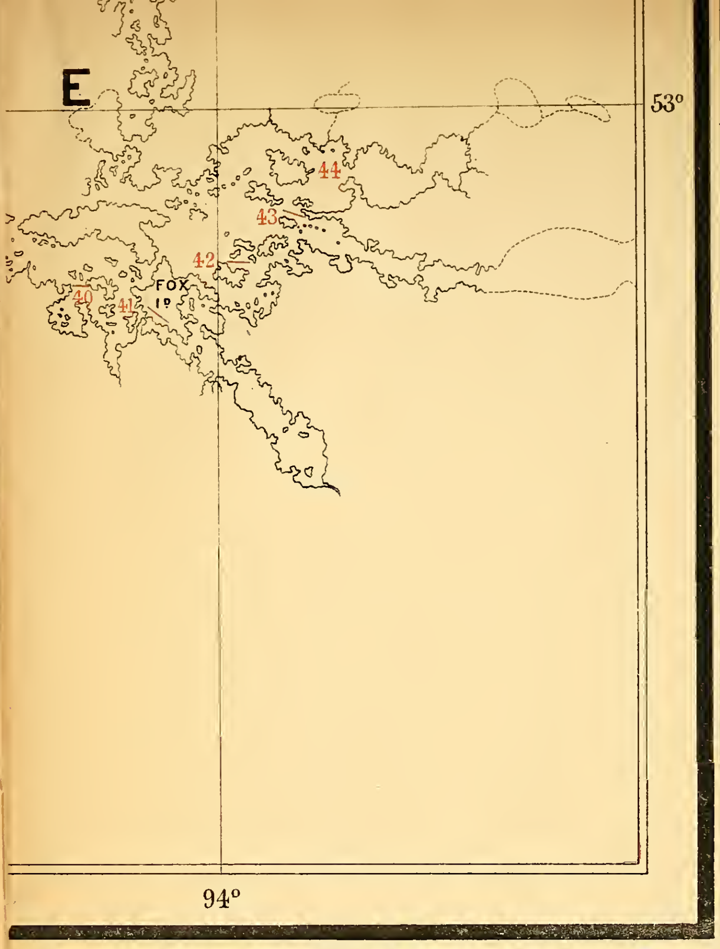
34. ELEVATION OF PART OF FRONT OF HOUSE.
35. ELEVATION OF FRAMING OF FRONT OF LARGE HOUSE.
36. PLAN OF PART OF FRAMING OF HOUSE.

a. *Kwul-ki-stung.*
b. *Ki-watl-ka.*
c. *Kwuls-kug-it*
d. *Tsan-skoo-ka-da.*
e. Place for lower transverse beam or *Hung-i-kek-i-da.*
f. Carved Post.
g. *Ki-stang-o.*
h. Door.

GEOLOGICAL SURVEY of CANADA
Alfred R. C. Selwyn, F.R.S., F.G.S. Director
MAP
of the
QUEEN CHARLOTTE ISLANDS
to illustrate report by
George M. Dawson D.S. A.R.S.M. F.G.S.,
SOURCES OF INFORMATION.
Running Surveys by G. M. Dawson 1878.-Skidegate Inlet, Houston Stewart Channel and Soundings, chiefly from Admiralty Plans.-Outline of West Coast from Admiralty Plan, corrected in longitude, & by Dixon's & Vancouver's bearings.
Drawn by Messrs. Bovey & Dawson
Scales.
Nautical Miles.
Statute Miles.
Natural Scale 1/506,880.
Miocene.
Cretaceous.
Agglomerates and Ash Rocks probably Triassic.
Triassic.
Intrusive Granite, Diorite &c.
(F.) Localities where Fossils older than Cretaceous have been found.
(Fe.) Iron.
(Cu.) Copper.
(Pb.) Lead.
GRAHAM
ISLAND
MORESBY
ISLAND
PREVOST
ISLAND
NORTH ISLAND
Virago Sound
Masset Sound
Masset Inlet
Skidegate Inlet
Cumshewa Inlet
Laskeek Bay
Juan Perez Sound
Skincuttle Inlet
Houston Stewart Chnl
Louise I.
Lyell I.
Burnaby I.
Kuper I.
Rennell Sound
Cartwright Sound
Frederick Island
Hippa Island
Rose Point or Nai-koon
Cape Fife
Cape Ball
Low level country densely wooded
Cliffs of Sand & Clay
Brown Passage
Edye Passage
Browning Entrance
Stephens I.
Porcher I.
Banks I.
Digby I.
Isles Kerouart
St James I.
Cape St James
The Burland Lithographic Co. Montreal.


PIPESTONE
29
The route
95

Geological Survey of Canada
ALFRED R.C. SELWY[...] R.S. DIRECTOR.
MAP
OF
ISLAND AND GOD'S LAKES
AND OF THE
CONNECTING WATERS TO
OXFORD LAKE
FROM TRACK SURVEYS
BY A. S. CO[...]RANE, C. E.
Assist. to [...]ELL.
1879
SCALE 4 MILES TO ONE INCH.
OXFORD LAKE
Oxford House
BACK LAKE
Trout River
KNEE LAKE
Wolf River
FISHING EAGLE LAKE
SWAMPY PORTAGE LAKE
Hayes River
JACKSONS BAY
RAT LAKE
ANT LAKE
CLEAR WATER LAKE
Mink River
TOUCH-WOOD LAKE
GODS LAKE
ELK ISLAND
BEAVER HILL LAKE
GOOSE LAKE
Island Lake River
Mainland River
H.B.Co. Post
PIPESTONE
96°
95°30
95°
94°30
94°
55°
54°30
54°
53°30
53°



ACK

GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, F.R.S., F.G.S., DIRECTOR.

REPORT

ON EXPLORATIONS ON THE

CHURCHILL AND NELSON RIVERS

AND AROUND

GOD'S AND ISLAND LAKES

1879

BY

ROBERT BELL, M.D., F.G.S., C.E.

PUBLISHED BY AUTHORITY OF PARLIAMENT.

Montreal:
DAWSON BROTHERS.

1880

GEOLOGICAL SURVEY OFFICE,

MONTREAL, May 4th, 1880.

ALFRED R. C. SELWYN, ESQ., F.R.S., F.G.S.,

Director of the Geological Survey.

SIR,—My report, containing a summary of the results of the operations of the season of 1879, is herewith respectfully submitted.

I have the honour to be,

Sir,

Your obedient servant,

ROBERT BELL.

REPORT

ON EXPLORATIONS ON THE

CHURCHILL AND NELSON RIVERS

AND AROUND

GOD'S AND ISLAND LAKES,

1879.

BY

ROBERT BELL, M.D., F.G.S., C.E.

Before proceeding to state the results of the work to which this report refers, I shall give a brief narrative of the season's operations and mention the methods pursued in endeavouring to accomplish the objects we had in view. In 1878 I had made a track-survey and a geological examination of the boat-route from Lake Winnipeg to Hudson's Bay by way of Oxford and Knee lakes, and the rivers thence to York Factory. I had also made topographical and geological surveys of the lower part of Nelson River, and of the upper part of the same stream, from Lake Winnipeg nearly to Split Lake, leaving unfinished the central part. In 1879 I was to complete this and to examine as much of the Churchill River as the season would permit. In order to accomplish this I proceeded, as before, by way of the city of Winnipeg to Norway House, which I again made my headquarters for the season. It is due to the officers of the Hudson's Bay Company that I should here again express our indebtedness to them for their uniform kindness and for the substantial assistance which they often rendered, enabling us to accomplish much more than would otherwise have been possible. In this connection I must mention more particularly Mr. Grahame, the Chief Commissioner, Mr. J. McTavish of Fort Garry, Mr. Wm. Flett of the Stone Fort, Mr. Roderick Ross of Norway House, Mr. C. Sinclair of Oxford House, Mr. Linklater of Island Lake, Mr. J. R. Spencer of Fort Churchill, and Mr. Joseph Fortescue of York Factory.

Methods pursued.

Previous surveys.

Work for 1879.

Acknowledgment of assistance.

Assistant.

I was assisted during the season by Mr. A. S. Cochrane, who had accompanied me on a former survey, and through his efficiency as an explorer the extent of our field-work was largely increased. On my journey west, by way of the lakes, I picked up, at the Sault Ste. Marie, three men whose merits I had tested on long explorations in previous years.

Men.

A few days after our arrival in Manitoba, the officers of the Hudson's Bay Company kindly allowed myself and party to take passage by the steamer *Colville* (which also towed our York boat) from Lower Fort Garry to George's Island, or the greater part of the distance to Norway House, for which they made no charge. They also gave me the use of the York boat referred to for the summer.

Norway House.

Before reaching Norway House, although diligent enquiry was made, no reliable information could be obtained with regard to the Churchill River, the central portion of the Nelson, or the country lying between these two streams; and even at this post very little was known on the subject. This arises from the fact that both these rivers have long since been abandoned as "voyaging" routes by the Hudson's Bay Company, and also that no Indians live at or near the parts I was to examine. At Norway House it was ascertained that a route for small canoes existed between Split Lake on the Nelson and the headwaters of the Little Churchill River, and I determined to follow it and the latter stream to the Great Churchill, and to descend this river to the sea. As it was necessary to find out everything as we went along, the question of how best to finish my survey of the central part of the Nelson River was left to be decided as circumstances might determine.

Want of information.

Abandoned rivers.

Route to Churchill River

Before leaving Norway House, Mr. Cochrane was instructed to proceed to God's Lake and Island Lake and to make track-surveys and a geological examination of their shores, as well as of his routes in going from Oxford House and returning to it again. The position of Oxford House I had determined the previous year. Mr. Cochrane performed this service in a very satisfactory manner.

Mr. Cochrane's instructions.

I left Norway House on the 16th of July with four Indians and two small canoes, and reached Fort Churchill, by the route above indicated, on the 5th of August, having completed a track-survey and made a geological examination of the whole distance. On reaching the junction of the Little with the Great Churchill River, I left most of my outfit in charge of one man, and with the other three made an upward exploration of the main river for two days, so that the time occupied on the journey between Norway House and the sea, at Fort Churchill, was only seventeen days, two of which were lost owing to rain.

Norway House to Fort Churchill.

From the mouth of the Churchill I started in a boat with my own men to examine the coast of Hudson's Bay northward, but circumstances soon obliged me to return. The Hudson's Bay Company's ship from London arrived the same day that I returned to the mouth of the river, and the captain kindly agreed to give a passage to myself and men to York Factory. While the ship was lying at Fort Churchill, I made an approximate survey of the surrounding region. Ship from London.

At York Factory I obtained some provisions, and, with the men who accompanied me from Norway House, proceeded in the same small canoes to ascend the Nelson River to the point which had been reached when *en route* for Churchill. The river above the first rapids proved very difficult to ascend and the journey occupied a longer time than I had expected, but with the aid of the game and fish which we obtained we managed to subsist. Ascend the Nelson River.

A short distance above Split Lake, the Grass River enters the Nelson on the west side. Having already explored the Nelson above this point both in 1878 and 1879, I determined to ascend the Grass River, and from one of its branches I again reached the Nelson at the foot of Sipiwesk Lake. I next made a track-survey of the north-western channels and arms of this lake, and then of the channels to and from Duck Lake, as well as of the latter lake itself. Grass River. Other surveys.

In going up from Pipestone Lake to Norway House I surveyed a small channel of the Nelson, which runs for some miles through the eastern part of Ross' Island, of which both sides were mapped in 1878, and the island found to be over fifty miles in length. In the course of these explorations along the Nelson River, observations were taken for latitude, longitude and the variation of the compass, and a number of photographs were obtained. Channel through Ross' Island. Observations.

On reaching Norway House again, I found that Mr. Cochrane had returned only a day or two in advance of myself, and as soon as we could get ready we set out for Manitoba in the same York boat in which we had come. The season proving very stormy with head-winds, we were three weeks in reaching Lower Fort Garry. Having made a track-survey in 1878 of the west side of Lake Winnipeg from the Dog's Head southward, the east side was followed on the present occasion from this place to the mouth of Red River, and a sketch of its outline taken. Return to Manitoba. Sketch of part of East shore of Lake Winnipeg

When in Manitoba, it was my intention to have made a geological examination of the line of the Canadian Pacific Railway eastward from Red River to Rat Portage, but it was not found practicable to do so, and as the season was well advanced I returned to Montreal, which I reached on the 11th of November. Return to Montreal.

Summary of surveys.

The following list shows the respective lengths of the several track-surveys which were made by myself:—

	Miles.
1. Canoe-route from Split Lake to Was-kai-ow-a-ka Lake..........	42
2. Shores of this lake..........	30
3. Little Churchill River, following its course..........	172
4. Great Churchill River, following its course..........	169
5. Shore lines, &c., in the vicinity of Fort Churchill..........	40
6. Nelson River, including some re-surveys; but not the lakes on its course..........	212
7. Shores and connecting channels of Gull, Split, and Sipi-wesk lakes, not including islands and the smaller bays..........	232
8. Grass River and lakes in its course, counting only the straightest line through each lake, between the points at which I entered and left it..........	108
9. Part of the east shore of Lake Winnipeg between the Dog's Head and the mouth of Red River..........	64
Total..........	1,069

These surveys, checked by the numerous latitudes which were taken, and knowing the longitudes of a few points and the magnetic variation which was frequently ascertained, enable us to lay down, with sufficient accuracy for present purposes, a considerably amount of topography. As, however, it is proposed that I shall continue operations during the coming season in the same field, and also extend the area explored, it is considered best to publish a map of the results of both years' work at the same time. For the same reason I propose next year to describe the whole region more fully, so that the present report may be considered as being to some extent only provisional. The area covered by Mr. Cochrane's explorations having being confined within narrower limits, may be considered as finished, and his map accompanies this report.

Data for a map.

Map showing Mr. Cochrane's explorations.

Summary of his surveys.

The following list shows the number of miles of track-survey accomplished by Mr. Cochrane:—

	Miles.
1. The channels between Great and Little Playgreen Lakes..........	49
2. Jack River, from Rossville mission to above the second rapids...	25
3. Canoe-route from Knee Lake to God's Lake..........	27
4. Shores of main body of God's Lake..........	136
5. Canoe-route, including Rat, Clearwater and Touchwood lakes, between Oxford Lake and God's Lake..........	67
6. Canoe-route between God's and Island lakes..........	69
7. Shores of Island Lake, all around..........	213
Total..........	586

A somewhat less accurate track-survey, embodying upwards of forty miles of shore-lines, which was made of the upper division of God's Lake, is not included in the foregoing statement.

The surveys mentioned in the above lists, amounting in the aggregate to 1,655 lineal miles, were completed in less than three months with the assistance of only six men. Although they are made only as accessory to our geological work, they afford a good knowledge of the principal geographical features of the country, and may be found useful for various other purposes at any future time. Besides performing the foregoing track-surveys, both Mr. Cochrane and I resurveyed in the same manner considerable stretches, not included in the above statements, which I had gone over in 1878 for the sake of checking distances and obtaining greater accuracy of detail.

Time and men required.

Resurveys.

In the course of the above surveys, I took a large number of observations both of the sun and pole-star, for latitude and the variation of the compass. Others for longitude were also made at a few points. In addition to this astronomical work, the reading of the barometer was constantly kept for ascertaining differences of level of water and the elevations on land, and the temperatures of rivers and lakes were noted as indicated by the thermometer. There was not a very great diversity of scenery. However, I exposed about forty prepared dry plates, which gave as many photographic views as it was thought worth taking, in order to show the characters of the different parts of the region explored, or to represent any points of particular interest met with. A few of these have been used in preparing the illustrations which accompany this report.

Astronomical observations.

Elevations and temperatures.

Photographs.

Illustrations.

I made a considerable collection of plants as I went along, and Prof. Macoun, of Albert University, Belleville, has kindly furnished a list of the specimens which I submitted to him. This will be found in the appendix. The best part of my collection was made along the Nelson River, but the greater portion of this was unfortunately lost, owing to an accident. Professor Macoun has, however, found 237 species among the specimens brought home. Notes were kept in regard to the nature of the woods in all localities visited, and the geographical range of the various shrubs and timber-trees was recorded. Some remarks on this subject will be found further on. The information derived from a study of the distribution of the trees and shrubs, and of the flora generally, in any district, affords us one of the most certain means of judging of its climate for agricultural purposes. It will be seen that the general trend of the northern limits of the forest-trees in the region under consideration agrees with that of the isothermal lines as determined from other data.

Botanical collections.

Distribution of trees.

Northern limits of species.

The character of the soil was always noted, as well as any facts

Soil.

which had been ascertained by the officers of the Hudson's Bay Company or others in regard to the crops which might be raised. Besides our own experience in regard to the nature of the climate, information was collected from others as to rain, snow, frosts, winds, &c., all with a view to ascertain as far as possible how much of the country may some day be turned to account for the support of man. Facts bearing on these subjects will be given in the course of this report.

Climate.

Zoology.

Attention was paid to the zoology of the country explored as far as our time would permit.

Mammals.—I continued to gather information as to the habits and life-history of all the species known to inhabit the district, both by direct observation and by prosecuting my enquiries among the officers of the Hudson's Bay Company and the better class of Indian hunters. I have been collecting notes on this subject for several years from all parts of the basin of Hudson's Bay, and I propose to give the results in a future report. In the meantime I beg to express my obligations to the gentlemen referred to and also to Dr. Elliott Coues, of Washington, D.C., the well-known authority in this department, for the correct determination of some of the smaller species.

Habits of Mammals.

Dr. Elliott Coues.

Birds.—A list will be found in the appendix of fifty-five species of birds, of which I obtained specimens of either the skins or eggs. This list may be of some interest in extending our knowledge of the geographical range and of the breeding grounds of some of the species enumerated. Although the number of birds whose occurrence was noticed is considerable, I have not added their names to this list, in case of doubt. During the coming season I hope to procure specimens of many of them, along with others not hitherto noticed.

List of specimens collected.

Fishes.—In travelling "light" in small canoes I was unable to carry along alcohol for preserving the smaller species, and none can be obtained at the posts in the district. When opportunities occurred, however, I preserved specimens of the larger fishes with common salt. Before publishing a list of the fishes of the district, it will be well to take advantage of the opportunities which it is expected will be afforded during the coming summer for adding to the number of species already known, and increasing our knowledge of the distribution of the others. I may mention that I have ascertained the existence of twenty-one species in Lake Winnipeg or the adjacent waters. From specimens which I sent to Professor Baird, Professor Gill, of the Smithsonian Institution, has determined the herring white-fish, which is caught in abundance at the mouths of the Nelson and Hayes rivers, to be *Coregonus Artedi*. The same fish is abundant at the mouths of all the rivers around James' Bay. The pike-perch from York Factory he

Fishes of Lake Winnipeg.

Herring white-fish.

Pike-perch.

identifies as *Stizostethium Canadense.* A fine grayling was obtained in the brooks flowing into the Churchill near the sea. From a specimen submitted to Prof. Gill, he finds the species to be *Thymallus signifer.* The salmon frequenting the mouth of the Churchill is the same species which is more abundant on the east side of Hudson's Bay, and was referred to in my report for 1877. A sea-trout is also found in the mouths of the Churchill, Nelson and Hayes rivers, as well as along the east side of Hudson's and James' bays.

Grayling.

Salmon.

Sea-trout.

Insects.—The Coleoptera, which I collected in the region of the Churchill and Nelson rivers, were kindly determined by Dr. J. L. LeConte, of Philadelphia, and a list of them will be found in the appendix. The Lepidoptera of the district which I explored last summer have been studied by Herr Geffcken, formerly of Stuttgart, Germany, who has kindly furnished me with the list of species given in the appendix. The specimens were collected principally by the Venerable Archdeacon Kirkby, who resided until 1879 at York Factory.

Coleoptera.

Lepidoptera.

Mollusks.—Owing to the muddy and brackish nature of the water, no mollusks are found in the part of Hudson's Bay near York Factory. About the mouth of the Churchill river the only living species observed were the common mussel (*Mytilus edulis*) and a species of *Littorina.* Dead shells were abundant on the beach, of *Pecten Islandicus, Cardium Islandicum, Mya arenaria, M. truncata, Astarte lactea* and *Rhynchonella psittacea*, but all these appear to have been washed out of the drift-clay, which abounds from below the sea-level upward. A list of the fresh-water shells collected in the district, together with some from Manitoba, is given in the appendix.

Hudson's Bay.

List of fresh-water species.

Waters of the Red and Assiniboine Rivers.

In the earlier days of the Geological Survey, analyses were made by Dr. T. Sterry Hunt of the waters of the great rivers of what then constituted Canada, as well as of those of many mineral springs and wells. As it was considered desirable to continue this important work in reference to the principal rivers now included in the Dominion, I obtained samples of the waters of the Nelson, Red and Assiniboine rivers for experiment. A complete qualitative and quantitative analysis of each of the two last mentioned is now being made in the laboratory of the Geological Survey, and the results will be reported on by Mr. Hoffmann. Having also brought home samples of each of these waters six years before, which were afterwards submitted to Dr. Baker Edwards, F.C.S., for analysis, I shall give his results in referring to the subject of the water-supply of the city of Winnipeg. The bottles

Samples from large rivers.

Former samples.

containing the sample of the Nelson River water were unfortunately broken on the way to Montreal, when our boxes were violently tossed about on a steamer during a gale of wind in Lake Huron.

The Water Supply of the City of Winnipeg.

City of Winnipeg.

Importance of a better supply.

Wells.

Owing to the rapid growth of the city of Winnipeg, which already contains a large population, the question of providing it with a cheaper, and, if possible, a better supply of water than that afforded by the present primitive and inadequate method has become a matter of great importance. The waters derived from the wells sunk in the stratified clay in and around the city, although clear and sparkling, are not always pleasant to the taste, and they are evidently too highly charged with mineral salts to be desirable for domestic use. Besides these objections, the quantity which might be obtained from such wells would, no doubt, prove quite inadequate for the wants of a large town.

Waters of the Red and Assiniboine rivers.

The water of either the Red or Assiniboine River is fairly good, and as these streams afford the most convenient sources from which to draw an unlimited supply, any information as to the nature of their respective waters will be of interest at the present time. Dr. Edwards' analyses, to which I have referred, were made in June and July, 1879. The samples were collected by myself on the 18th of October, 1873—that of the Assiniboine at Fort Garry Ferry, and that of Red River a few miles above the confluence of the two rivers. In each case the samples were taken from the centre of the stream. They were preserved in hard glass bottles, at a pretty uniform temperature, in a cellar in Montreal until required for analysis. Having been kept for such a length of time, a portion of the organic matter has most likely been lost, but the mineral constituents have probably not been affected to any practical extent. Before the analyses were undertaken the greater part of the suspended impurities had settled to the bottom, and the decanted water, being almost clear, was not filtered. The quantities operated upon were smaller than would have been desirable, but owing to Dr. Edwards' skill, and his experience as a water analyst, I have no doubt his figures represent very nearly the composition of the respective rivers at the above date. The samples handed to Messrs. Hoffmann and Adams, and which were collected in the corresponding period in the month of October (1879), were taken from each river at a short distance above its junction with the other. It may be expected that some change has taken place in the composition of these waters in the interval of six years, owing to various causes, among which may be mentioned the dredging by the United States authorities of the bottom of the Red River throughout a considerable part of its course, to the

Collecting of samples.

Dr. Baker Edwards' analyses.

Probable change in composition.

cultivation and drainage of land, and perhaps also to the increased rainfall in Manitoba during the last few years. These analyses may, therefore, be found to possess some historical interest:—

WATER OF THE ASSINIBOINE IN 1873.

		Total solid contents in grains per Imperial gallon.	
1. Organic matter (loss by ignition)		7·71	Assiniboine water.
2. Calcic sulphate	4·39		
3. Calcic carbonate	7·05		
4. Iron, alumina and silica	1·09		
5. Alkaline salts, chiefly as chlorides	9·75		
6. Magnesia sulphate	7·81		
		30·09	
		37·80	

Hardness by Clarke's scale, 10·5°.

WATER OF THE RED RIVER IN 1873.

		Total solid contents in grains per Imperial gallon.	
1. Organic matter (loss by ignition)		5·28	Red River water.
1. Calcic sulphate	2·42		
3. Calcic carbonate	10·50		
4. Iron and alumina, 2·80 ; silica, ·98	3·78		
5. Alkaline salts, chiefly as chlorides	5·18		
		21.88	
		27·16	

Hardness by Clarke's scale, 9°.

It will be observed from the above analyses that (all things considered) the water of the Red River is rather better than that of the Assiniboine. This, I think, is contrary to the general belief, owing to the greater quantity of mechanically suspended impurities in the Red River water. The amount of organic matter in both is considerable, and would, no doubt, be greater in fresh samples. *Comparison of waters.*

They contain a large quantity of lime salts, the carbonate predominating in the Red River, while the Assiniboine has the most sulphate. Magnesia sulphate does not appear to be present in appreciable quantity in the water of the Red River, while its occurrence in so large a proportion in the Assiniboine water constitutes its worst feature. If the Red River in any part of its course contained magnesia sulphate, its absence in the stream near Fort Garry at the above date may be accounted for by its having been precipitated by the carbonate of iron contained in springs and surface water flowing into the river, or by the carbonate of potash resulting from the lixiviation of the ashes left by the extensive burning of the timber belt going on almost every year along the course of the river. And this suggests a means by which the Assiniboine water might be freed of its Epsom salts, in *Relative composition.*

case it should be found otherwise desirable for the supply of the city, namely, by adding to it a certain amount of wood ashes, which could easily be obtained so long as wood is so largely used as fuel. In this way a salubrious salt, the sulphate of potash, would be substituted in the water for one which Dr. Parkes, the well-known writer on sanitary science, says should not exceed three grains to the gallon in a wholesome water.

Stage of water when samples were collected.

The samples of water analysed by Dr. Edwards were collected after a long term of dry autumn weather, and at a time when both rivers were rather low. They would, therefore, represent the average composition of the streams better than if they had been collected at any other season. During the spring freshet the waters would contain a larger proportion of organic matter relatively to the mineral salts, in summer they would be affected locally and temporally by the wash from thunderstorms, while during the winter they would be exceptionally pure.

"Alkali" of the region drained by the Assiniboine.

I might mention in connection with this subject that the same year in which I brought home the above samples of water, I collected specimens of the white efflorescing salt or "alkali" which every traveller observes around many of the lakes and covering the dry beds of ponds in the region drained by the western branch of the Assiniboine, and found that it consists principally of sulphate of sodium and magnesium, together with chlorides of calcium and sodium.

Improvement of the water.

As to the possibility of improving either of these waters before distributing them in the city, I may remark that, while much of the coarser matter held in suspension might be thrown down in settling ponds, a portion of it is so very fine that it cannot be got rid of in this way. The turbid water of the Red River imparts a muddy appearance to the whole length of Lake Winnipeg, notwithstanding the immense volume of clearer water supplied by the Winnipeg River, and along with the milky Saskatchewan it is discharged by the Nelson River into the sea—still very muddy—700 miles from the city of Winnipeg.

Filtration.

Filtration is the only effective remedy for this defect, and in addition to the sand and gravel for removing the mechanical impurities, there should be a layer of animal charcoal for eliminating the organic matters. Such a provision would add comparatively little to the cost of filtration, since this substance is found in practice to act efficiently in such cases for a great length of time. Unfiltered river waters, more than any other kind, are frequently the medium for propagating such diseases as typhoid fever, cholera, diarrhœa, dysentry, internal parasites, &c., by means of the living germs which they contain, and

Propagation of diseases.

which multiply with extraordinary rapidity in the warm weather. The danger arising from this cause will increase in the case of the rivers under consideration, as the districts through which they flow become more thickly inhabited. Almost the entire area drained by the Assiniboine is believed to be underlaid by soft flat-lying rocks of Cretaceous age, while the basin of the Red River lies principally on Silurian strata. Its largest branch, however, the Red Lake River, which flows from the eastward, rises in the metamorphic region to the west of Lake Superior.

Geology of the river basins.

Other possible sources of supply.

A supply of better water might be brought down at some future time from one of the clear streams of the Pembina or the Riding Mountain; or it might be conveyed from the Broken-head, Whitemouth or Winnipeg River, or even from the Lake of the Woods (which lies at a very considerable elevation above the Lower Red River Valley,) should the city become sufficiently populous and wealthy to afford the great expense which would be involved in the operation. The streams flowing entirely through the Laurentian country, beyond the Winnipeg, could, no doubt, furnish a still purer and softer water than any of the sources which have just been mentioned.

Rain water.

A large amount of rain falls in Winnipeg, especially in the months of May and June, and probably the quantity of most excellent soft water which is shed from the roof of every house and lost, if husbanded, would prove sufficient for the wants of its occupants. In order to preserve this supply, a large eistern might be dug below the bottom of the cellar floor, so as to protect the water from frost in winter and evaporation in summer. This should be lined with hydraulic cement and covered with iron, over which a thick layer of earth ought to be spread. A quantity of scrap iron might be placed in the bottom. The only openings should be those admitting the feed-pipe and pump-tube. The water might be made to pass through a filtering box before entering the eistern. If the cellar should be liable to be flooded, the upper part of the cistern might be puddled all round after the manner adopted by miners to keep out water.

Cisterns.

Comparison with waters European rivers.

It may be interesting to compare the waters of the Red River and the Assineboine with those of rivers in other parts of the world, both in regard to their solid constituents and to their hardness. The following list shows the number of grains of solid matter, of all kinds, per gallon, in a number of the rivers of Europe:—Thames, above London, 15 to 18·5; Seine, at Paris, 20·0; Rhine, at Lyons, 12·88; Garonne, at Toulouse, 9·56; Loire, at Mehung, 9·52; Scheldt, in Belgium, 20·49; Rhine, at Basle, 11·97; Spree, at Berlin, 8·0; Danube, at Vienna, 10·15.

St. Lawrence and Ottawa waters.

Dr. T. Sterry Hunt found the clear water of the St. Lawrence at the Cascades to contain 11·74 grains of solids to the gallon, while the brown water of the Ottawa at St. Anne's contained only 4·84 grains, the colouring being due to a minute quantity of vegetable matter derived from swamps at the head waters of the river, while the invisible impurities of the St. Lawrence consisted mainly of mineral salts.

Hardness.

The hardness of the St. Lawrence at the Cascades was found by Dr. Edwards to be 3·5°, and of the Ottawa at St. Anne's 2·5°, while that of the mixed water of the two rivers supplied to Montreal varied from 2° to 3° according to the season of the year. The Assiniboine and the Red River waters, although harder than those of the St. Lawrence or Ottawa, are not much worse in this respect than much of the water supplied to towns in England, as shown by the following examples taken from Dr. Wanklyn's treatise on *Water Analysis*:—The Thames, above London, 14°; Castleton, Derbyshire (water supply), 11°; Oxton, Birkenhead, 11·9°; Chelmsford, Essex, 13·3°; Kirbyshore, Westmoreland, 22°; Chatham, 24°.

Geological and General Description of the Regions Explored.

Owing to the uniformity in the geological character of large areas of the region which I passed over, and the total absence for long distances of any rocks older than the drift, this report may be shortened and simplified by including a notice of the geological observations in the general account of the season's operations. This will be arranged in the order in which the work was performed, as already indicated.

Continuation of previous survey of Nelson River

The track-survey which I made in 1878 of the upper part of the Nelson River, terminated at the Goose-hunting River, about half way from Lake Winnipeg to the sea. On my way to the Churchill River I resumed the survey of the Nelson at this point, and continued it to Split Lake, the direction being nearly north and the distance about nine miles. Grand Rapid occurs at four miles in a straight line before coming to the lake, and has a descent of about fifteen feet in the form of a steep chute. This is apparently the only formidable obstruction to the navigation of the Nelson River from the south-west extremity of Sipi-wesk Lake, or from Red Rocks Rapid, on another channel, all the way to the foot of Gull Lake, a distance of about 160 miles. A portage of less than 200 yards in length, over a steep ridge of clay and rock, leads past this chute, at the foot of which the river makes a short western "jog" and receives the Grand River on the left side. At a mile and a half below the "jog" the Nelson gives off a large channel or discharge to the right, which flows north-east into Split Lake. The

The Grand Rapid.

Navigable stretch.

Lower Chain-of-Rocks (or Islands) Rapid, with a descent of only about two feet, occurs one mile further down.

Between the Grand Rapid and the western part of Split Lake the gneiss is partly reddish and partly grey and hornblendic. The strike varies in different places from S. 60° to S. 80° W. It is cut by a number of dykes of dark-coloured diorite, some of which, just below the junction of the Grass River, are very large. Their run has a general north-and-south tendency. On the north side of Split Lake, opposite the two inlets of the Nelson, the gneiss is cut by numerous dykes of all sizes and running in many directions. Below Chain-of-Rocks Rapid, on the north-west side of the river, dark grey quartzite and hornblendic schist occur, and also a dark green serpentinous-looking rock with a somewhat schistose structure. The Burntwood River, a large stream, with turbid water like that of the Nelson, enters the western extremity of Split Lake. On each side of the mouth of this river, the rocks consist of quartzose, felsitic and hornblendic slates, running west-south-west, much cut up by trap dykes. At the Island of the Dead, in the entrance of the river, hornblendic schist is interstratified with ribboned quartzite, striking east and west. The rocks on some islands about a mile north-east of the western or principal inlet of the Nelson River, consist of dark bluish-green hornblende and mica schist, interstratified with ribboned gneissic bands and with irregular layers of softer, light green schist, all much contorted. The rocks of the point between the Nelson and Burntwood rivers, and the islands for two miles to the north-west of it, may be considered as Huronian, but beyond this, in the same direction, they pass into gneiss, consisting of thin hornblendic and micaceous layers, alternating with others of quartz.

Gneiss.

Dykes.

Schists.

Burntwood River.

Schists.

Huronian.

Split Lake runs east-north-east, and is about twenty-five miles long by two or three wide. The rocks along its northern shore consist of gneiss, which is generally of a hornblendic character, interstratified with quartzose layers. Towards the west end the strike is about east and west, but elsewhere it is much disturbed. Besides the rocks of Huronian character just described as occurring at this extremity of the lake, a green hornblende rock, which was met with on an island near the east end, may be of the same age. What appears to be another limited area of Huronian rocks in this part of the country, is met with on the south side of the Grass River where it joins the Nelson. Here, at about half a mile west of the Grand Rapid portage, there is a ribboned, slaty, hornblendic rock, together with a coarse variety, and a dark gray quartzite, dipping S. 20° W. $<$ 60°. These are cut by a great dioritic dyke, running about north and south. Siliceous and

Split Lake.

Probable Huronian on Grass River.

hornblendic slates are found to the west of this, but at about four miles from Grand Rapid portage rusty quartzose gneiss which is believed to be Laurentian, appears, dipping S. 40° E. $<$ 60°.

Country around Split Lake.

The country around Split Lake presents a generally even, but slightly undulating outline. The immediate shore-line is usually rock-bound, but on ascending this a deposit of brownish clay, which appears to afford a good soil, is found to be spread over the country. The tops of the larger and higher islands in the lake are also covered with the same deposit.

Temperature of water.

On the 24th of July the water of Split Lake had a temperature of 69°, and on the 11th of September of 59° Fah.

Elevation.

According to my barometric observations, Split Lake would have an elevation of 440 feet above the sea.

Split Lake to Assean Lake.

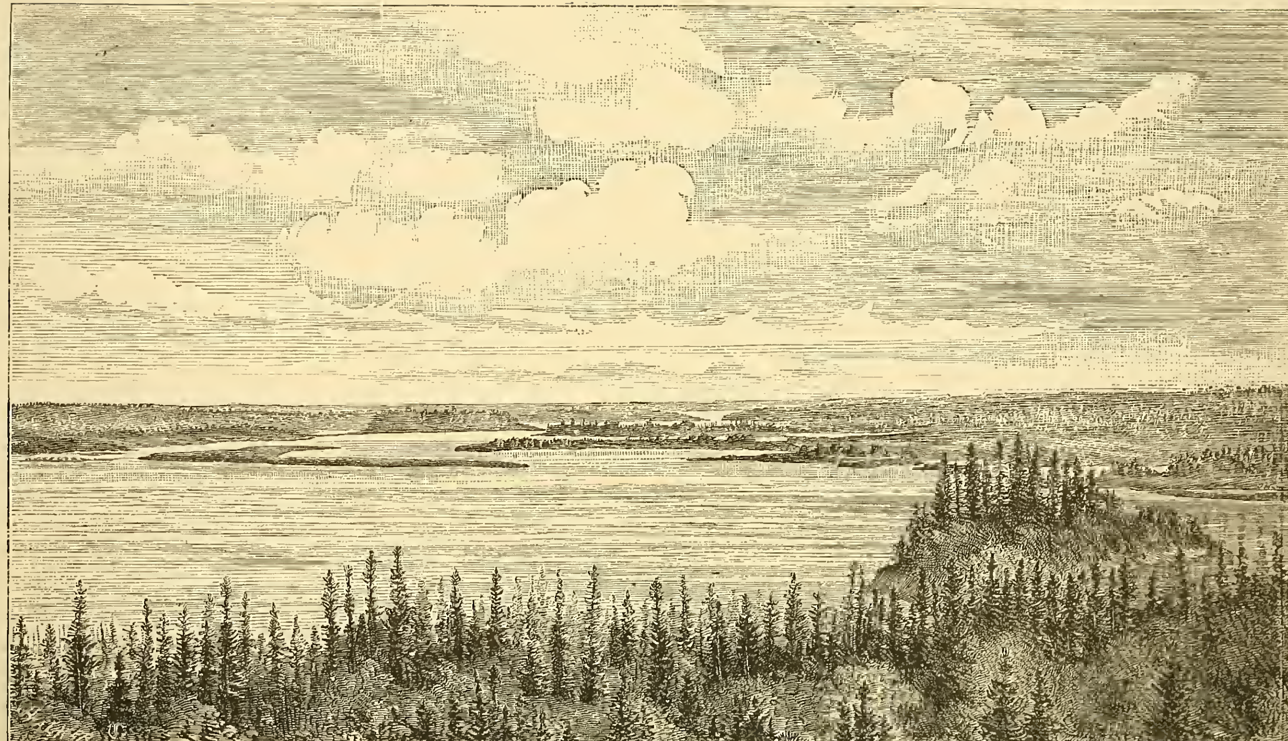
In order to reach the waters of the Churchill River we ascended a creek on the north side of Split Lake, about half way from its west end, and from it made a portage a mile long in a north-westerly direction, over a nearly level surface of brownish clay with small spots of sphagnum, to a pond, from which another portage, one-third of a mile long, with the same bearing, brought us to the shore of Assean Lake, which runs at right angles to the portage trail. The north-eastern part of this lake, which we followed from the portage to the outlet, a distance of nearly seven miles, is narrow and straight. The lake is said to run about an equal distance south-westward from the portage, and it must therefore have a total length of about thirteen miles. It has an elevation of about twenty feet above Split Lake. The rock on either side of the portion which we followed is gneiss, with a general north-and-south strike.

Assean Lake to Was-kai-ow-a-ka Lake.

Leaving Assean Lake we followed a small, crooked stream called the O-na-ton-wi for a distance of eight miles northward, in a straight line, to a small lake of the same name. From this we reached the south end of Was-kai-ow-a-ka Lake, at the head of the Little Churchill River, by a chain of seven portages and six lakes running north-westward, the whole distance being about seven miles in a straight line. The country traversed consists of brownish-grey clay, which presents steep banks on some of the lakes, in one case eight feet high. Where the ground is level it is covered with wet sphagnum.

Was-kai-ow-a-ka Lake.

The eastern division of Was-kai-ow-a-ka Lake runs nearly north, and has a length of about twelve miles. The outlet is on the east side, about eight miles from the southern extremity, at which it receives a stream; and another, called Pickerel River, enters the north end. Opposite to the outlet, a narrow channel connects this with an extension of the lake, which the Indians informed me runs south-eastward six or seven miles, and has a width of three or four miles. The south-eastern shore



From a Photograph by DR. R. BELL.

VIEW UP THE LITTLE CHURCHILL RIVER, TEN MILES ABOVE RECLUSE LAKE.

Shewing General Character of Country.

of the lake washes the base of a ridge of drift, which extends for some miles to the north-east and south-west, and presents a bare bank of clay rising about sixty feet above the water, from which the lake derives its name. The water is clear, and on the 26th of July it had a temperature of 67° Fah. It abounds with fish, including grey trout, some of which are very large, whitefish, pike, pickerel, dog-fish and suckers. Its elevation above the sea appears from my barometrical observations to be 936 feet. The country around is green, the timber consisting of spruce, white birch, aspen, balsam-poplar and tamarac.

Fish. Elevation. Timber.

The general course of the Little Churchill River, all the way from the southern extremity of Was-kai-ow-a-ka Lake to its junction with the Great Churchill, is nearly north-east, and the distance between the points about ninety miles in a straight line. For three miles below the outlet the river has a tranquil course, and then expands into a small lake, but below this, for some seventeen miles, it is broken, here and there, by rapids, past some of which short portages require to be made. Solid gneiss rock occurs at the rapids, but elsewhere the banks consist of clay, gravel or sand. Further on the river flows for a few miles with a gentle current, among islands and lagoons, with occasional banks of clay, covered in some places with peat four feet thick. The accompanying wood-cut is from a photograph taken at the lower end of this stretch, looking up-stream. At thirty-eight miles from the southern extremity of Was-kai-ow-a-ka Lake, the Switching River falls in from the left side, and at five miles further we enter the Recluse Lakes, which are of small size and connected by a short sluggish portion of the river. So far the woods along the river have been generally green, but below these lakes the timber is mostly burnt all the way to the Great Churchill.

Little Churchill River. Rapids. Wood-cut. Recluse Lakes. Burnt country.

The rock of the east side of Was-kai-ow-a-ka Lake is a coarsely crystalline, massive, greyish-red syenitic gneiss, but along the river, especially in the first twenty miles below the lake, other varities of gneiss are exposed at the rapids. The strike is not uniform, but in most cases it approaches a south-westward direction. The Recluse Lakes lie in the north-eastern part of a valley four miles wide, excavated in the great clay deposit which is everywhere spread over this region. Along the north-west side the banks are from 100 to 150 feet high. On leaving the lakes a few rapids occur, but below these, the river, for a long distance, flows in a crooked channel of uniform breadth with a tolerably swift current, between banks of clay, varying from twenty to one hundred and fifty feet in height, but averaging from forty to fifty feet. The upper part of this deposit appears to be a modified clay, with occasional layers of gravel, and sometimes a ridge of gravel and sand

Syenitic gneiss. Clay deposit.

above it; while the lower part is unstratified and full of pebbles, with some boulders. The latter comprise yellowish-grey magnesian limestone of Silurian age, gneiss, and a great variety of rocks belonging to the unaltered, unfossiliferous series of the east coast of Hudson's Bay, which resembles the Nipigon group and which have been described in my report for 1877. Boulders of these rocks are abundant around Was-kai-ow-a-ka Lake and they were also observed along the Nelson River. Limestone gravel became abundant a few miles below Was-kai-ow-a-ka Lake.

Boulders.

In approaching the Great Churchill, the river, for a number of miles, is deep and smooth, and the clay banks have retired to a considerable distance on both sides. The water of this stream has a brownish tinge and forms a striking contrast with that of the great river into which it falls. The latter is bright and clear, like the St. Lawrence water, and on the 3rd of August it had a temperature of 62° Fah. During the few days preceding this date, the temperature of the Little Churchill averaged 63° Fah. Just below the junction or "forks" the river is nearly a mile wide, and the land on the east side rises from 300 to 450 feet above its level. No rock appears in these high banks, which are evidently composed of drift. Immediately above the forks the river is much narrower, and the clay banks on both sides rise steeply to a height of about 150 feet. The latitude of the north-west side of the river, opposite the mouth of the Little Churchill, I found to be 57° 30′ 57″, and the variation of the compass at this locality to be about 12° 30′ E. On the latter stream, at twenty miles south of the junction, the variation was ascertained to be 10° 30′ E., and at twenty-four miles it was 11° 30′ E.

River waters.

Churchill River at junction of Little Churchill

I ascended the Churchill for a distance of twenty-three miles (following the stream) from the mouth of the Little Churchill. In this distance it averaged about one-third of a mile in width and had high banks of clay on alternate sides. Numerous rapids were met with, and the total rise in the above distance amounted to 173 feet, or at the rate of seven and a-half feet per mile. A perpendicular fall, remarkable for its great width, was reported by an old Indian whom we met at Norway House to occur at no great distance further up the river. The upward course of the river beyond the point which I reached, must be nearly parallel to the Little Churchill, as the Indians say that in the winter the vapor from the falls all along this section can be seen from the latter river and Was-kai-ow-a-ka Lake. The fundamental rocks are exposed in the bed of the river at the rapids, and consist of coarse greyish-red or light reddish syenitic gneiss, like that of Was-kai-ow-a-ka Lake, and in some parts poryhyritic, passing into a somewhat fine-

Churchill River above the "Forks."

Syenitic gneiss.

The Burland Lithographic Co Montreal.

From a Photograph by DR. R. BELL.

LOW TIDE AT NEW FORT CHURCHILL.

Eskimo Dogs in the Foreground.

grained red gneiss resembling a hard altered red sandstone. Both rocks have a very "dry" character. The general strike is north-eastward or across the strike of the river.

The distance from the junction of the Little Churchill to the mouth of the river, according to my survey, is about 105 miles in a straight line, and the bearing about N. 33° E. (ast.) A considerable stream enters from the left side at twenty miles below the Little Churchill; but with this exception the tributaries are apparently all small. For the first twenty-five miles in a straight course below the point just mentioned, the river bends about a good deal, but from thence it makes only two (nearly straight) reaches to the sea. From the forks to the end of the first of these, the average width of the river is about half a mile, and few islands occur, but in the last reach, islands are numerous, and the width, for a considerable distance, is upwards of two miles. The tide extends to the foot of the last rapid, a distance of seven or eight miles from the open sea, the intervening section forming a lagoon about two miles broad. The mouth of the river, which is bounded by solid rock, is less that half a mile in width, and the point on the west side projects some distance beyond the other. The fine harbour of Churchill lies immediately within the mouth of the river.

Lower part of Churchill River described.

Lagoon.

Churchill Harbor.

From half a dozen barometric observations, taken on three different days, I found the river, where it is joined by the Little Churchill, to be 705 feet above the sea. This would give an average descent of rather more than seven feet per mile to the head of tide water. Rapids are numerous, especially in the first thirty miles, and again in the neighborhood of the angle formed by the last two stretches of the river at forty miles from the mouth. Only one of them, however, is formidable enough to require a portage to be made. This is a steep rapid, which may be called the Portage Chute, situated at twenty-eight miles, in a straight line, below the forks. Here the canoes are carried a distance of 205 paces on the south side of the river.

Descent in river.

Only one portage.

In the first twenty-five miles above referred to, in which the river is more crooked than elsewhere, it runs from side to side in a valley two to four miles in width, of which the slopes, consisting of earth, rise to heights of two or three hundred feet above the water. Beyond this distance, the high banks disappear or recede further from the river.

Deep valley.

The same coarse reddish syenitic gneiss which was found above the forks continued to be met with in the bed of the river at almost every rapid for a distance of thirty-five miles, in a straight line, downward from this point. In some places it was porphyritic from the presence of large crystals of salmon-coloured feldspar. The strike could scarcely be recognized. At one place it appeared to be W. N. W.

Syenitic gneiss.

Rusty sandstone.

At the end of the twenty-five miles from the forks, a rather coarse greyish rusty sandstone, in horizontal beds, makes its appearance on the right side of the river, and continues for three miles, or to the Portage Chute above referred to. In one place it forms a cliff twenty feet in height, and rests upon the red syenitic gneiss which is here seen in the bottom of the river.

Cliff of earthy limestone.

On the opposite, or left side of the river, a cliff of greyish-buff very crumbling earthy limestone or calcareous marl begins at the Portage Chute, and continues for eight miles downward with a height varying from thirty to fifty feet. In this interval the same rock crops out in a few places on the opposite side of the river from beneath the drift clay, which is also heaped above the beds forming the cliff on the left side.

Illustration.

The accompanying view, looking down the river, is copied from a photograph taken two miles and a half below the Portage Chute, and shows the appearance of the banks in this vicinity.

Last gneiss.

The last of the red syenitic gneiss is seen in a rapid at the termination of the long limestone cliff above described.

A second limestone cliff.

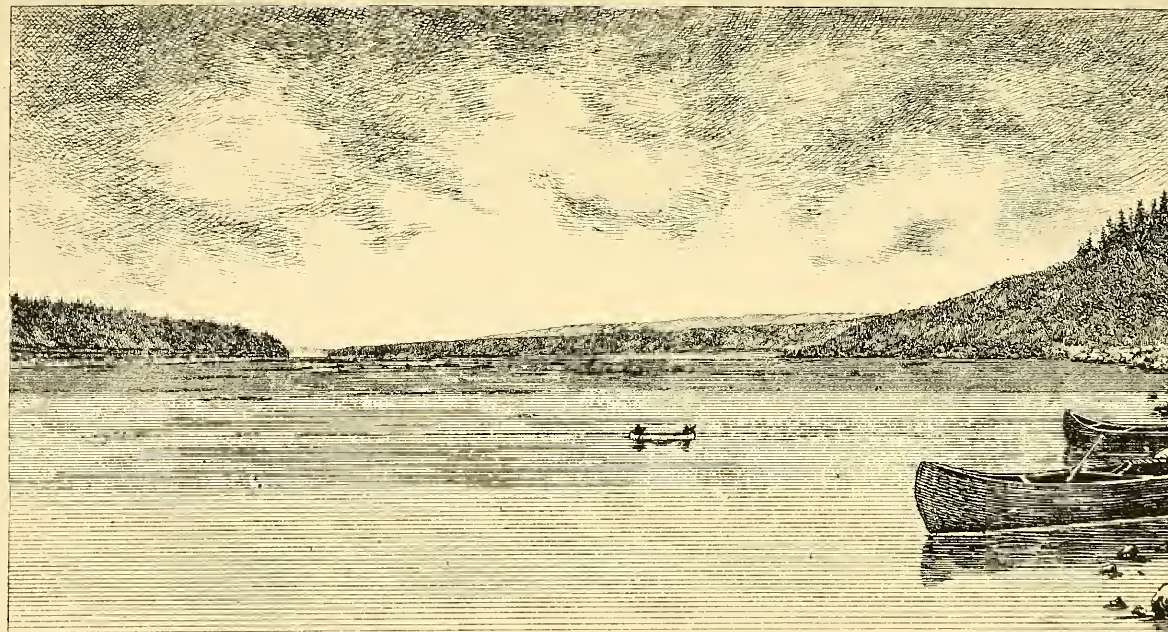
Here another escarpment of the marly limestone, like the one just passed on the left side, and of about the same height, begins on the right side of the river and continues for upwards of four miles, while the opposite bank consists of drift clay with the limestone exposed in one place. Thin irregular and interrupted beds of tolerably pure grey limestone occur among the marly strata. The only fossils observed were some fragments of encrinal stems and casts of *Leptæna.*

The termination of this lowermost cliff is about seventy miles from the mouth of the river. Between it and the commencement of the last stretch, a distance of upwards of thirty miles, the banks are from seventy to one hundred and fifty feet high, and consist of drift clay with the limestone cropping out here and there at the base on either side.

Banks of limestone and drift clay.

The latter is likewise exposed at a short distance back from the main banks in the ravines cut by numerous tributary brooks. The limestone also occasionally extends across the bed of the river. The channel of the Churchill in this section is evidently of pre-glacial origin. Along it a considerable thickness of drift rests upon the uneven surface of the limestone, filling its inequalities with a mixture of boulders, gravel and clay. The undisturbed pebbly and bouldery clay is also sometimes observed to fill the angle between the ancient cliff and the river bed.

Along this part of the stream the limestone becomes less earthy and of a dolomitic character. Some of the stronger beds are mottled with white chalky nodules, while others have straggling dark-colored patches running over their surfaces. At the commencement of the last reach, or forty miles from the mouth of the river, the rock becomes more



The Burland Lithographic Co. Montreal. From a Photograph by DR. R. BELL.

VIEW DOWN THE GREAT CHURCHILL RIVER.

SHEWING LIMESTONE CLIFF AND CLAY BANKS.

evenly bedded and of a lighter grey or buff color. The last observed exposure of the dolomite occurs about five miles further down. No fossils were found in this vicinity. Buff-colored dolomite.

Beginning at thirty miles from the mouth and extending downward for ten miles, the river spreads out among a great number of islands, and below this, as far as the tidal lagoon, it is broad, shallow and much interrupted with gravelly and bouldery rapids, the last of which is opposite to Mosquito Point, between seven and eight miles from the mouth. The flat-lying limestones or dolomites do not extend to the sea-coast on the Churchill, as they evidently do on the Hayes and Nelson Rivers. Westward of the lagoon, and on both sides of the mouth of the river, a different formation makes its appearance. This consists of a massive dark grey quartzite, which seems to contain more or less felspar or argillaceous matter, and weathers to a lighter grey on old surfaces. It is easily broken in any direction, and seldom shows distinct traces of bedding. It holds a good many straggling, irregular and short veins of white and grey quartz, with others of a tolerably regular character. Nearly all these contain scales of specular iron. Specks of iron pyrites were found in some of them, and traces of green carbonate of copper in one. In another of these veins, about two miles east of the mouth of the river, I found small specimens of a blue mineral which appears to be lazulite. Specimens from a number of these veins were brought home to be assayed for the precious metals, and are reported on by Mr. Hoffmann. Islands in the river. The limestones do not reach the coast. Grey quartzite. Quartz veins. Lazulite.

On the west side of the river the strike of the quartzite formation appears to be to the south-westward, and on the east side to the south-eastward, as if the strata were forming the opposite sides of an anticlinal axis, running down the lagoon and tending to terminate northward of the mouth of the river. At Fort Churchill the quartzite is very massive, and the strike is apparently S. 25° W. On the coast, about a mile and a half eastward of the river, it appears to be S. 45° E (mag). At a mile still further east it is quite distinct, and runs S. 75° E. Here the quartzite holds an occasional rounded quartz pebble. On Eagle Nest Point, about seven miles eastward of the mouth of the river, the strike, as shown by a bed containing small rounded pebbles of white quartz, is N. 75° E. Attitude of quartzite formation.

The geological age of these rocks cannot be accurately determined from present data. Tney contain no fossils, and are a considerable distance from the limestones already described as occurring further up the river, and which, no doubt, belong to the Lower Silurian system. They resemble the gold-bearing quartzites or "whin-rocks" of Nova Scotia (which are apparently Lower Cambrian) more closely than any Age of the quartzite formation.

other strata which I have seen. As a convenient name for present purposes they might be called the Churchill quartzites.

Peat.

Peat of fair quality, and perhaps of sufficient thickness to be of economic value, was noticed in several places along the route from Split Lake to Fort Churchill. The following localities may be mentioned:—Creek north of Hudson's Bay Company's post, Split Lake; outlet of Asscan Lake; southern part of Was-kai-ow-a-ka Lake, both sides; lagoons twelve miles south of Recluse Lakes, four feet thick on top of bank; Churchill River, twenty-one miles below the forks, five feet thick on top of bank. For some distance above and below the commencement of the last stretch, the woods occur only in patches in an open peaty country as far as can be seen along the river.

Grassy spaces.

Among the islands further down, bouldery and grassy spaces extend between those which are left dry at low water. For a distance of eighteen miles before reaching the mouth of the river, open grassy flats extend for a considerable but irregular breadth on either side. This open country is said to resemble the barren grounds which begin to the northwestward of Fort Churchill, and are represented in the accompanying illustration taken from a photograph.

Illustration.

Spring ice.

The upper branches of the Churchill being in a warmer region than the lower part of the river, the water rises in spring and bursts away the ice in the latter, while it still retains its strength. This circumstance, and the rapid nature of the river, evidently cause great packing and shoving of the ice during the freshet, and this no doubt has the effect of temporarily damming back the water in many places. Below the junction of the Little Churchill the banks are entirely denuded of timber, and have an even and uniform slope up to a height of twenty or thirty, and sometimes even forty feet above the summer-level of the river. The ice would also appear to extend annually to the valleys of the tributary streams, preventing the growth of timber along their sides for a considerable distance back from the main river. During the summer, however, a luxuriant growth of grass and other plants springs up, and covers these sloping banks in most places with a rich green. Further down, after the river has expanded among the islands and the banks have become lower, the effects of the spring ice are no longer noticeable.

Bare sloping banks.

Marine shells in the drift.

Marine shells were first noticed in the drift at sixty miles from the mouth of the river. The locality was towards the top of a bank, about 150 feet high, on the right side. The river at the base, from barometrical observation, was 200 feet above the sea, so that these shells probably occur at an elevation of nearly 350 feet above the same level. As the bank, (which consists of pebbly grey clay with apparently a

Elevation above the sea.

The Burland Lithographic Co Montreal

From a Photograph by DR. R. BELL.

VIEW OVER THE BARREN GROUNDS, NORTH-WEST OF CHURCHILL.

WITH CHIPPEWYAN CAMP IN THE FOREGROUND.

capping of modified clay,) continued, with the same characters, for a long distance up stream, I have no doubt the shells may be found at a greater distance inland than that at which they were observed by myself. The species noticed at this locality were *Mya arenaria*, *M. truncata*, *Saxicava rugosa*, and *Tellina proxima*. Among the islands further down, where the banks have diminished to about seventy feet in height and the bed of the river has descended to within 100 feet of the sea-level, *Pecten Islandicus* and *Cardium Islandicum* were found in addition to the foregoing species. These shells, together with *Rhynchonella psittacea*, were very abundant in the clay forming the bed of the lagoon at Fort Churchill.

Shells in clay at sea-level.

The comparatively rapid elevation of the land, or retiring of the sea, around James Bay and at York Factory was referred to in my reports for 1877 and 1878. The same phenomenon is also noticeable at Fort Churchill. From various circumstances connected with the history of old Fort Prince of Wales, at the mouth of the river, and other data, I conclude that the relative level of the sea and land in this vicinity is changing at the rate of about seven feet in a century. This recession of the sea may be due to a general lowering of its level relatively to the land, and partly to the silting up of portions of Hudson's Bay, interrupting the free flow of the tides.

Apparent lowering of the sea.

Spruce and tamarac timber are found growing near the sea coast in favourable situations as far as Seal River, beyond which their north-eastern limit curves inland. The spruce, although not growing as a continuous forest quite as far north as Fort Churchill, is still found of sufficient size in the neighbourhood of this post to be used for building houses, boats, &c. The balsam poplar is rare and of small size at Fort Churchill. White birch, which was found on the main river, eighteen miles above the forks, is said to occur at about sixty or seventy miles west of the mouth of the river. Along the direct overland route from Fort Churchill to York Factory the timber is reported to be generally small, and large prairie-like openings are said to occur, in which the ground is dry and covered with grass or other herbage.

Timber of the Churchill.

I saw very good potatoes and turnips growing in the garden at Fort Churchill. Previous to the advent of Mr. and Mrs. Spencer, the cultivation of potatoes had not been attempted, and the possibility of raising them at Churchill, when suggested by Mrs. Spencer, was ridiculed by the oldest inhabitants. However, in spite of predictions of certain failure, ground was prepared, seed planted, and a good crop harvested. The experiment has been repeated successfully for seven consecutive years, so that the question of the practicability of cultivating the potato on the shore of Hudson's Bay in this latitude has been pretty well solved.

Potatoes grown at Fort Churchill.

Breeding cattle at Churchill.

Hay can be cut in abundance in the neighbourhood of Fort Churchill, and cattle thrive well, yet the same ignorance or obstinacy as that above referred to, formerly prevented any attempt being made to breed stock on the spot, so that every fresh animal required had to be brought from some other post. Now, the small herd which is kept at the place is recruited by raising the animals calved at the fort itself. The open grassy land near the sea is practically of unlimited extent. Much of it is dry and undulating, affording abundance of pasture for the cattle. The butter made by Mrs. Spencer could hardly be excelled for quality and fineness of flavor in any country.

Pasture.

Butter.

Although I did not succeed in exploring much of the shore of Hudson's Bay to the north-west of the Churchill, enough was seen to give one a good idea of the nature of the coast. The east shore of Button's Bay, which begins at the point on the west side of the mouth of the river, runs south-westward for nearly ten miles. Fort Churchill is situated on the west side of the lagoon, about five miles from the mouth of the river. From the fort, the distance westward across the peninsula to Button's Bay I found to be only a little more than two miles. Around the bottom of this bay, and westward, the shore is extremely low. When the tide is out, wide bouldery flats are laid bare. These descend so gradually to the sea level that it is difficult to effect a landing, even from a small boat. Looking over these flats, the sky and the even outline of the boulders seem to meet in the distance, and their appearance suggests "a sea of boulders" as an appropriate name for them. Even within the lagoon of the Churchill, when the tide is out, the bouldery flats on either side form a conspicuous feature. Those on the west are represented in the accompanying illustration, taken from a photograph, looking southward at Fort Churchill. The boulders, which are of all sizes and generally well rounded, comprise a considerable variety of rocks, the prevailing ones being those of the unaltered group of the east coast of Hudson's Bay in the neighbourhood of Manitounuck and Nastopoka Sounds, which, as already stated, resembles the Nipigon series. Boulders of gneiss and fossiliferous yellowish-grey limestone are also numerous. At some places on the shore, within the first few miles to the eastward of the mouth of the Churchill River, a very light cream-coloured dolomite, resting on the grey quartzite, is so abundant, in a fragmental condition, that I have little doubt it occurs in place immediately beneath, or at no great distance off.

Coast N. W. of the Churchill.

Button's Bay.

Flat bouldery shores.

Illustration.

Derivation of the boulders.

Cream-coloured dolomite.

Latitude of (new) Fort Churchill.

While waiting at Fort Churchill for the sailing of the Hudson's Bay Company's ship, in order to proceed to York Factory, I obtained the latitude of the place by five different observation of the meridian altitude of the sun, taken by Troughton's repeating circle, as follows :—

The Burland Lithographic Co. Montreal.

From a Photograph by DR. R. BELL.

VIEW UP THE LOWER NAVIGABLE PORTION OF THE NELSON RIVER, SIXTY MILES FROM THE SEA.

SMOOTH WATER WITH HIGH BANKS OF DRIFT CLAY.

(1.)	58°	44′	54″·61
(2.)	58°	44′	22″·80
(3.)	58°	44′	31″·70
(4.)	58°	44′	55″·20
(5.)	58°	44′	50″·90
Mean.....	58°	44′	43″·04

Variation of the compass.

The mouth of the river is about 4′ further north. I also ascertained that the variation of the compass at this locality is at present about 11°E., but on the river, at twenty-seven miles southward of the mouth, I found it to be only 6° 30′.

Completion of Track Survey of the Nelson River.

Ascent of the Nelson River. Shallowest part of river. Soundings. Seal Islands. Derivation of boulders. Boulders of Churchill quartzite. Banks of the lower Nelson.

On the 27th of August I left York Factory, and camped on Point of Marsh, or the extremity of Beacon Point, between Hayes and Nelson rivers, and the next morning started to ascend the latter to Lake Winnipeg. My report for 1878 contains a description of the lower part of the Nelson, which was explored during that season. It will not be necessary, therefore, again to describe this section. In regard to the question of the navigation of this stretch of the river, it was stated that the shallowest place discovered by my soundings was at the head of the tide, abreast of "Gillam's" or the Lower Seal Island. When at this locality again, last August, I carefully sounded the whole width of the river and found the deepest water to be ten feet, as before. The bottom consists of shingle, resting apparently on boulder clay, which here forms both banks of the river and the Seal Islands. "Gillam's" Island and the south bank opposite to it were found, by barometer, to have each a height of eighty feet, while the north bank rises to upwards of 100 feet above the river. The boulders and the pebbles of the drift in this neighbourhood are made up largely of the rocks of the supposed equivalent of the Nipigon series of the east side of Hudson's Bay. Specimens of almost every variety of these strata may be picked up along the banks in this part of the river. Three miles above the Seal Islands I found a large piece of white quartz exactly like that of the veins in the grey quartzite of the mouth of the Churchill. It also contained scales of specular iron precisely similar to those of the Churchill veins. At "The Cache," which is on the north side of the river opposite Deer's Island, or sixteen miles from the Seal Islands, there are numerous large and a few immense angular and partially rounded blocks of this grey quartzite. One of them contains some white quartz pebbles similar to those occasionally observed in the rock in place at Churchill. The accompanying illustration, from a photograph taken on the north-west of the river at sixty-three miles from Point of

Marsh (the extremity of Beacon Point), will serve to show the appearance of the clay banks of the Nelson along its lower section.

First Limestone Rapid.

The First or Lowest Limestone Rapid proved to be about seventy-seven miles in a straight line from Point of Marsh, or about ninety by the river. The foot of the rapid is in latitude 56° 36′ 6·1″. Here, and at twenty-two miles higher up the river, the variation of the compass is 11° 30′, while at the place where the above photograph was taken it is 8° 45′. Two more strong rapids over limestone occur at nine and ten miles respectively above the lowest one. The first gneiss is seen in the bed of the river ten miles higher up, and the limestone in the banks disappears at two or three miles further on. The high clay escarpments of the lower part of the river continue to the Limestone Rapids, where they still have an elevation of about 100 feet, but they have diminished somewhat where the limestone disappears; and the bare banks skirting the river terminate near the foot of a chute with a perpendicular pitch of twelve feet, sixteen miles above the Third Limestone Rapid. Beyond this, an occasional bank of clay is seen as far as Gull Lake, but around this body of water and up to Split Lake the country appears to be generally pretty level. A few species of marine shells were observed in the upper parts of the clay banks all the way from the mouth of the river to the twelve-feet chute just mentioned. The only species met with at this upper limit were *Saxicava rugosa* and *Tellina proxima*. The elevation, as indicated by barometer, was upwards of 200 feet above the sea.

First gneiss.

Termination of bare clay banks at Twelve-feet Chute.

Marine shells in clay.

Pre-glacial channel.

In my report for 1878 it was stated that the lower part of the Nelson River appears to flow in a pre-glacial channel. Evidences of the existence of such a channel were found in various places along the river all the way to Split Lake. It was also mentioned in the report referred to, that the straight portion of the river between this lake and Sipi-wesk lies in a channel scooped out during the glacial period along the course of a great dyke and afterwards filled with pebbly clay. In the neighbourhood of the Limestone Rapids, and for some miles both above and below them, the hard boulder-clay has been excavated in many places and the hollows filled with loose boulders, shingle, gravel, sand and stratified clay. For a number of miles before coming to the First Limestone Rapid the banks on both sides are about 120 feet high and consist generally of unstratified pebbly clay, but at a point on the north-west side, between two and three miles below the rapid, from twenty-five to fifty feet of sand, gravel and cobble-stones rest upon 100 feet of this clay. Close by, to the north-east of this, the river bank consists of yellow-drab fine sandy clay, and a little further on in the same direction it consists of thirty feet of boulders, cobble-stones and

River channel along a great dyke.

Loose shingle, &c., in hollows in boulder clay.

Composition of river banks.

pebbles at the bottom, overlaid by ninety feet of sand and gravel. On the same side of the river, at the foot of the rapid itself, 100 feet of the hard drift clay, which here shows uneven joints with rusty surfaces, rest upon twenty feet of buff-coloured fossiliferous dolomite in nearly horizontal beds. It is shaly at the base, but at the top some of the beds are two feet thick. These hold flinty and white chalky nodules. A cliff, twenty feet high, of greyish-buff dolomite, mottled with yellow, runs along the edge of the rapid on the other side of the river. Among the fossils observed here was an *Orthoceras* two and a-half feet long and six inches in diameter. On the south-east side, just below the Second Limestone Rapid, nine miles above the first, a cliff, twelve feet high, at the edge of the river, is formed of horizontal beds of crumbling buff and greyish dolomite. At about a mile below this locality these beds were observed to be slightly undulating. At the Third Limestone Rapid the rock is exposed in horizontal beds at the foot of the clay bank along the south-east side of the river, and consists of bluish-grey, drab and buff, somewhat arenaceous dolomite. Near the foot of this rapid a considerable stream, which I took to be the Limestone River, enters on the opposite side.

First Limestone Rapid.

Section of fossiliferous dolomite.

Second Limestone Rapid.

Third Limestone Rapid.

Arenaceous dolomite.

For the next eleven miles the river is very swift, and then a rapid, two miles wide and full of knobs and little ridges of gneiss, begins, and continues for five miles, or to the Twelve-feet Chute already mentioned. This might be appropriately termed the Broad Rapid. In going from the lowest of these rapids to the other, the banks on both sides diminish from a height of about one hundred feet at the former to about fifty or sixty at the latter; yet the surface of the ground probably slopes in the same direction as the river, the descent in the latter being apparently greater than would be accounted for by the difference in the altitude of the banks, supposing the tops of the latter to be horizontal. On the north-west side, the clay bank is quite continuous and almost bare all the way to within a mile of the Twelve-feet Chute, a distance of over sixteen miles by the river. Near the Third Limestone Rapid the bank was observed to be more or less distinctly stratified throughout its whole height. On the opposite side, the upper part, and sometimes its whole depth, consists of gravel and sand.

Broad Rapid.

Diminution in height of banks over river-bed.

Slope of river-bed.

Along the above interval between the rapids, ledges of the dolomite crop out from beneath the banks here and there on both sides. The last exposure is on the south-east side at the bottom of the Broad (five miles) Rapid. Here it is finely arenaceous, of a mottled light bluish-grey color, and holds some of the same fossils as those found further down the river. The fossils collected at the three Limestone Rapids

Arenaceous dolomite.

Fossils examined by Mr. Whiteaves.

have been examined by Mr. Whiteaves, and his report upon them is given as an appendix. From this it will be seen that we have here most of the species characteristic of the dolomite which occurs along the Red River in Manitoba, and which Mr. Whiteaves regards as equivalent to the lead-bearing limestone of the Western States or about the horizon of the Utica formation. In passing through Manitoba on the way home, I made a considerable addition to our collection of fossils from the banks of the Red River, in the parish of St. Andrew's, and some from the same parish were presented by Mr. William Murdock, C.E.

Nelson River and Manitoba dolomites of Utica age.

From the Twelve-feet Chute to the foot of Gull Lake, the distance, in a straight line. is forty-three miles, and the bearing a little south of west. The River in the interval is of very unequal width. Rapids occur in many places, and numerous portages require to be made. In the last four or five miles before entering Gull Lake the worst rapids in the whole course of the Nelson River are encountered. They may for convenience be called the Gull Rapids. The lower chute of this interval has a descent of about fifty feet in less than half a mile, and requires a portage of 900 paces to be made in order to get past it. The upper portion of the Gull Rapids is divided among islands, but its total fall must amount to more than that of the lower chute. Six principal rapids occur between the Twelve-feet Chute and those described, and the whole ascent in the river in this space cannot be far from 100 feet. About mid-way down this section, the river divides among islands, the largest of which may be about four miles long. Just above these islands, the upward course of the river makes a bend to the southward of about six miles, and then resumes its former course. Nine miles above the Twelve-feet Chute, a brown-water river falls in from the south, which appears to be the largest tributary from that side below Split Lake.

River for 43 miles below Gull Lake.

Gull Rapids.

Six rapids above Twelve-feet Chute.

Islands.

Bend in the river.

Gull Lake is merely an expansion of the river, and runs with its general course, which has the same bearing (a little south of west) all the way from the commencement of the Laurentian gneiss to the head of Split Lake. It is twelve miles long and four wide in the middle, and contains a few islands. The distance from the head of Gull Lake to the outlet of Split Lake is eighteen miles, and the average width of the river is nearly one mile. An easy rapid, two miles in length, occurs at the outlet of Split Lake, and two short ones about mid-way between the two lakes. An occasional bank of clay is seen along the section of the river under description, but, as already stated, the country in the neighbourhood has a generally level appearance, the only excep-

Gull Lake.

Slight rapids.

tion being Fox Hill (a part of the ridge running past the south end of Was-kai-ow-a-ka Lake), which is visible to the north-westward from the lower part of Split Lake. The Assean River enters the north side near the outlet, and at a narrow place, just west of it, there is a perceptible current in the lake. Fox Hill. Assean River.

From the termination of the fossiliferous dolomites to the outlet of Split Lake, the rocks along the Nelson River consist of Laurentian gneiss and schists, with the exception of a small area of what appear to be Huronian strata at the foot of the lowest Gull Rapid. At a point on the north side, about one mile below this rapid, a coarse grey mica-schist, with strings and bunches of white quartz along the bedding, dips N. 15° E. $<$ 80°. Crossing the foot of the rapid itself is a band of fine-grained massive mica-schist, passing into dark grey quartzite, ribboned with streaks of white quarts and red felspar. The dip is N. 10° E. $<$ 80°. A dark finely-crystallized diorite, probably forming part of a dyke, was observed at the sides of the rapid. Laurentian. Huronian at Gull Rapids.

The Laurentian gneiss, in the section which has been indicated, presents some variety in composition, color, texture, and in the character of its stratification, which it is unnecessary to describe minutely in the present report. Sometimes the gneiss passes into hornblende or mica schist. In a few places the latter is studded with garnets, and it generally contains veins of coarse, light-colored granite. The strike, which was recorded in many places, was nowhere found to preserve a general uniformity of direction for any considerable distance, but in the majority of all the cases noted it had a northwesterly tendency. Laurentian gneiss. Garnets. Granite veins. Strike.

On the first island above the narrows near the outlet of Split Lake, a green hornblende rock, which may be Huronian, runs S. 15° W., vertical, and on the east side of the point forming the narrows there is a peculiar light reddish-grey gneiss, containing a soft chloritic mineral. The weathered surfaces are very thickly pitted, and have a rough, spongy appearance. Split Lake and the geology of its shores have been already referred to in describing my route from Lake Winnipeg to the mouth of the Churchill River. Split Lake.

Grass River.

Having already surveyed the section of the Nelson River between the "jog" at the foot of the Grand Rapid and Sipi-wesk Lake, I followed the Grass River between these points, in returning to Norway House, after completing the exploration of the river below Split Lake. The upward course of the Grass River from its junction with the Nelson bears southwestward, nine miles to the outlet of Witchai ("Stinking") Lake, from which it runs southward, or parallel to the Upward course of river.

Chain of straggling lakes.
Wintering Lake.
Wintering Lake to Sipi-wesk.
Landing Lake.
Cross Portage.

Nelson, for twenty miles, to the Standing-rock Rapid. A canoe-route, seven or eight miles in length, leads from the head of this rapid across to the Nelson. From this rapid the "river" is rather a chain of straggling lakes connected by narrows, with more or less current, for thirty-eight miles in a southwestward direction, to the head of Wintering Lake, where the Pickerel River flows in with the same upward course. About half-way up this stretch, at Burnt Lake, the main branch of the Grass River joins the one we have been following. The short route from Sipi-wesk Lake to Burnt-wood River crosses Wintering Lake at right angles. On the present occasion we followed the part of this route lying between the latter and the outlet of Sipi-wesk Lake. The distance is about fourteen miles in a general eastward direction. From the eastern bay of Wintering Lake we made a portage of one mile and ten chains to the western part of Landing Lake, which discharges into the Nelson River, seven or eight miles below Sipi-wesk Lake. A creek only a few chains in length, entering the south side of Landing Lake, conducted us to a small sheet of water, from which a trail, called Cross Portage, one mile and a third long, brought us to the outlet of Sipi-wesk Lake.

Gneiss.

I have already referred to the supposed Huronian rocks at the mouth of the Grass River. At about three miles from the Nelson, a rusty, quartzose variety of gneiss dips S. 40° E. $<$ 60°. For two miles further up, hornblendic gneiss is seen in places, and at the end of this distance it dips S. 10° E. $<$ 80°. Here some large dioritic dykes run across the river. At the first rapid, about seven miles from the mouth, a ribboned felsitic red gneiss has also the same dip.

Great dyke at Standing-rock Rapid.
South-westward strike.

At the Standing-rock Rapid, a great dioritic dyke crosses the river. It is divided by vertical fissures, one of which has detached from the main rock the mass (shown in the accompanying illustration) to which the rapid owes its name. For about a mile above the rapid, the gneiss, which dips N. 45° W. $<$ 80°, is full of trap dykes. Thence all the way along the route to the outlet of Sipi-wesk Lake, the rocks consist of different varieties of gneiss, often cut by trap dykes. The general strike in this interval is southwestward, the directions ranging from about W. to S. 20° W.

Character of country along Grass River.

The country traversed by the Grass River route between its mouth and Sipi-wesk Lake presents generally an undulating appearance. The land is usually of a clayey nature and the soil often good. There seems to be very little swamp, as far as could be judged by following the canoe-route. Along the river, and around the lakes on its course, the rocks are seen beneath the clay on the islands and ends of points. Half-way up the north-west side of Wintering Lake (which is fourteen

The Burland Lithographic Co. Montreal.

From a Photograph by DR. R. BELL.

STANDING-ROCK RAPID, GRASS RIVER, NELSON VALLEY.

COLUMNAR TRAP OF A LARGE DYKE.

or fifteen miles long) a rocky hill overlooks the water for a few miles. Here, and in some other places on the route, the woods are burnt, but most of the timber in this region appears to be green, and of a thrifty growth, the spruces sometimes measuring over six feet in girth. The water of Grass River is slightly turbid, but that of Landing Lake is clear. The barometer indicated that this lake has an elevation of thirty-six feet over Wintering Lake, and fifty-four feet over Sipi-wesk Lake.

Elevation of Landing Lake.

Explorations by Mr. A. S. Cochrane.

Finding that the method which would be most advantageous for me to adopt in making my surveys of the Churchill and Nelson Rivers, would not require the aid of my assistant, I assigned to Mr. Cochrane a separate region to explore, in order that by working independently of each other, we might examine a larger area of country during the season. He was instructed to make a topographical and geological exploration of the region lying to the south of the route which I had followed the previous year, using God's and Island Lakes and their connecting waters from Oxford House as a basis of operations. He was also directed to make observations and collect information as to the fauna of the region, the climate, soil, timber, and the character of the country generally.

Instructions.

Region southward of Oxford House.

The accompanying map, on a scale of one inch to four miles, engraved from the original, as prepared by Mr. Cochrane from his own track-surveys, exhibits the leading topographical features of the region which he explored. It serves to simplify very much the following description, which is taken from this gentleman's account, aided by his plans, notes and specimens. He proceeded from Norway House to Oxford House by the Hudson's Bay Company's boats, and at the latter place obtained a canoe and men through the courtesy of Mr. Cuthbert Sinclair, the officer in charge. The route which he followed to God's Lake, leaves a bay on the south side of Knee Lake about sixteen miles from its western extremity, and proceeds by way of Wolf and Wolverine Rivers and Swampy Portage, which is nearly two miles long and terminates on the shore of God's Lake.

Map.

Route to God's Lake.

God's Lake runs north-east and south-west, and has a length of forty-eight miles. Its widest portion measures fourteen miles across. At rather more than half-way up from its north-east extremity, is the Manitouwapa, or Wonderful Narrows, where the lake contracts to a few chains in width, and a current flowing to the north-eastward is perceptible. A canoe-route to Oxford Lake leaves the north-west side of the upper portion of the Lake by way of Touchwood River,

God's Lake.

Inlet. which flows into the latter. The river from Island Lake enters the south-western extremity of God's Lake, and here the Long Rapid or Kinoutchewan is encountered. God's Lake does not discharge into Outlet. Knee Lake, as hitherto represented on sketch-maps, but by God's River, a large and rapid stream, which, on uniting with the Little Severn from the south, forms the Shamattawa River. The outlet of the lake is on the north side, about mid-way between Swampy Portage and its north-east extremity. Vermilion Lake. Vermilion Lake lies not far to the north-east of the foot of God's Lake and sends its water into God's River, some distance below the lake of the same name. Knife River. Knife River, about the same size as Touchwood River, enters the south-east side of the lake twenty miles from its north-east extremity.

God's Lake, being comparatively free from islands, presents to the eye a greater expanse of water than any other in this part of the country, but Island Lake is about one third larger. Surrounding country. The region around God's Lake, as far as can be judged from its appearance from the lake, is rocky but mainly level, and the surface of the water lies, apparently, only about fifty feet, or less, below the general surface of the land immediately surrounding the lake. Between Knife River and Manitouwapa, a distance of eight miles, the bank is higher than High shore. usual, the rocks in some places rising as much as 200 feet above the level of the lake. Burnt timber. The timber has been burnt at different times over more than half of the tract visible from the lake, and the same conditions are said to extend far into the interior all around. The water, Clear water. which is clear, is said to be deep throughout most of the lake, and it abounds in fine fish, the more valuable of which are the whitefish and grey trout. Large trout. Specimens of the latter are occasionally caught of great size. This circumstance has given origin to the fables told by the Indians of the mythical trout of huge proportions represented as Origin of the name of the lake. inhabiting these waters. The present name of the lake has in some way grown out of the legends connected with this supernatural fish.

Having completed his exploration of God's Lake, Mr. Cochrane returned to Oxford House for a new outfit, and then proceeded to Route from Oxford to Island Lake. Island Lake by way of the route which leaves the eastern extremity of Oxford Lake and passes through the south-western division of God's Lake. Betwen these two sheets of water the route traverses Rat, Clearwater, and Touchwood Lake. In order to go from Rat Lake to Clearwater Lake, three portages required to be made (the intervening space being broken by two ponds), namely, the Long Portage, 3759 Portages. yards; Ant Portage, 873 yards; and High-hill Portage, 1538 yards. The country between Oxford Lake and the south-western part of God's Lake along this route is not quite so rocky, nor is the timber so much burnt as it is around the latter lake.

The Kinoutchewan or Long Rapids, at the head of God's Lake, are passed by three portages, with a total length of 2460 yards, and a demicharge 1234 yards long. Above these the upward course of Island Lake River turns east-south-east, and passes through the lower part of Beaver-hill Lake, which stretches to the south-westward about thirty miles. At the end of this reach of the river there is a short demicharge into a small round lake, from which a portage of 650 yards leads us into another small sheet of water called Goose Lake. The Kinoutchewanoose, or Little Long Rapids, fall into the southern part of this lake, and are surmounted by four portages, having an aggregate length of 957 yards. Beaver-hill Lake.

From Goose Lake the Island Lake River has a nearly direct upward course, bearing southward, all the way to the lake from which it takes its name, the distance being twenty-three miles. Its volume is about the same as that of Trout River (between Oxford and Knee Lakes), and its width, which varies much, may average about 200 yards. In some parts of its course it passes between walls and banks of bare gneiss rock, which sometimes rise to the height of fifty feet or rather more. Indeed this character prevails all the way from God's Lake. The rocky parts are the narrowest, and in the intervals between them the river often opens out into reedy and marshy bays with clayey soil around them. The Island Lake post of the Hudson's Bay Company, in charge of Mr. Linklater (to whom Mr. Cochrane was indebted for much kindness), stands on an island near the outlet of the lake. Island Lake River. Post of the H. B. Company.

Island Lake lies nearly east and west, and its greatest length is about seventy miles. The main body of the lake, however, measures only forty-eight miles, and has an average width of twelve miles. Both the northern and southern shores curve gently to the south, parallel to one another. The whole form of the main lake, and the positions of the inlet and outlet, present a striking resemblance to the outline of the human stomach and the situations of its orifices. This lake is very appropriately named, being literally filled with islands in every part. The aggregate area of these islands is apparantly as great as that of the water-surface. The number probably amounts to several thousands, and they present a great variety in form and size, the largest being several miles in length. Mr. Cochrane counted upwards of one thousand adjacent to the main land all around, most of which are indicated on the accompanying map, and the whole of the interior of the lake is studded with an equal profusion. Island Lake. Many islands.

A narrow and straight bay runs west from near the outlet for a distance of nine miles, which, for convenience of description, might be called Narrow Bay. From its northern shore a canoe-route starts to Narrow Bay.

Old Wife's Lake, and a similar route to Deer's Lake leaves the west side of Island Lake River about two miles above Pelican Rapid. Several deep bays occur on the south side of Island Lake, and one extends from the eastern extremity, a distance estimated to be about eighteen miles, where it receives the Sagawitchewan River, which is believed to be the principal inlet of the lake. The water of this stream and of all the other feeders of the lake is of a dark color, contrasting strongly with the clear water of the lake itself.

Inlet.

Clear water.

Surrounding country.

The land about Island Lake is level, and has an average elevation above the water of apparently less than fifty feet. The woods in the neighborhood of the lake are mostly green (or unburnt), so that the country presents a more pleasing appearance than that around God's Lake. The proportion of soil to rock is also much greater than in the neighbourhood of the latter lake.

Soil.

Soil of the District. Large areas of low sandy land occur on Oxford and Knee Lakes, especially on their northern sides. These tracts support a uniform growth of small spruce timber through which the forest fires have generally run. The higher grounds, where not rocky, present usually a stiff light-colored clay, and soil of this description with more or less loam, is found along the valley of the Trout River. Oxford House is situated on a stiff clayey soil, which here produces barley and all kinds of garden vegetables in perfection. This locality is remarkable for its abundance of wild gooseberries, acres of ground in some places being covered with gooseberry bushes. The land to the north of the lake, opposite to Oxford House, rises to an elevation of about 200 feet, and appears to be higher than any other ground in this part of the country. I was informed that it consists entirely of soil underlaid by drift materials, no rock cropping up in the vicinity. Mr. Cochrane estimates that on an average about half the length of the immediate bank or shore-line of God's Lake may consist of rock, while the other half is made up of clay, sand, gravel, swamp and marsh. From the generally level appearance of the country at a distance, and its resemblance to regions which are covered with soil, he thinks it probable that the greater part of the area is overspread with soil or loose material of some kind. Along the route from Jackson Bay, at the east end of Oxford Lake, to the upper part of God's Lake, the country is more diversified than in the neighbourhood of the latter lake. Although the general outline is more uneven, the proportion of rock to other kinds of surface was estimated by Mr. Cochrane to amount to only about one fourth of the whole. The soil or loose materials consist of loam, clay, sand and gravel, or of mixtures of these. Peat and sphagnum are found in the low grounds in many

Productiveness

God's Lake.

Route from Jackson Bay.

Peat.

places. On the north-west side of Swampy Lake, below Knee Lake, there is a bed of good peat of considerable extent, which shows a perpendicular face of four or five feet above the level of the water. Peat of fine quality occurs at Clearwater Lake and Swampy Portage Lake. As already mentioned, rocky banks prevail along the Island Lake River, although, at the wider parts, clay and other soils are met with.

Around Island Lake, although the action of the water has, in the course of time, washed away the loose materials and earth, leaving the underlying rocks exposed along a great part of the immediate banks, yet on going back a short distance, a covering of good soil is generally met with. After Mr. Cochrane had completed the circuit of Island Lake, and when he was at the Hudson's Bay Company's post near the outlet, I find that he has made the following note in his field-book, under date of 31st August: "The soil I have seen in passing round the lake is very good indeed, being generally clay of a light brownish color, mixed, in most places, with a little fine gravel. In nearly every case where I went inland for any distance, the rock seen along the lake shore disappeared or was covered with soil, and the trees were of a larger and better growth than near the water. There is a very good garden at this post, and certainly I have never seen potatoes look better than they do here." The other varieties of soil which Mr. Cochrane noticed around this lake include clay, sand, vegetable loam, and sandy and gravelly loam.

Island Lake.

Extract from field-book.

Varieties of soil.

Timber of the District. Spruce is the most abundant wood everywhere in this region. Next in order comes aspen, white birch, tamarac, balsam-poplar and Banksian pine. In many places the spruce attains a very good size, and is used in the form of logs and beams for building purposes. It is also sawn into planks and boards for all sorts of carpenter work. The tamarac and Banksian pine sometimes have a diameter of about twenty inches. Balsam-fir is common and of good size around Island Lake, some of the trees measuring nearly four feet in circumference, but it is scarce at God's Lake, and only rarely seen and of small size as far north as Knee Lake. In going southward the rowan or mountain ash was first seen on Island Lake. Ground maple was met with only on the south side of this lake. I may here mention that on the eastern side of Lake Winnipeg, George's Island, off Poplar Island, is the most northern locality at which I have seen this species.

Timber.

Geological Features of the Region Explored by Mr. Cochrane.

Laurentian gneiss is the prevailing rock throughout the whole district between Knee and Island Lakes. It presents little variety, and no in-

Geology of the district.

dications of useful minerals were found in this formation. The colour is usually some shade of grey, generally rather light, but sometimes it is reddish-grey, and more rarely a distinct red or pink. The stratification, which in most parts is moderately distinct, is often bent or contorted. In some places the gneiss has a spotted appearance, and occasionally strongly contrasting beds are seen, but, as a rule, it is of a very uniform character. Its average texture is of the medium variety, or rather tending to be fine-grained, but coarse forms are occasionally seen. Judging from the specimens and Mr. Cochrane's description, an area of very light grey, fine-grained granite occurs on the south-east side of God's Lake, about midway between the Narrows and the north-east extremity; and another, probably of small extent, of light grey, coarse granite at the outlet of Beaver-hill Lake. The latter consists of plates of yellow mica in white quartz and feldspar. Both of these localities are surrounded by Laurentian gneiss.

Gneiss.

Granite.

Character and strike of gneiss.

In order to save a more tedious description, the general character and the strike of the gneiss throughout the region explored by Mr. Cochrane is here given in tabular form. It will be evident from this that no prevailing or general direction can be detected in this part of the country. The bearings are all magnetic.

TABLE SHOWING THE GENERAL CHARACTER AND THE STRIKE OF THE GNEISS IN THE REGION TO THE SOUTHWARD OF OXFORD AND KNEE LAKES.

Between Oxford Lake and God's Lake.

1. Five miles up Rat River—Greyish Red .... West.
2. Northern part of Rat Lake—Grey .... West.
3. Three miles N. of southern extremity of Rat Lake—Micaceous, grey, finely ribboned .... West.
4. One mile E. of High-hill Portage, Clear-water Lake—Coarse grey .... S. 22° W.
5. Clear-water Lake, two miles E. of last—Grey.............. S. 5° W.
6. Narrows, at centre of Clear-water Lake—Coarse grey........ S. 12° W.
7. One mile and a-half S.E. of Narrows, Clear-water Lake—Light reddish and very light grey............................ S. 50° E.
8. Point N. side, centre of Touchwood Lake—Coarse, grey...... S. 60° E.

Around God's Lake.

9. On Island, eight miles N. of Kinoutchewan Rapids, W. side—Dark grey .... S. 70° E.
10. On Island, three miles S. of Narrows—Micaceous grey, finely ribboned .... S. 43° E.
11. Island, W. side, three miles N. of Narrows—Grey .... S. 60° W.
12. Island, W. side, four miles N. of Narrows—Grey .... S. 40° E.
13. Point, W. side, seven miles N. of Narrows—Reddish grey .... S. 70° E.
14. Point, entrance to Bay, N.W. corner......................... East.

15. Point, S. end of Fishing Eagle River—Finely grained, flesh coloured.......................................S. 60° E.
16. Eleven miles E. of Swampy Portage ....S. 20° W.
17. Three miles E. of God's River ....S. 52° W.
18. Island, four miles E. of God's River......................East.
19. Point, eight miles E. of God's River—Finely grained ("pepper and salt")..S. 30° W.
20. Island, nine miles E. of God's River—Finely grained ("pepper and salt") ....S. 16° E.
21. Point, eighteen miles E. of Narrows.......................East.
22. Island, thirteen miles E. of Narrows—Grey ....S. 45° W.
23. Point, eight miles N.E. of Narrows—Grey..................S. 60° E.
24. Island, six miles E. of Narrows............................S. 63° E.

Along Island Lake River.

25. Head of Kinoutchewan Rapids—Ferruginous, dark coloured, siliceous, finely crystalline, hornblendic, schistose........S. 80° E.
26. Point on S. shore of Beaver-hill Lake, near outlet—Coarse reddish grey..S. 68° E.
27. Outlet of Beaver-hill Lake—Fine grained, dark grey, micaceous.S. 65° E.
28. Portage at outlet of Goose Lake—Coarse reddish grey ....S. 48° E.
29. Pelican Rapid—Coarse, grey.................................S. 70° W.

Around Island Lake.

30. One mile N. of Hudson Bay Co.'s post—Grey and greyish-red.S. 45° W.
31. Near mouth of Main-land River, head of Narrow Bay—Very coarse grey ....S. 15° E.
32. Western extremity of main body of lake, just south of Narrow Bay—Grey ....S. 25° E.
33. Near head of Pipestone Bay.................................S. 70° E.
34. Point between Pipestone and Highway Bays—Fine greenish grey..East.
35. West shore of Highway Bay, three miles from extremity—Greenish grey..S. 40° W.
36. Point four miles E. of Highway Bay—Grey ....S. 16° E.
37. South shore, four miles eastward of last—Light grey........East.
38. Island, five miles further east—Light grey ....S. 40° E.
39. Point fourteen miles west of Fox Island—Dark grey ....S. 80° E.
40. Island in Land-locked Bay, twelve miles W. of Fox Island—Grey ....S. 80° W.
41. Island, six miles west of Fox Island—Dark grey.............S. 20° E.
42. Island, five miles west of Fox Island.......................S. 18° W.
43. Island, just west of Fox Island—Very coarse, grey..........East.
44. Island, four miles north-east of Fox Island.................S. 65° W.
45. Island, near N. shore, eight miles north of Fox Island.......S. 45° W.
46. Point on N. shore, eighteen miles north-westward of Fox Island—Grey, and with reddish and greenish spots ....S. 75° E.
47. Point about the middle of the north shore, or twenty miles from Fox Island—Fine-grained, greenish................East.

Huronian.

Huronian. The large trough of Huronian schists, &c., in which Oxford and Knee Lakes are included, was described in my report for 1878. The strata of the eastern part of the former lake consist of greyish micaceous and more or less calcareous schist-conglomerate, its pebbles, which are well rounded, consisting mostly of granite and opaque white quartz. On Rat River, a short distance south of the old Wesleyan Mission of Jackson Bay, the strike of this rock, which is of the same variety as that of Oxford House, is east and west, and the dip southward at an angle of 86°. The same conglomerate is found also at the head of Trout River, but farther down the stream, is mostly grey mica-schist without pebbles. I found beds of magnetic iron ore interstratified in siliceous slates where Trout River falls into the head of Knee Lake, and not far from this locality Mr. Cochrane observed the calcareo-micaceous schist-conglomerate, holding granite pebbles, associated with finely crystalline black hornblende schist, full of dull garnets as large as peas. No new facts were noted in regard to the Huronian rocks of the shores of Knee Lake.

Schist-conglomerate.

Grey mica-schist.

Magnetic iron.

Garnets.

Huronian on God's Lake.

Mr. Cochrane's specimens and notes show that on the shores of the larger division of God's Lake, rocks which we may consider Huronian, occur a short distance west of the outlet, at the eastern extemity and on both sides of the Narrows. About a mile west of the outlet there is a compact, dark, greenish-grey diorite with small quartzite pebbles, running S. 80° W. (mag.) and dipping northward, and on an island about three miles further west dark greyish-green dioritic schist occurs, dipping S. 40° W. Compact dark greenish-grey diorite with a little calcspar in the joints, occurs around the bay at the eastern extremity of the lake. The strike is in various directions, and the dip at different angles from 45° upwards. At the extremity of the first long point on the south-east side of the lake, or about eight miles from the bottom of the bay just referred to, the rocks run nearly east and west, and consist of dark grey felsitic schist, thickly spotted with whitish felspar, giving it a porphyritic appearance, together with a nearly black finely crystalline hornblende schist. On the same side of the lake, three miles north-east of the Narrows, dark green crystalline diorite occurs, with calcspar in the joints. It holds iron pyrites and small veins of quartz. Two miles nearer the Narrows the rock on an island is a massive grey mica schist with glassy spots. The dip is here southward at an angle of 50°. In the Narrows it consists of grey felsitic schist, showing very fine lines of stratification and dipping N. 30° E. $<$ 85°.

Schist on Touchwood Lake.

A dark greenish-grey felsitic hornblende-schist occurs on the eastern part of Touchwood Lake, and a similar rock was found on a small island in Clear-water Lake. About the middle of the south-east shore of the upper division of God's Lake, green mica and hornblende schist was met with, dipping W. N. W. $< 50°$.

The Huronian strata are largely developed around the western part of Island Lake, and they occur again at its eastern extremity. On the shores of the narrow bay, which runs west from the vicinity of the outlet, the following rocks were found: dark grey felsitic schist with fine lines of stratification; dark grey glossy calcareous schist; grey finely ribboned siliceous slate, felsitic and highly calcareous; grey felsitic silicious slate, and a felsitic slate of an olive-grey color. The strike varies from S. 70° to S. 80° W., and the dip is northward at various angles from 45° upwards. Huronian strata around Island Lake.

On the south side, in the entrance of Pipestone Bay, a long narrow arm, opening off the lake at eighteen miles from the outlet, beds of a grey calcareous, slightly crystalline steatitic schist are associated with dark greenish-grey felsitic and hornblende slates. Here the strike is about S. S. W. Tobacco pipes are carved by the Indians out of the steatitic rock. Steatitic schist.

Along the south side of the next bay, or at a distance of twenty-four miles south of the outlet, the principal rock is a green epidotic hornblende schist. Associated with this are dark green finely crystalline hornblendic and dioritic schists. The dip here is N. 20° W. at a considerable angle. Green schists.

Laurentian gneiss occupies the shore between the different localities of Huronian rock which have just been described. The same rock is also found about the outlet of the lake, but at a point on the northern side, four miles south of the outlet, the Huronian system is represented by the siliceous schist-conglomerate which is so largely developed at the east end of Oxford Lake. A grey quartz-rock is found on the next prominent point, four miles south-east of the last. Further up the shore, or sixteen miles from the outlet, a very dark grey diorite was met with, and at about twenty miles the rocks consist of soft grey schist with harder varieties of the same color full of grains of clear vitreous quartz, together with many of iron pyrites. The dip in this neighbourhood is northward at high angles. Fine grained greenish gneiss, having the same dip, was met with two or three miles further east. This may be either Huronian or Laurentian. To the eastward of it, the ordinary grey Laurentian gneiss was found all along the shore as far as the bay at the head of the lake. Laurentian gneiss. Schist-conglomerate. Grey gneiss.

On Iron Island, which lies close to the north shore between the two localities of Huronian rocks last described, Mr. Cochrane found dark green serpentine, with calcareous joints, along with a hard fine-grained, semi-crystalline rock of a deep green color, as if due to the presence of Serpentine.

chromic oxide. As far as I am aware, this is the first locality at which serpentine has been discovered in the Huronian rocks to the north-west of Lake Superior. Its association with the great diorite dyke cutting the gneiss along the Nelson River above Split Lake was described in my report for 1878. It was also referred to by Dr. Harrington in connection with his investigations of the mineralogical relations of these two rocks. A tobacco-pipe, carved out of a fine variety of serpentine, was presented to me by an Indian on the Nelson River, who said that the stone came from the great Rein-deer Lake, to the north of the Churchill River, into which it discharges in about longitude 103°. At the eastern extremity of the main body of Island Lake, the Huronian rocks are again met with in the form of light bluish-grey calcareous felsitic schist towards the north side, and of grey quartz-rock towards the south. A quartz vein in this vicinity contained patches of yellow pearl-spar, but no indications of metallic ore was found either here or in any other vein around Island Lake.

Serpentine from Rein-deer Lake.

Huronian rocks at east end of Island.

Relations of Laurentian and Huronian strata.

The strike of the Laurentian gneiss in the neighborhood of the Huronian rocks appears in most cases to correspond nearly with that of the latter in the vicinity of Oxford and Island Lakes, but around God's Lake both systems seem to be much disturbed, and it is difficult to ascertain their relations to each other. From the table already given, showing the strike of the gneiss in a considerable number of localities throughout this region, it is evident there is no tendency to a general uniformity of direction over any considerable extent of country.

Glacial striæ.

The directions of the glacial striæ in forty-four localities, at which Mr. Cochrane noted them, are given, along with a list of those recorded by myself in the other parts of the district.

Glacial Striæ.

Having already referred to the superficial deposits and the glacial phenomena generally, with the exception of the striæ, in the course of my description of the regions traversed, it only remains for me to give the directions of these grooves, which, for the sake of brevity, I shall state in tabular form. They are all referred to the magnetic meridian. Distances are given in straight lines.

Little Churchill River.

1.	Four miles below outlet of Was-kai-ow-a-ka Lake	S. 30° W.
2.	Thirteen miles below " "	S. 70° W.
3.	Eighteen miles below " "	S. 85° W.
4.	Outlet of lower Recluse Lake, various directions from S. 5° W. to S. 40° W., also	S. 80° W.

5. Eagle Rapid, two miles in a straight line below the last. Two sets, both distinct, S. 10° W. and...................... S. 80° W.

Great Churchill River.

6. Six miles above the mouth of the Little Churchill......... S. 5° W.
7. Five miles above the last, S. to .... S. 5° W.
8. Four miles below the mouth of the Little Churchill, S. 10° W. and .... S. 70° W.
9. At Fort Churchill. (Here, in one place, the walls on opposite sides of a gap are both grooved.) S. 20° W. to........... S. 30° W.
10. On the east side of the mouth of the Churchill............. S 10° E.
11. On the coast of Hudson's Bay two and a-half miles eastward of the river.. S. 15° W.
12. On the coast of Hudson's Bay five miles eastward of the river. S. 20° E.

Nelson River.

13. Third Limestone Rapid, distinct from S. 40° E. to.......... S. 60° E.
14. Broad Five-miles Rapid, just above the termination of the horizontal dolomite, S. 5° W., also up the sloping gneiss S. 45° to S. 65° W. On level surfaces or normal course... S. 40° W.
15. Just above the twelve-feet chute at the head of the rapid last mentioned .... S. 45° W.
16. Mouth of river from south, eight miles above last locality, or thirty-four miles below the outlet of Gull Lake.......... S. 55° W.
17. Twenty-eight miles below Gull Lake...................... S. 65° W.
18. South side opposite large island, twenty miles below Gull Lake.. S. 70° W.
19. Bend in the river, sixteen miles below Gull Lake.......... S. 60° W.
20. Foot of lowest Gull Rapid, newer set S. 45° W, older set.... S. 60° W.
21. Middle Gull Rapid...................................... S. 70° W.
22. Upper Gull Rapid....................................... S. 80° W.
23. Point midway up south side of Gull Lake.................. S. 85° W.
24. Five miles above Gull Lake, S. 60° W. and................ West.
25. Seven miles below outlet of Split Lake.................. West.
26. Three miles below outlet of Split Lake.................. S. 85° W.
27. Near H. B. Co.'s post, about midway up north shore of Split Lake, the striæ intersect each other at various angles, but the average direction is............................. S. 85° W.
28. Mouth of Burntwood River, Split Lake.................... S. 70° W.
29. Western inlet of Nelson River, Split Lake................ S. 70° W.
30. Chain-of-rocks Rapid, three miles above Split Lake, one set, S. 25° E., the other.................................. S. 70 W.

Grass River Route.

31. Grass River, five miles from the mouth.................... S. 75° W.
32. Outlet of Witchai (Stinking) Lake....................... West.
33. East side Witchai Lake.................................. S. 72° W.
34. Grass River, five miles south of Witchai Lake............. S. 70° W.

35. From last locality nearly to Standing-rock Rapid, several places	S. 70° W.
36. Around Burnt Lake at the forks of Grass River	S. 70° W.

Sipi-wesk Lake.

37. N.W. side of Sipi-wesk Lake, about ten miles from outlet, S. 30° W. and	S. 45° W.
38. Islands in the lake, about fourteen miles from outlet	S. 40° W.
39. Different places about midway up the lake, which is about thirty-five miles long, S. 40° W. to	S. 50° W.
40. About six miles from the south-west extremity of the lake. Here the under-surface of an overhanging wall of gneiss is striated	S. 35° W.

The following are the directions of the striæ in the God's Lake and Island Lake region, as recorded by Mr. Cochrane, the bearings also referring to the magnetic meridian :—

Around God's Lake.

1. Island two miles south of entrance of river from Touchwood Lake	S. 15° W.
2. Point on east shore, opposite river from Touchwood Lake. (One set, S. 8° E.)	S. 8° W.
3. Point at Narrows	S. 70° W.
4. Island three miles north of Narrows	S. 20° W.
5. Island four miles north of Narrows	S. 12° W.
6. Point seven miles north of Narrows	S. 35° W.
7. Entrance of bay at north-west extremity of Lake	S. 30° W.
8. Outlet of Wolverine River into Fishing Eagle Lake	S. 34° W.
9. Point six miles west of God's River (outlet)	S. 44° W.
10. Point two miles west of God's River	S. 35° W.
11. Island four miles east of God's River	S. 25° W.
12. Island eight miles east of God's River	S. 18° W.
13. Point nine and a-half miles east of God's River	S. 10° W.
14. Point eleven and a-half miles east of God's River	S. 5° W.
15. Island near south-eastern shore, eleven miles east of God's River	S. 70° W.
16. Point fifteen miles north-east of Knife River	S. 24° W.
17. Island twelve miles north-east of Knife River	S. 18° W.
18. Point six miles north-east of Knife River	South.
19. Point of large island two miles north of Knife River	S. 16° W.
20. Point eight miles north-east of Narrows	S. 20° W.
21. Island five miles north-east of Narrows	S. 25° W.
22. Point four miles north-east of Narrows	S. 30° W.

Between Jackson Bay, on Oxford Lake, and southern part of God's Lake.

23. Northern end of Rat Lake	S. 20° W.
24. Large island two miles from south end of Rat Lake	S. 30° W.

25. Island in north-west end of Clearwater Lake.............. S. 30° W.
26. At Narrows, Clearwater Lake........................ S. 30° W.
27. Point near south-east extremity of Clearwater Lake........ S. 30° W.
28. Point six miles south-west of outlet of Touchwood Lake... S. 18° W.
29. Point two miles west of outlet of Touchwood Lake......... S. 20° W.

Around Island Lake.

30. Kettle Island, half way up long narrow bay at west end..... South.
31. Small island two miles from southern extremity of Pipestone Bay... S. 25° W.
32. Point west side of Highway Bay, four miles from southern extremity .... South.
33. Point east side of Highway Bay, three miles from southern extremity .... South.
34. Point one mile north-east of portage from Highway Bay.... S. 10° W.
35. Point five miles south-east of portage from Highway Bay... S. 5° W.
36. Island fourteen and a-half miles west of Fox Island....... S. 20° W.
37. Island in landlocked bay, twelve miles south-west of Fox Island.. S. 8° W.
38. Island one mile east of Fox Island...................... S. 16° W.
39. Point three miles north-east of Fox Island............... S. 16° W.
40. Point on north shore fifteen miles north-west of Fox Island. S. 20° W.
41. Point nineteen miles south-east of H. B. Co.'s Post......... S. 26° W.
42. Point sixteen and a-half miles south-east of H. B. Co.'s Post. S. 6° W.
43. Point on small island seven miles south-east of H. B. Co.'s Post .... S. 8° W.

Northern Limits of Forest Trees.

It would be impossible, within the limits of a report like the present, to give all the facts collected with reference to the trees and shrubs of the country explored; still, the information secured in regard to this subject may prove useful for reference at any time hereafter. The timber has already been incidentally alluded to in describing the regions explored, but it may be worth while here to note some facts in regard to the range of the trees whose northern boundaries traverse the part of the country under consideration.

White Spruce—(the "Pine" of Rupert's Land).—This is the most northern coniferous tree. On the east side of Hudson's Bay the last of it is seen on the coast a short distance north of Richmond Gulf. On the west side it terminates about Seal River. Thence its limit runs north-westward, and is reported to cross the McKenzie River about 200 miles below Peel's River.

Tamarac—(also called "Juniper" and "Red Spruce").—On the east side of the bay it accompanies the spruce almost to the extreme limit. It is abundant at York Factory. Along the lower part of the Nelson

River it is of fair size, but on the Churchill it becomes small towards the sea. Its northern limit runs north-westward to the McKenzie River, which it is said to cross below Peel's River.

Banksian Pine—("Cypress.")—This tree appears to attain its greatest perfection on the southern branches of the Albany River, where I have seen large groves with tall straight trunks, free from branches, and about two feet in diameter at the butt. The original forests of the lower part of the valley of the Moose River having been destroyed by fire many years ago, a crop of white birch and poplars now replaces the former coniferous timber, so that the proper northern limits of the different species of the latter can scarcely be defined. A young and healthy growth of Banksian pines was seen on the Missinaibi branch of this river a few miles below "Hell's Gate," but none were observed to the northward in this region. It was abundant along Steel River, but ceased to be noticed on the upper part of Hayes' River. In going up the Nelson River, it was first met with about twenty miles below Gull Lake. It was found on the upper part of the Little Churchill River, and is said to be very abundant along the Great Churchill above the point which I reached, and also around Athabasca Lake. Its northern limit is reported to cross the McKenzie below Peel's River.

Balsam Fir—(also called "Single Spruce" and "Silver Pine").—Abundant around the southern part of James' Bay and on good dry soil along the Albany River. Mr. Cochrane reports it as common around Island Lake, but scarcer on God's Lake. It is rare and of small size at Knee Lake. In going down the Nelson River, it is scarce below the Sea River Falls, and the last tree which I observed was at the outlet of Sipi-wesk Lake. On the Grass River some good-sized trees were seen as far north as the Standing-rock Rapid. It is not a common tree along the east side of Lake Winnipeg, is scarce between that lake and Lakes Manitoba and Winnipegosis, and appears to be absent to the westward of these lakes, although to the north-west it reaches the McKenzie River.

White Cedar.—The northern limit of this species touches the southern extremity of James' Bay, and to the north-westward it crosses the Albany River at some distance from the sea. It is, however, abundant in the upper Albany country and in the Lonely Lake and English River regions. Its northern boundary crosses the Winnipeg River a few miles south of Pine Falls. Near the south end of Lake Winnipeg it is met with, of good size, in the bay to the south of Grand Marais Point. In Manitoba, it is found east of Red River in the Big Woods, and even in Kildonan, from which its western limit runs towards the south-east angle of the Province and thence southward in the United

States. Cedar brushwood grows around Cedar Lake on the Great Saskatchewan, near its mouth, and trees of fair size are reported to occur on the island in Lake Winnipeg opposite the mouth of this river, and again on the south side of Long Point, in the same neighbourhood. I have not seen these cedars myself, but they are described as belonging to this species. The locality just mentioned would, therefore, constitute an outlying patch, removed 190 miles to the north-westward of the north-western point of the main area occupied by this tree.

Willow.—What appear to be three distinct species of willows, two of which, however, can only be considered as shrubs, extend northward beyond the mouth of the Churchill River, and are the most northern species of deciduous wood.

Balsam Poplar ("Rough-barked Poplar," "Cotton Tree," "Balm of Gilead," &c).—On the west side of Hudson's Bay this is the most northern species of poplar. It is abundant around York Factory, and attains a fair size along the lower part of the Nelson River. In descending the Great Churchill it becomes smaller and scarcer until the mouth of the river is reached, where it is rare.

Aspen (Trembling-leafed Poplar).—This tree, which is so abundant and of such a thrifty growth around the southern part of James' Bay and on the border of the prairie regions of the North-west Territories, does not extend quite as far north as York Factory. In ascending the Nelson River it was not met with until within a few miles of the Lowest Limestone Rapid. It extends northward nearly to the junction of the Little with the Great Churchill River.

White Birch (Canoe Birch).—This species terminates on Hayes' River, a few miles below the Steel River. On the Nelson, the first tree was met with at seven miles before coming to the Lowest Limestone Rapid, or at seventy from Point of Marsh. In descending the Little Churchill it disappeared about midway between the Recluse Lakes and the mouth, and in ascending the Great Churchill, it disappeared at eighteen miles above the forks. Along the Burntwood River and the upper part of the Nelson it is large enough for building canoes, but becomes better for this purpose to the northwestward, and is said to be very good around Lake Athabasca.

Rowan (Mountain Ash).—Common along the east side of Lake Winnipeg, and it is seen here and there along the Nelson River as far as White Mud Falls, where it disappears. Mr. Cochrane met with it on Island Lake.

Pigeon Cherry.—Found around Island and God's lakes, and northward to Knee Lake. On the Nelson it extends to a point some miles below

Sipi-wesk Lake, and on the Grass River to the junction of the west branch at Burnt Lake.

Forest Preservation.

Up to 1878 the great region covered by this report had been annually devastated by forest fires, ranging over large areas and destroying the timber in different localities from time to time, until, perhaps, more than half of it is already swept away. In that year I made a point of calling the attention of the Indian chiefs and head men to this great waste, and informed them that it was the wish of the Government that the timber (which the Indians had not before considered of any value) should not be thus destroyed, and requested them to make their temporary fires on the beach or on bare rock, and to extinguish their camp-fires in all cases before leaving. This they all promised to attend to, and the result has been that during 1879 no forest fires, as far as I could learn or observe myself, had occurred. The saving thus effected is worth to the country many times more than the cost of our explorations.

APPENDIX I.

—

ON SOME SILURIAN AND DEVONIAN FOSSILS FROM MANITOBA AND THE VALLEYS OF THE NELSON AND CHURCHILL RIVERS, FOR THE MOST PART COLLECTED BY DR. R. BELL IN THE SUMMER OF 1879.

BY J. F. WHITEAVES.

1. From the Banks of the Red River, in the Parish of St. Andrews, Manitoba.

Receptaculites Oweni, Hall. (=*Coscinopora sulcata*, D. D. Owen, non Goldfuss.) A fine specimen, which, when perfect, was probably at least one foot in diameter. The occurrence of this species at Lower Fort Garry (which is in the parish of St. Andrews) was first placed upon record by D. Dale Owen in 1852, on page 181 of his "Report on a Geological Survey of Wisconsin, Iowa and Minnesota." According to Professors Hall and Whitney ("Geology of Wisconsin, 1862," vol I., p. 429) *R. Oweni* "is the common and abundant species of the Lead region and the one known as the 'lead-coral,' from its constant association witn the lead-bearing rock."

Favosites prolificus, Billings. A characteristic fragment. This species, which was originally described from the Hudson River group of Anticosti, occurs also, as will be shewn further on, in rocks of the same age at Stony Mountain, Manitoba.

Halysites catenularia, Linn. One good specimen.

Monticulipora (*Monotrypa*), Sp. Indt. A fragment of a rather large, hemisphærical, or possibly sphœroidal coral, apparently allied to *Monotrypa undulata* Nicholson, but too imperfect to allow the whole of its specific characters to be ascertained. To the naked eye the specimen appears as a portion of a hemisphærical crust, about three-quarters of an inch thick in the thickest part and half an inch in the thinnest. The convex and presumably upper surface is almost covered with small, irregular, but mostly annular, siliceous concretions, and the concave face looks as if it had been broken from a much thicker mass. When viewed with a lens the coral is seen to be made up of minute, polygonal, thin-walled, contiguous and continuous corallites, of different sizes, apparently arranged in groups. The larger corallites are about one-sixth of a line in diameter, and the smaller from one-eighth to one-tenth of a line. The cells are entirely filled with mineral matter, and the shape and position of the tabulæ cannot be satisfactorily defined.

Zaphrentis, Nov. sp. Two imperfect specimens of an apparently undescribed species of *Zaphrentis* or *Streptelasma.*

Actinoceras Lyoni, Stokes. The types of *A. Lyoni* are from Igloolik and Ooglit, in Arctic America, but Dr. Bigsby, on page 170 of the "Thesaurus Siluricus," gives Fort Garry as one of the localities of this species. *A. Richardsoni* of Stokes, from Lake Winnipeg, may be the same shell in a different state of preservation, for, according to Stokes' descriptions, the only difference between *A. Lyoni* and *A. Richardsoni* is that in the former "a small tube is seen within the siphuncle, but no radii have been traced from it," while in the latter the tube is said to be small and "surrounded by numerous laminæ or plates filling up the siphuncle." In Stokes' figures, however, the siphuncle of *A. Lyoni* is represented as larger in proportion to the size of the shell than it is in *A. Richardsoni*. In the extremely large size of their siphuncle and in the apparently entire absence of any radii proceeding from the central tube, which latter cannot be discerned at all in some individuals, the two specimens collected by Dr. Bell at this locality, and several others from Stone Fort, Manitoba, in the collection of the Survey, agree much better with the descriptions and figures of *A. Lyoni* than with those of *A. Richardsoni.*

Illænus, Sp. (allied to and possibly identical with *I. latidorsatus*, Hall). An imperfect cast of a small *Illænus*, most likely the same as the trilobite from Fort Garry referred by D. D. Owen to *I. crassicauda*, Wahlenberg. The specimen collected by Dr. Bell is, however, clearly not the true *I. crassicauda*, for in the original figure of that species in the "Petrificata Telluris Suecanæ" (pl. 2, figs. 5 and 6) the central lobe of each of the ten body rings is represented as equal to about one-third of the entire diameter, whereas in the specimen from St. Andrews the central lobes of the body segments are equal to nearly three-fourths of their greatest diameter. The *Illænus* from this locality is too imperfect for the species to be identified with much certainty, but if not actually identical with *I. latidorsatus*, it appears to be very closely allied to it.

2. FROM LIMESTONE RAPIDS 100 MILES UP THE NELSON RIVER.

Leptæna sericea, Sowerby. Not uncommon.

Strophomena tenuistriata, Hall. One specimen. According to Davidson, *S. tenuistriata*, Hall, is merely a variety of *S. rhomboidalis*, Wilckins.

Strophomena filitexta, Hall. Several detached valves.

Strophomena subtenta, Conrad. A single valve.

Rhynchonella Anticostiensis? Billings. Two imperfect, badly preserved and small examples of a species of *Rhynchonella*, apparently identical with some larger and more perfect casts from the south-west shores of Lake Winnipeg, in the collection of the Survey, which have been identified by the writer with the *R. Anticostiensis.*

Murchisonia bellicincta, Hall. (=*M. major*, Hall.) A single large cast, which corresponds fairly well with the figures and description of this species.

Asaphus megistos? Locke. A cast of the pygidium only.

3. FROM "FIRST BIRCH BROOK," NELSON RIVER.

Strophomena alternata, Conrad. One valve.

Ecculiomphalus, Nov. sp. A single specimen.

4. FROM THE SECOND AND THIRD LIMESTONE RAPIDS OF THE NELSON RIVER.

Receptaculites Oweni, Hall. Several fragments.

Halysites catenularia, Linnæus. According to Dr. Bell this well-known species is quite common at this locality.

Eridophyllum, Nov. sp. A single fragment. The same species was collected by Dr. Bell at Fort Churchill, but in loose pieces of rock, and there is a fine specimen of it in the Museum of the Survey, from Stone Fort, Manitoba.

Strophomena alternata, Conrad. One specimen.

Murchisonia bellicincta, Hall. (=M. major.) A large cast, precisely similar to one from the locality last mentioned.

Maclurea (near *M. Bigsbyi*, Hall). Two tolerably perfect casts of a shell which may be an extreme variety of *M Bigsbyi*, but the outer whorl is wider above, and more obliquely compressed below, between the periphery and the umbilical margin, than the corresponding parts of the shell of *M Bigsbyi* are. In a figure of the latter species recently published by Prof. Whitfield, the aperture is represented as a little higher than wide, whereas in the most perfect of the two Maclureas collected by Dr. Bell at this locality the maximum width of the aperture is about one-third greater than its height.

Endoceras (*Cameroceras*) *annulatum?* Hall. Three distorted and imperfect examples of an *Endoceras*, which agree in most respects with the definition of *E. annulatum*. The outline of their transverse section is rather oval than circular, but this circumstance may be due to lateral compression.

Oncoceras, Nov. sp. One fine but somewhat distorted specimen.

5. From the Junction of the Little and Great Churchill Rivers.

Zaphrentis, Nov. sp. Two specimens, one of which is the same as those from St. Andrews, previously mentioned.

Columnopora cribriformis, Nicholson. A small but well-preserved example.

6. From Fort Churchill. (Loose.)

Eridophyllum, Nov. sp. Identical apparently with that from the Second and Third Rapids of the Nelson.

Rhynchonella capax, Conrad. One very imperfect specimen.

Actinoceras Lyoni? Stokes. A fragment of a siphuncle, consisting of a cast of four of the chambers.

The fossils from localities Nos. 1, 2, 3 and 4 are from limestones or dolomites which evidently belong to the same geological horizon. On stratigraphical as well as on palæontological grounds there is good reason for supposing that these rocks represent the upper part of the Trenton Limestone, and that they are the equivalents of the Galena Limestone of Wisconsin and Illinois. At Stony Mountain, Manitoba, they are immediately and conformably overlaid by true Hudson River rocks.

The few fossils collected on the banks of the Churchill, from localities Nos. 5 and 6, are insufficient to establish the exact age of the rocks in which they occur, but it is probable that both are referable either to the top of the Trenton Limestone or to the lower part of the Hudson River group.

7. From Stony Mountain, Manitoba.

In 1875 Mr. R. W. Ells made an interesting collection of fossils from this locality, on behalf of the Survey, which has not hitherto been reported on. Stony Mountain, it may be mentioned, is a hill some fifty feet in height, on the western bank of the Red River, not far from Fort Garry. The species obtained by Mr. Ells are as follows:—

Chætetes delicatulus, Nicholson. Two specimens.

Monticulipora, Sp. One good example. This is the common Trenton and Hudson River species which Mr. Billings identified with *Stenopora fibrosa*, Goldfuss. It is also the coral figured by Prof. Hall on Plate 24, figures 1 g, h, i. (cœt. excl.) of the first volume of the Palæontology of New York, as one of the forms of *Chætetes lycoperdon*, Say. Dr. H. A. Nicholson places the coral represented in these figures among the synonyms of *Chætetes Fletcheri*, Edwards and Haime. In *C. Fletcheri*, however, the corallites are said to be rounded or oval, with comparatively thick walls, whereas in the present species the corallites are clearly polygonal, with thin walls.

Monticulipora (*Diplotrypa*) *Whiteavesii ?* Nicholson. Two small specimens growing on the shells of brachiopoda.

Favosites prolificus, Billings. A fine large specimen, identified and labelled by Mr. Billings himself.

Streptelasma corniculum, Hall. Several well-preserved examples of a rather small *Streptelasma*, with a well-developed and smooth epitheca, precisely similar to the small individuals of *S. cornicula* figured by Rominger. These Stony Mountain *Streptelasmæ* represent the Hudson River group coral commonly referred to *S. corniculum*, rather than the typical form of that species from the Trenton Limestone.

Crinoidal Stems. Detached joints only.

Ptilodictya (*Stictopora*) *acuta*, Hall. A few characteristic fragments.

Strophomena nitens, Billings. Eight perfect examples of an entirely smooth form of this species.

Strophomena Hecuba, Billings. One dorsal valve, *Orthis testudinaria*, Dalman. Abundant.

Orthis subquadrata, Hall. Many perfect and well-preserved specimens of an unusually coarsely ribbed variety of this shell.

Rhynchonella capax, Conrad. Several large and perfect examples.

Murchisonia gracilis? Hall. One small cast.

Cyrtolites ornatus? Conrad. One imperfect cast.

Ascoceras Newberryi, Billings. Two specimens.

The collection made by Mr. Ells at this locality shows, first, that a large portion of the mass of Stony Mountain consists of limestones, with clayey partings, which are identical, both in their lithological and palæontological characters, with the well-known rocks of the Hudson River or Cincinnati group of Southern Ohio and elsewhere; and, secondly, that these Hudson River rocks of Stony Mountain overlie, immediately and conformably, the buff-coloured, fossiliferous and more or less magnesian limestones of the Red River valley, which have already been assumed to be the representatives of the upper part of the Trenton limestone.

At Stony Mountain Dr. Bell also made a small collection of fossils, consisting of the following species.

Orthis testudinaria, Dalman.

Orthis subquadrata, Hall.

Rhynchonella capax, Conrad.

Cheirurus Icarus, Billings. One pygidium.

Calymene Blumenbachii, Billings, as of Brongniart. An imperfect pygidium. This is the common *Calymene* of the Trenton and Hudson River groups, identified by Billings and Dr. Nicholson with the *C. Blumenbachii* of Europe. Mr. S. A. Miller, however, says that the true *C. Blumenbachii* has not been found in North America, and that the species mistaken for it is the *C. senaria* of Conrad, which latter is a synonym of *C. calliteles*, Green.

A few fossils were collected by Dr. Bell at various places on the Churchill and Nelson Rivers, which appear to be of newer age than the Lower Silurian, but which are insufficient to indicate with much probability the exact geological horizon of the rocks in which they were found. The following are the localities at which these fossils were collected, with notes on the species.

8. Three Miles East of Churchill River.

Pentamerus (Sp. Undt.) Three casts of the ventral valve of a rather finely-ribbed *Pentamerus* in some respects like *P. occidentalis* Hall, from the Guelph limestone of Elora and Hespeler, Ont.

9. Gillam's Island, Nelson River.

Atrypa reticularis, Linnæus. Two specimens. Upper Silurian or Devonian.

10. Walker's Island, Oxford Lake.

Atrypa reticularis, Linnæus. Five detached specimens, four with very fine ribs and one with remarkably coarse ones. Matrix a pale brick-red colour, just like that from the last locality.

11. York Factory. (Loose.)

Cyathophyllum Davidsoni, Milne-Edwards. (=*Acervularia profunda*, Hall.) One characteristic but much worn specimen.

Favosites (Sp. Indt.) A small rolled and rounded mass, of a species with small corallites.

The fossils from the last mentioned locality are certainly Devonian, but they may have been drifted from some distance.

APPENDIX II.

LIST OF PLANTS COLLECTED BY DR. R. BELL AROUND THE SHORES OF HUDSON'S BAY AND ALONG THE CHURCHILL AND NELSON RIVERS IN 1877 AND 1879.

The specimens have been kindly determined by Prof. John Macoun, F.L.S., Albert University, Belleville.

I. East coast of Hudson's Bay.

II. Churchill River.

III. North end of Lake Winnipeg.

IV. Nelson River between Lake Winnipeg and the coast of Hudson's Bay.

A. Plants crossing the Arctic Circle.

CATALOGUE.

Nos.		I.	II.	III.	IV.	A.
	RANUNCULACEÆ.					
1	Anemone parviflora, Michx		*			*
2	" multifida, D C.		*		*	*
3	" Pennsylvanica, Linn			*		*
4	Thalictrum dioicum, Linn				*	
5	" Cornuti, Linn			*		
6	Ranunculus aquatilis, var. trichophyllus......				*	*
7	" multifidus, Pursh		*			*
8	" acris, Linn.....................		*			*
9	" Cymbalaria			*		*
10	" sceleratus, Linn		*			*
11	" flammula, var. reptans, Gr		*	*		*
12	Caltha palustris		*			*
13	Actœa spicata, var. rubra Gr...............		*			
	NYMPHÆACEÆ.					
14	Nuphar luteum, Smith (leaf only)		*			
	FUMARIACEÆ.					
15	Corydalis aurea, Willd				*	
16	" glauca, Pursh			*	*	

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
	CRUCIFERÆ.					
17	Nasturtium palustre, D C.		*		*	*
18	Cardamine hirsuta, Linn			*		*
19	" pratensis, Linn	*				*
20	Arabis Drummondii, Gr			*	*	
21	Erysimum cheiranthoides, Linn			*	*	*
22	Sisymbrium sophioides, Fischer					
23	Draba incana, Linn		*		*	*
	VIOLACEÆ.					
24	Viola cucullata, Ait				*	*
25	" canina, var. sylvestris			*		*
	CISTACEÆ.					
26	Hudsonia tomentosa, Nutt			*		
	DROSERACEÆ.					
27	Drosera rotundifolia, Linn		*			*
	CARYOPHYLLACEÆ.					
28	Lychnis apetala, Linn		*			*
29	Arenaria lateriflora, Linn			*		*
30	" peploides, Linn		*			*
31	Stellaria longipes, Goldie			*		*
32	Cerastium arvense, Linn			*	*	
33	" alpinum, Linn		*			*
34	Sagina nodosa, Frengl			*	*	*
	GERANIACEÆ.					
35	Geranium Carolinianum, Linn			*	*	
	POLYGALACEÆ.					
36	Polygala Seneca, Linn	*			*	*
	LEGUMINOSÆ.					
37	Astragalus Canadensis, Linn				*	
38	" hypoglottis, Ker	*			*	*
39	" alpinus, Linn		*		*	*
40	" frigidus, Gray				*	*
41	" adsurgens, Pall				*	
42	Glycyrrhiza lepidota, Nutt				*	
43	Hedysarum Mackenzii, Richard	*				*
44	Vicia Americana, Muhl				*	*
45	Lathyrus maritimus, Bigel	*		*		*
46	" ochroleucus, Hook			*		*
47	" palustris, Linn			*		

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
	ROSACEÆ.					
48	Prunus Pennsylvanica, Linn				*	
49	Dryas integrifolia, Vahl	*	*			*
50	Geum rivale, Linn				*	
51	" strictum, Ait			*	*	
52	Fragaria Virginiana, Ehrh			*		
53	Potentilla Norvegica, Linn			*	*	
54	" Anserina, Linn			*	*	*
55	" fruticosa, Linn	*			*	*
56	" tridentata, Ait			*		*
57	" palustris, Scop		*		*	*
58	" Pennsylvanica, Linn		*		*	
59	" nivea, Linn		*			*
60	" arguta, Pursh			*		
61	" flabelliformis, Nutt				*	
62	Rubus Chamæmorus, Linn		*			*
63	" triflorus, Richard			*	*	
64	" arcticus, Linn	*	*			*
65	" strigosus, Michx			*		
66	Rosa blanda, Ait			*		*
67	Amelanchier Canadensis, var. oblongifolia, Gray			*	*	*
68	Pyrus sambucifolia, Ch. & Schl			*		*
	SAXIFRAGACEÆ.					
69	Ribes prostratum, L'Her			*	*	
70	" rubrum, Linn		*			*
71	" oxycanthoides, Linn				*	
72	Parnassia palustris, Linn		*			*
73	Saxifraga aizoides, Linn	*				*
74	" Hirculus, Linn. ?		*			*
75	" tricuspidata, Retz			*		*
76	Heuchera hispida, Pursh			*	*	
77	Mitella nuda, Linn		*			*
	HALORAGEÆ.					
78	Hippuris vulgaris, Linn		*			*
79	Myriophyllum spicatum, Linn		*			*
	ONAGRACEÆ.					
80	Epilobium angustifolium, Linn			*	*	*
81	" latifolium, Linn		*			*
82	" coloratum, Muhl				*	
83	Œnothera biennis, Linn				*	
	UMBELLIFERÆ.					
84	Heracleum lanatum, Michx			*		
85	Cicuta virosa, Linn			*		*
86	Sium lineare, Michx			*		
	ARALIACEÆ.					
87	Aralia hispida, Michx				*	

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
	CORNACEÆ.					
88	Cornus Canadensis, Linn			*		*
89	" stolonifera, Michx			*	*	*
	CAPRIFOLIACEÆ.					
90	Linnæa borealis, Gronov				*	*
91	Lonicera involucrata, Banks		*			
92	Viburnum pauciflorum, Pylaie				*	
	RUBIACEÆ.					
93	Galium trifidum, Linn				*	*
94	" boreale, Linn			*	*	*
	COMPOSITÆ.					
95	Nardosmia palmata, Hook		*			*
96	" sagittata, Benth		*			
97	Aster graminifolius, Torr. & Gr		*			
98	" æstivus, Ait				*	
99	" multiflorus, Linn				*	*
100	Erigeron Canadense, Linn				*	
101	" Philadelphicum, Linn			*		*
102	Solidago lanceolata, Ait				*	
103	" Canadensis, Linn				*	
104	Achillæa millefolium, Linn			*		*
105	Leucanthemum arcticum, D C		*			*
106	Artemisia Canadensis, Michx				*	
107	" biennis, Willd				*	*
108	" vulgaris, Linn				*	*
109	Antennaria dioica, Gærtn				*	*
110	" plantaginifolia, R. Br			*		
111	Senecio palustris, Hook		*	*		*
112	" ———?				*	
113	" aureus, L., var. obovatus				*	
114	Arnica foliosa		*			
115	Hieracium Canadense, Michx				*	
116	Taraxacum palustre, D C				*	*
	LOBELIACEÆ.					
117	Lobelia Kalmii, Linn				*	
	CAMPANULACEÆ.					
118	Campanula rotundifolia, Linn			*	*	*
	ERICACEÆ.					
119	Vaccinium cæspitosum, Michx	*				
120	" oxycoccus, Linn			*		*
121	" Vitis-Idæa, Linn		*		*	*
122	" Canadense, Kalm				*	*
123	" uliginosum, Linn	*	*			*

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
124	Arctostaphylos uva-ursi, Spreng				*	*
125	" alpina, Spreng		*			*
126	Andromeda polifolia, Linn	*	*			*
127	Cassandra calyculata, Don		*			
128	Kalmia glauca, Ait	*	*			*
129	Ledum palustre, Linn	*	*		*	*
130	" latifolium, Ait				*	
131	Pyrola minor, Linn			*		*
132	" secunda, Linn				*	*
133	" rotundifolia, Linn				*	*
	PLANTAGINACEÆ.					
134	Plantago major, var. Asiatica, Decaisne				*	*
	PRIMULACEÆ.					
135	Primula farinosa, Linn		*			
136	" Mistassinica, Michx		*			
137	Trientalis Americana, Pursh			*		
138	Lysimachia ciliata, Linn					
139	" thyrsiflora, Linn	*	*	*		
	LENTIBULIACEÆ.					
140	Utricularia vulgaris, Linn		*			*
141	Pinguicula vulgaris, Linn		*			*
	SCROPHULARIACEÆ.					
142	Veronica peregrina, Linn				*	
143	Castilleia pallida, Kunth		*			*
144	Euphrasia officinalis, Linn			*	*	*
145	Rhinanthus Crista-galli, Linn				*	*
146	Pedicularis euphrasioides, Steph		*			*
147	" hirsuta, Linn ?		*			*
	LABIATÆ.					
148	Mentha Canadensis, Linn			*		
149	Dracocephalum parviflorum, Nutt		*			*
150	Scutellaria galericulata, L		*		*	
151	Stachys palustris, Linn			*	*	*
	BORRAGINACEÆ.					
152	Mertensia paniculata, Don				*	
153	" maritima, Don		*			*
	GENTIANACEÆ.					
154	Gentiana Amarella, var. stricta		*		*	*
155	Pleurogyne Carinthiaca, Griesb. var. pusilla, Gr.		*			
156	Menyanthes trifoliata, Linn		*			*

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
	CHENOPODIACEÆ.					
157	Chenopodium album, Linn				*	*
158	" glaucum, Linn		*			
	POLYGONACEÆ.					
159	Polygonum aviculare, Linn		*		*	*
160	" amphibium, Linn		*		*	
161	" cilinode, Michx				*	
162	" viviparum, Linn	*	*			*
163	" lapathifolium, Ait		*		*	
164	Rumex maritimus, Linn					
165	" salicifolius, Weinn			*		*
	ELÆAGNACEÆ.					
166	Elæagnus argentea, Pursh			*	*	*
167	Shepherdia Canadensis, Nutt		*		*	*
	SANTALACEÆ.					
168	Comandra umbellata, Nutt			*		
	EMPETRACEÆ.					
169	Empetrum nigrum, Linn	*	*			*
	URTICACEÆ.					
170	Urtica gracilis, Ait		*		*	
	BETULACEÆ.					
171	Betula glandulosa, Michx			*		*
172	Alnus incana, Willd				*	*
	SALICACEÆ.					
173	Salix candida, Willd			*		
174	" myrtilloides, Linn		*		*	*
175	" vestita, Pursh		*			
176	" ——— ?		*			
177	" ——— ?			*		
	CONIFERÆ.					
178	Juniperus communis, Linn			*		*
179	" Sabina, var. procumbens			*		
	TYPHACEÆ.					
180	Sparganium simplex, Huds				*	*
181	" minimum, Bauhin		*			*

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
	NAIADACEÆ.					
182	Potamogeton lucens, L.				*	
183	" rufescens, Schrad				*	*
184	" pectinatus, Linn				*	
185	" perfoliatus, Linn				*	
	ALISMACEÆ.					
186	Triglochin maritimum, Linn		*			*
	ORCHIDACEÆ.					
187	Habenaria rotundifolia, Richard		*			
188	" hyperborea, Lindl				*	*
189	Spiranthes Romanzoviana, Cham		*		*	
190	Corallorhiza innata, R. Br		*			*
191	Cypripedium guttatum, Swartz ?		*			*
	IRIDACEÆ.					
192	Sisyrinchium Bermudianum, Linn			*		*
	LILIACEÆ.					
193	Smilacina trifolia, Desf		*			
194	" bifolia, Ker			*	*	
195	" stellata, Desf			*		
196	Lilium Philadelphicum, Linn				*	
197	Tofieldia palustris, Huds		*			
	JUNCACEÆ.					
198	Luzula parviflora, var. melanocarpa Gray	*				*
199	Juncus alpinus, var. insignis Fries				*	
200	" Balticus, Dethard			*	*	
201	" tenuis, Willd				*	
	CYPERACEÆ.					
202	Eleocharis palustris, R Br				*	*
203	Scirpus atrovirens, Muhl				*	
204	" validus, Vahl				*	
205	Eriophorum gracile, Roth		*			
206	Carex aristata, R. Br. ?				*	
207	" aurea, Nutt				*	
208	" canescens, Linn			*		*
209	" gynocrates, Wormsk		*			*
210	" scoparia, Schk				*	
211	" straminea, Schk				*	
212	" stricta, Lam				*	
213	" vesicaria, Linn		*			*
214	" vulpinoidea, Michx				*	

CATALOGUE—Continued.

Nos.		I.	II.	III.	IV.	A.
	GRAMINEÆ.					
215	Alopecurus aristulatus, Michx		*			
216	Calamagrostis Langsdorffii, Trin.............	*		*	*	
217	Agrostis scabra, Willd......................				*	
218	Glyceria fluitans, R. Br				*	*
219	Poa alpina, Linn	*				*
220	" serotina, Ehrh..........................				*	
221	" laxa, Hænke				*	
222	Festuca ovina, Linn				*	*
223	Elymus dasystachyum				*	
224	Hordeum jubatum, Linn..				*	*
225	Beckmannia erucæformis, Hook.............		*			
	EQUISETACEÆ.					
226	Equisetum sylvaticum, Linn.................		*			
227	" limosum, Linn		*		*	
	FILICES.					
228	Polypodium vulgare, Linn..................				*	
229	Asplenium Trichomanes, Linn	*				
230	Aspidium fragrans, Swartz..................	*				
231	" spinulosum, Swartz..............					
	var. dilatatum, Gr................			*	*	
232	Cystopteris fragilis, Bernh		*			
233	Woodsia Ilvensis, R. Br....................				*	
234	Botrychium Lunaria, Swartz		*			
	LYCOPODIACEÆ.					
235	Lycopodium clavatum, Linn................		*			
	MUSCI.					
236	Sphagnum subsecundum, Nees					*
237	Polytrichum strictum, Hook					*

APPENDIX III.

—

LIST OF FRESH-WATER MOLLUSCA FROM MANITOBA AND THE VALLEY OF THE NELSON RIVER.

The following list includes some species collected in Manitoba, which Mr. Whiteaves, of the Geological Survey, has kindly determined.

Lamellibranchiata.

1. *Unio rectus*, Lamarck. Red River, Manitoba.
2. *Hyridella* (?) *radiata*, Lamarck. Numerous in Lake Winnipeg and the Nelson River.
3. *Hyridella luteola*, Lamarck. (=*Unio siliquoideus*, Barnes.) Red River, Manitoba.
4. *Lampsilis flavus*, Rafinesque. (=*Unio rubiginosus*, Lea.) Red River, Manitoba.
5. *Theliderma quadrulus*, Rafinesque. (=*Unio lachrymosus*, Lea.) Red River, Manitoba.
6. *Dysnomia plicata*, Lesueur. Red River, Manitoba.
7. *Metaptera alatus*, Say. Red River, Manitoba.
8. *Complanaria complanata*, Barnes. Common in the Nelson River, but larger and finer in the Red and Assiniboine Rivers.
9. *Strophitus Pennsylvanicus*, Lamarck. (=*Anodonta undulata*, Say.) Lake Winnipeg and Great Playgreen Lake.
10. *Anodonta* (Sp. uncertain.) Red River at Winnipeg.

    Nos. 4, 5 and 6 are characteristic Western species.
11. *Sphærium transversum*, Say.
12. *Sphærium striatinum*, Lamarck.

} Both found in numbers in the stomachs of sturgeon caught in Great Playgreen Lake.

Gasteropoda.

13. *Valvata* (*Tropidina*) *tricarinata*, Say. Found in the stomachs of sturgeon caught in Great Playgreen Lake.

5

14. *Limnæa stagnalis*, Linné. Lake Winnipeg, Nelson River and lakes and rivers to the south-eastward.

15. *Linnophysa catascopium*, Say. Great Playgreen Lake.

16. *Physa heterostropha*, Say. Inhabits the same waters as *Limnæa stagnalis.*

17. *Bulinus hypnoruin*, Linné. Ponds in Manitoba.

18. *Helisoma trivolvis*, Say. Around Winnipeg and in Manitoba.

19. *Helisoma bicarinatus*, Say. Lake Winnipeg.

20. *Segmentina armigera*, Say. Abundant in Great Playgreen Lake.

APPENDIX IV.

—

LIST OF LEPIDOPTERA FROM THE NELSON AND CHURCHILL RIVERS AND THE WEST COAST OF HUDSON'S BAY.

Herr Geffcken of La Tour de Peilz, Switzerland, has kindly supplied the following list of the Lepidoptera of the region explored. The specimens were collected by the Venerable Archdeacon Kirby (now of London, England), who laboured for many years in this and other parts of the Northwest Territory.

1. Papilio Turnus, Linn.
2. " Zolicaon, Boisd.
3. Colias Christina, Edw.
4. " Chippewa, Ed.
5. " Nastes, Boisd. Churchill.
6. " *Nov. sp.* Allied to C. Hecla and C. Boothii, but distinct from both. Found at Churchill or north of York Factory.
7. Danais Archippus, Fab.
8. Argynnis Triclaris, Hub.
9. " Frigga, Thunb, *var.* Laga.
10. " Atlantis, Edw.
11. " Freya, Thunb.
12. " Chariclea, Schneid.
13. Melitæa Thar os, Drury.
14. Vanessa Milberti, Godt.
15. " Hunter, Drury.
16. " Cardui, Linn,
17. " Atalanta, Linn.
18. " Antiopa, Linn.
19. Limenitis Arthemis, Drury.
20. Erebia Discoidalis, Kirby. York Factory.
21. " Fasciata, Butler. North to Churchill.
22. " *Nov. sp.* North Churchill.

23. Satyrus Nephele, Kirby.
24. Chionobas Jutta, Hubn. York Factory.
25. Polyommatus Xanthoides ? Boisd.
26. Macroglossa Flavofasciata ?
27. Alypia Maccullochi ? Kirby.
28. Telea Polyphemus, Linn. } Evidently south of York Factory.
29. Platarctia Parthenos, Fab. }

APPENDIX V.

LIST OF COLEOPTERA COLLECTED BY DR. R. BELL IN 1879 ON THE NELSON AND CHURCHILL RIVERS.

The species of Coleoptera collected during my exploration of the Nelson and Churchill rivers have been kindly determined by Dr. J. L. LeConte of Philadelphia, who has forwarded the following list of them.

1. Carabus tædatus, Fabr.
2. Nebria Sahlbergi, Fisch.
3. Calathus ingratus, Dej.
4. Platynus ruficornis, Lec.
5. Pterostichus orinonum, Leach.
6. " empetricola, Dej.
7. Amara hæmatopus, Dej. (=Stereocerus similis, Kirby & Lirus lacustris, Lec.)
8. Dytiscus confluens, Say.
9. " anxius, Mann.
10. Gaurodytes lutosus, Crotch.
11. Gyrinus (immature and undeterminable).
12. Lathrobium simile, Lec.
13. Silpha Lapponica, Linn.
14. " trituberculata, Kirby.
15. Coccinella 12-maculata, (=incarnata, Kirby,=picta, Randall.)
16. Hippodamia quinque signata, Kirby.
17. Buprestis Nuttalli, Kirby.
18. Melanophila Drummondi, Kirby.
19. Chrysobothris trinervia, Kirby.
20. Photinus (Ellychnia) corruscus. (small var.)
21. Podabrus, allied to piniphilus.
22. Telephorus fraxini, Say.

23. Criocephalus agrestis, Kirby.
24. Xylotrechus undulatus, Say.
25. Acmæops pratensis, Laich. (=strigilata, Fab.)
26. Leptura subargentata, Kirby.
27. " sex-maculata, Linn.
28. " chrysocoma, Kirby.
29. Monohammus scutellatus, Say.
30. Pogonocherus mixtus, Hald.
31. Orsodachna Childreni, Kirby.
32. Odoxus vitis, Linn.
33. Chrysomela spireæ, Say.
34. Gonioctena arctica, Mann.
35. Graptodera bimarginata, Say. (=Plicipennis, Mann,=vitivora, Thomas.)
36. Stenotrachelus arctatus, Say.
37. Meloe Americanus, Leach.(=angusticollis, Lec.)
38. Lepyrus colon, Linn.

APPENDIX VI.

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LIST OF BIRDS FROM THE REGION BETWEEN NORWAY HOUSE AND FORTS CHURCHILL AND YORK.

The following is a list of the birds, of which either the skins or the eggs were actually obtained, in the region between Norway House and Forts Churchill and York. Many other species were noted, and a list of these is reserved to be verified and enlarged the coming season. I am indebted to Mr. H. G. Vennor, of the Geological Survey, and Mr. P. Kuetzing, naturalist and taxidermist, for assisting in the determination of the skins. Several of these were given to me by Dr. Percy Mathews and Mr. Henry Johnstone, of York Factory.

1. *Haliœtus leucocephalus*, Bald eagle. Rather scarce.
2. *Pandion haliœtus*, Briss.; Osprey, or Fishing eagle. Common. Several nests seen along the Churchill and Grass rivers.
3. *Falco communis*, Gm.; Peregrine or Duck hawk, male. York Factory.
4. " *columbarius*, Linn.; Pigeon hawk. Norway House to Fort Churchill.
5. " *sparverius*, Linn.; male. York Factory.
6. " *sacer*, Forst.; Ger-falcon. York Factory. A fine specimen, presented by Mr. Fortescue.
7. *Buteo borealis*, Gm.; Red-tailed hawk. Fort Churchill.
8. *Brachyotus palustris*, Bechst.; Swamp owl. Fort Churchill and York Factory.
9. *Nyctea nivea*, Daudin; Snowy owl. Abundant throughout the district in winter.
10. *Surnia ulula*, var. *Hudsonica*, Gm.; Hawk owl. Fort Churchill and York Factory.
11. *Corvus Americanus*, Aud.; Common crow. On Lake Winnipeg the young were able to fly in the beginning of July. Not often seen in the woods. Common on Hudson's Bay.
12. " *corax*, Linn.; Raven, or Barking crow. Breeds throughout the district.

13. *Ceryle Alcyon,* Linn.; King-fisher. Lake Winnipeg to York Factory. Rare towards Fort Churchill.

14. *Colaptes auratus,* Linn.; Yellow-shafted woodpecker. Very numerous, owing to the abundance of food afforded by the extensive *brulés.* The Hairy Woodpecker is also very common.

15. *Collurio borealis,* Vieil.; Great northern shrike. York Factory.

16. *Loxia leucoptera,* Gm.; American cross-bill. A specimen, which flew on board ship in Hudson's Strait, was presented by Dr. Mathews.

17. *Quiscalus purpureus,* Bartr.; Purple blackbird. York Factory.

18. *Scolecophagus ferrugineus,* Gm.; male, Rusty Grakle. York Factory.

19. *Melospiza melodia,* Wils.; Song-sparrow. Norway House.

20. *Dendrœca æstiva,* male, Gm.; Yellow-poll warbler. York Factory.

21. *Eremophila alpestris,* Forst.; Shore lark. Fort Churchill and York Factory.

22. *Plectrophanes nivalis,* Linn.; Snow Bunting. York Factory.

23. *Turdus migratorius,* Linn.; American Robin. Common throughout the district.

24. *Tachycincta bicolor,* Vieil.; White-bellied swallow. York Factory.

25. *Chordeiles Virginianus,* Gm.; (western variety) Night hawk. York Factory. Common southward. The Whip-poor-will was not seen nor heard north of Norway House.

26. *Lagopus albus,* Gmel.; Willow ptarmigan. Abundant at Churchill and York in winter, and comes as far south as Norway House.

27. *Bonasa umbellus,* Linn.; Ruffed grouse. Rare as far north as York Factory.

28. " *Canadensis,* Linn.; Canada grouse. Rare at Fort Churchill.

29. *Pediœcetes phasianellus,* Linn.; Pin-tailed grouse. Some of these birds were shot near Dog's Head, Lake Winnipeg. Thence I have found them eastward as far as Long Lake and Pic River on Lake Superior.

30. *Strepsilas interpres,* Linn.; Turnstone. York Factory.

31. *Grus Canadensis,* Linn.; Sand-hill crane. Norway House.

32. *Botaurus minor,* Gm.; Little bittern. York Factory.

33. *Gambetta flavipes,* Gm.; Yellow-shanks. Common throughout the district.

34. *Gambetta melanoleuca*, Gmel.; Tell Tale: Stone Snipe. Norway House.

35. *Tringoides macularius*, Linn.; Spotted sandpiper. Norway House to York Factory.

36. *Numenius borealis*, Forst.; Eskimo curlew. Abundant in July and August at Fort Churchill, as were also the Hudsonian Curlew, Golden Plover, and other species of which no specimens were brought home.

37. *Aegialitis semipalmata*, Wilson. Semipalmated Sandpiper. York Factory.

38. *Larus argentatus*, Brunn; Herring gull. Fort Churchill.

39. *Sterna hirundo* (?), Auct.; Black-headed tern. Very common in the larger lakes and on the shores of Hudson's Bay.

40. *Erismatura rubida*, Wils. Ruddy Duck. York Factory.

41. *Anas boschas*, Linn.; Grey or Stock duck, or Mallard. This is the commonest duck in the district. Breeds in considerable numbers along the Nelson and Little Churchill Rivers.

42. *Dafila acuta*, Linn.; Pintail duck. Breeds near Norway House.

43. *Bucephala clangula*, Linn.; Common Golden-eye or "Tree Duck." Also breeds near Norway House.

44. *Spatula clypeata*, Linn.; Spoon-bill duck. On Lake Winnipeg the young were nearly full-grown in the beginning of July.

45. *Querquedula Carolinensis*, Gm.; Green-winged teal. Very common near Norway House; scarce northward.

46. *Mergus cucullatus*, Linn.; Hooded merganser. Young going south in flocks on the Nelson River in September.

47. " *merganser*, Linn.; Red-headed merganser. Common throughout the district.

48. *Pelionetta perspicillata*, Linn. Surf Duck. York Factory.

49. *Anser Canadensis*, Linn.; Canada goose. Breeds in considerable numbers along the Churchill River. Most of the young could fly in the beginning of August.

50. " *hyperboreus*, Pal., var. *albatus*; Lesser snow-goose. One specimen which had been shot at Fort Churchill was presented by Mr. J. R. Spencer. Is very rare on the west side of Hudson's Bay.

51. *Anser hyperboreus*, Pal.; Common White wavy. Abundant at Churchill and York during the spring and autumn migrations.

52. *Cygnus Americanus*, Sharpless; Whistling swan. A few are shot every spring at Fort Churchill, from which place a specimen was presented by Mr. J. R. Spencer.

53. *Pelecanus fuscus*, Linn.; Brown pelican. Breeds in the smaller lakes near Lake Winnipeg and north-westward. Several specimens were shot in Lake Winnipeg in October.

54. *Colymbus septentrionalis*, Linn.; Red-throated diver. York Factory. Mr. Ross has shot a specimen flying past at Norway House.

55. " *torquatus*, Brunn; Great Northern diver. Breeds in many lakes throughout the district. Mr. Fortescue informed me that in the spring of 1878, just after the ice broke up at York Factory, great numbers of these birds congregated in the mouth of Hayes' River, a circumstance which had never been observed in any previous season.

The Passenger Pigeon was seen in small flocks in the upper part of the Nelson River in the beginning of September, 1878. It very rarely passes York Factory, and has never been known at Fort Churchill. The common American Snipe was met with near the Nelson River above Split Lake. I saw one specimen of the Woodcock at York Factory in the end of August last. This bird is not uncommon in Manitoba, although the fact is not generally known. The Pine Grosbeak was frequently seen on the Churchill River in the end of July, showing that it probably breeds in this region.

APPENDIX VII.

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VARIATION OF THE COMPASS.

The following list shows the variation of the compass in twenty-one localities in the territory explored during the season. The observations were taken with as much care as was possible while making such a rapid survey of an extensive region, where one had to attend, unaided, to such a variety of different matters. The local attraction, which exists in many places, especially among the Laurentian and Huronian rocks, sometimes renders it difficult to ascertain the true variation for any locality. Sir Henry Lefroy (who visited this region in 1843-44), in a letter which I have received from him on this subject, says:—"I used a new 7-inch compass, and used it carefully, but the results differ much more than I can account for. This is particularly the case where a change of geological formation occurs—say, for example, about the narrows of Lake Winnipeg—and I should be greatly interested in a good comparison by means of A.M. and P.M. sights on the 'Dog's Head' and the 'Bull's Head,' and on the opposite side to both. * * About Oxford Lake I have 12° 58′, 10° 11′, 14° 21′, in near proximity." Among other causes influencing the variation in this region, besides that of change in geological formation on a large scale, above alluded to, I have noticed beds of magnetic iron, deposits of iron sand, dykes of diorite, great magnetic boulders, sudden change in the general level in passing from one region to another, proximity of a cliff or bank or even of a thick grove or (when very close) a single large tree.

	Variation E.
1. Little Churchill River, 24 miles south of its junction with the Great Churchill. (The north side of the "forks" being in lat. 57° 30′ 57.34″ and about long. 95° 30′)	11° 30′
2. Little Churchill River, 5 miles north of last	10° 30′
3. At the north side of the junction of the Little with the Great Churchill River, in the above latitude	12° 30′
4. Great Churchill River, 22 miles north of the above junction	15° 00′
5. Great Churchill River, 27 miles from its mouth	6° 30′
6. Fort Churchill, on the west side of the river, 4 or 5 miles from its mouth. (Lat. 58° 44′ 43.04″)	11° 00′

7. York Factory, S. W. side of the fort. (In 1878 I found only about 5° 30′ at the N. E. side, but there appears to be some local attraction there)	7° 00′
8. Hill River, about 20 miles above its junction with Fox River (1878)	9° 45′
9. Nelson River, 63 miles from Point of Marsh, or the N. E. extremity of Beacon Point	8° 45′
10. Nelson River, First (or lowest) Limestone Rapid, (lat. 56° 36′ 6.″), about 77 miles in a straight line from Point of Marsh	11° 30′
11. Nelson River, Broad Rapid, 23 miles S. W. of last	11° 30′
12. Nelson River, outlet of Split Lake. (Lat. 56° 16′ 27″)	18° 00′
13. Grass River, outlet of Witchai ("Stinking") Lake, about 12 miles S. W. of the upper end of Split Lake, or about lat. 56°	16° 30′
14. Nelson River, north side of outlet of Sipi-wesk Lake, at south end of Cross Portage. (Lat. 55° 13′ 29.38″)	16° 30′
15. Nelson River, Chute at outlet of Duck Lake (Duck Portage)	19° 15′
16. Nelson River, 12 miles below White Mud Falls. (Lat. 54° 45′ 48.14″)	14° 30′
17. Nelson River, Western Channel of East River, 5 miles south of Pipestone Lake	16° 30′
18. Nelson River, Junction of Pine River with East River, 6 miles above Sea River Falls	16° 00′
19. Norway House	14° 00′
20. Point at east end of Mossy Point (at outlet of Lake Winnipeg), about one mile north of Warren's Landing	16° 45′
21. Lake Winnipeg, north side of Poplar Point, near extremity	15° 15′

I am indebted to Sir J. H. Lefroy, of London, for the following "memorandum of observations of variation on Lake Winnipeg in 1843-44."

	Variation E.
1. Fort Alexander	13° 56′
2. Grassy Narrows	14° 14′
3. Opposite Bull's Head	16° 18′
4. Opposite Dog's Head	15° 24′
5. By Beren's River	16° 55′
6. Point near Wesleyan Mission	14° 26′
7. By Mossy Point	19° 23′
8. A little beyond (lat. 52° 29′)	15° 27′
9. Norway House	15° 13′
10. Second Rocky Point	17° 03′

The following were taken in 1877 in connection with the Dominion Lands Department:—

Mouth of Poplar River, east side Lake Winnipeg	15° 20′ E.
Black River, north of Winnipeg River	13° 00′ E.

GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, F.R.S., F.G.S., DIRECTOR.

REPORT

ON THE

GEOLOGY OF SOUTHERN NEW BRUNSWICK,

EMBRACING THE COUNTIES OF

CHARLOTTE, SUNBURY, QUEENS, KINGS, ST. JOHN AND ALBERT,

1878-79

BY

PROF. L. W. BAILEY, M.A., PH. D., G. F. MATTHEW, M.A., AND R. W. ELLS, M.A.

PUBLISHED BY AUTHORITY OF PARLIAMENT.

Montreal:
DAWSON BROTHERS.

1880

To Alfred R. C. Selwyn, F.R.S., F.G.S.,

Director of the Geological Survey of Canada.

Sir,—The geological maps accompanying this report include an area of about 6,000 square miles, surveyed by us in southern New Brunswick up to 1878, assisted in 1877 and 1878 by Mr. Wallace Broad, B.A., and in 1877 by Mr. Frank Adams, B. Ap. Sc. Detailed reports on various portions of the area have already been published from time to time in the annual Reports of Progress, and the present report may be regarded as a *resumé* of these, with a general statement of the results of the work to date, especially in relation to the geological structure of the region. The difficulties presented over a large part of the area, from the wooded and unsettled character of the country, have rendered the working out of the detailed structure in many places almost an impossibility, and the authors wish it to be understood, that, while they believe the maps as now presented are in the main correct as to general features, some portions may be found, upon future and more detailed examination, to require amendment. Especially does this apply to the Silurian belt in western and northern Charlotte and its extension east into Queens and Kings, where lack of roads and good exposures, together with an entire absence of fossils, have rendered the assigning of this group to any definite horizon a very difficult matter; and for the present, although within the area there are rocks which possess, lithologically, many characters in common with the recognized pre-Cambrian as well as others of Silurian aspect, it has been thought best to assign them provisionally to the Cambro-Silurian as most in accordance with their apparent stratigraphical position. The outlines of the different formations have been carefully traced and their stratigraphical relations in most cases clearly made out. In addition to the geological, a large amount of necessary topographical work has been done. Surveys of roads have been made by odometer, chain and pacing throughout the whole of the counties of Sunbury, Queens, Kings, St. John and Albert, with portions also of Charlotte and Westmoreland, as well as many streams and coast sections. In addition to the working out of the general geology, special examinations have been made of the Grand Lake coal field in 1872-73; of the Albert and Beliveau mining areas (Albert shales) in 1876; of the copper mines along the southern coast in 1877, and of the anthracite mine at Lepreau in 1878. In constructing the maps, the St. John River and the coast lines have been laid down from the Admiralty charts corrected from the United States Coast Survey; the parish and county lines, with a large portion of the streams and lakes, are from the most recent data in the Crown Lands Department at Fredericton; the railways are taken from accredited plans, while the roads have been surveyed principally by ourselves.

We are, sir,

Your obedient servants,

L. W. BAILEY,
G. F. MATTHEW,
R. W. ELLS.

MONTREAL, 1st May, 1880.

REPORT

ON THE

GEOLOGY OF SOUTHERN NEW BRUNSWICK,

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R. W. ELLS, M.A.

The geological formations described in this report may be stated thus:

I. Pre-Cambrian.
II. Cambrian.
III. Cambro-Silurian.
IV. Silurian. (Upper Silurian of previous reports.)
V. Devonian.
VI. Lower Carboniferous.
VII. Middle Carboniferous.
VIII. Triassic.

I. PRE-CAMBRIAN.

The rocks comprised under this heading include the Laurentian of 1870-71 and the three former divisions of the Huronian, Coastal, Coldbrook and Kingston; but for the purpose of more fully illustrating the report of 1870-71, the portion then described as Laurentian is indicated by a different color on the map. The results of the subsequent examinations of the rocks of this group, principally in 1876-77-78, when the extent and stratigraphical relations of the various members were carefully studied and defined, have been stated in the report of 1877-78. The different divisions were then found to be in ascending order. Previous exploration of these rocks.

1. Basal or probable Laurentian rocks, comprising syenite, gneiss

Subdivisions of Pre-Cambrian.

and felsite, the former often chloritic or talcose, and described in former reports as protogine.

2. An upper portion comprising also syenite and gneiss, with quartzite, felsite and limestone, mica and felsite schists and black graphitic slates. These two divisions form what has in earlier reports been regarded as constituting the Laurentian area of the southern portion of the province.

3. Red, grey and blackish petrosilex and felsite, with breccia conglomerates, diorites, amygdaloidal ash rocks and felspathic conglomerates, with grey felspathic sandstones, constituting the Coldbrook division of the Huronian of previous reports.

4. Chloritic, felspathic and talcose schist, often a schistose conglomerate, interstratified with beds of purple ash rock and amygdaloid, and purple conglomerate and clay slate, with pale grey and pyritous, rusty-weathering felsite and felspathic quartzite.

These constitute the Coastal division of the Huronian of former reports.

5. Reddish and grey felsite, often hard and flinty, felspathic and chloritic schist, with diorite, hornblende schist and granitoid and gneissic rocks, with heavy beds of slate conglomerate and felsite conglomerate and clay slate in the upper portion.

These constitute the Kingston division of the Huronian of former reports.

Division 2.

Of the relations of Division 2 of the above series (mica schist, limestone and fine gneiss) to the main body of coarse syenite and syenitic gneiss (Division 1), nothing further is known than is contained in the report of 1870-71, wherein they are described as the "upper series of the Laurentian area." The greatly broken and disturbed character of this supposed "upper" series, the obscure stratification of much of the underlying group, together with the frequent occurrence of intrusive masses, combine to make the determination of its position difficult. There can, however, be no question that the bulk of the calcareous and silicious strata met with in this area are more recent than the coarse granitoid rocks with which they are associated, while both are at many points seen to pass beneath the Cambrian or Primordial Silurian. Their principal mass forms a long, irregularly lenticular belt extending from the vicinity of South Bay on the west side of the St. John River, across this stream and through the parish of Portland through and beyond Torryburn, while a second but narrower belt skirts the southern edge of the Laurentian area, appearing on either side of Musquash Harbor, crossing the peninsula of Pisarinco and reappearing near the suspension bridge of the St. John River. At Lily Lake, near St. John, the limestones of this latter belt pass beneath a narrow band of schistose petrosilicious strata of the Coastal (Huronian) group (Division 4), which intervene between them and the basal beds of the Primordial.

In the eastern portion of the metamorphic area other rocks, presumably representing the upper portion of Division 2, and embracing limestones and dolomites of Laurentian aspect, are met with in eastern Kings and Albert, forming two anticlinal ridges, which are separated by the rocks of Division 4.

The rocks of Division 3 are most extensively exposed along the county line of St. John and Kings. Their eastern limit is in the northern part of Mechanic settlement in Kings county, where the petrosilicious and slaty portions are found apparently resting upon strata which bear some resemblance to those of Division 2, from which, however, they are in places separated by intrusions of diorite and possibly by faults. West of Donegal settlement the rocks of this group increase rapidly in breadth, and on the Shepody road, where they are well exposed between Hammond River and Londonderry post office, they have a superficial breadth of about seven miles. Over portions of this area, however, as in Long and Filamaro settlements, they are in part covered and concealed by the schistose and amygdaloidal beds of Division 4, which also flank them upon their northern and southern sides. At Handford Brook and thence westward to St. John, the Huronian rocks are separated into two belts by the Primordial Silurian (Cambrian), and they are also covered over, on the east side of St. John Harbour, by the Mispeck Devonian. With the possible exception of Mechanic settlement, no instances of direct superposition of the rocks of Division 3 on those of Divisions 2 and 1 have been observed. As, however, the rocks of that division, being largely made up of volcanic or semi-volcanic material, are extremely variable in thickness and character, but little stress can be placed upon their absence, while the distinct superposition of Division 4 upon Division 3, as well as upon Division 2, leaves no reasonable doubt as to their true succession. Division 3.

The relations of Division 4, the so-called former Coastal group, to the petrosilicious rocks of Division 3 are well seen along either of the roads running southerly or south-easterly across the county of St. John, but especially along the line of the St. Martins and Upham railway, between Upham and Quaco, or on the Lower Quaco road either side of Bloomsbury Mountain. In passing from the one to the other at these several points, there is often, though not always, a somewhat abrupt change of dip, the higher beds, or those of Division 4, dipping at a much lower angle than the beds upon which they rest, while along the same line of contact it is not uncommon to find masses of coarse breccia conglomer- Division 4.

ate in which the fragments are largely of petrosilex derived from the inferior group. It is, however, questionable whether the unconformability thus indicated is sufficient to prove the fact of any considerable lapse of time as having occurred between the two, they being very generally found together, and exhibiting many features of close resemblance, more especially as regards the abundance in both of volcanic products. The extreme fineness of many of the rocks of Division 3, together with the prevalence of breccias and the frequent absence of recognizable stratification, in contrast with the schistose character of Division 4 and the abundance in the latter of coarse conglomerates, may be explained upon the supposition that they result from differences in the conditions of deposition.

In addition to the main belts of Coastal rocks (Division 4) above described, areas of more limited extent are at various points met with overlying or occupying low synclines of the Coldbrook group (Division 3), as in the valley of Black River, near Garnett settlement, in Golden Grove and elsewhere.

Division 5. Kingston group

Division 5 derives its name from its great development in the Kingston peninsula, which is almost entirely composed of the rocks of this group, and whence it may be traced westward to the shores of Beaver Harbour. The age and equivalency of these Kingston rocks, as well as the somewhat similar belt of slate and diorite occupying the Mascarene peninsula and thence extending through the chain of the western isles, have been subjects of much discussion; the uncertainty as to their true position arising in part from the difficulty of obtaining satisfactory stratigraphical data bearing upon the subject, and in part from the close resemblance which many of them bear on the one hand to the rocks of the Huronian system, and on the other to those of the Silurian. The difficulty was further increased by the occurrence at a variety of points, as well in Washington county, Me., as in this province, of fossils of Silurian aspect in rocks apparently forming a portion of the Kingston series, and under circumstances which seemed to point to this as their proper horizon. Thus, along the south side of the Long Reach, fossil corals and other forms were found by Mr. Matthew in 1878 to occur in a band of felspathic ash rocks, singularly like some of those in the Huronian of St. John county, and which had an apparent dip which would seem to constitute them the lowest member of the rocks of the Kingston peninsula. Subsequent investigations, however, served to show that these Silurian beds abut unconformably against the crystalline rocks of the peninsula, and are of much more recent age. In consequence of this discovery the typical and crystalline rocks of the Kingston series, compared in earlier reports with the Upper Silurian, were in 1878 referred back to their

Fossils.

original position, and are here represented as pre-Cambrian (Huronian). A similar plan has been adopted in the case of the rocks of the Letite peninsula with their extension through Deer and Campo Bello Islands; but as to these the authors feel less confident, they presenting important points of difference in comparison both with the typical Huronian and the Kingston group, while in some of their features they recall the rocks of northern Charlotte and Queens counties, to be presently noticed under the designation of Cambro-Silurian.

Kingston group west of St. John River.

Compared with the typical Huronian of St. John county, the true Kingston rocks appear to include both Divisions 3 and 4. (Rep. 1877-78.) Between these and the rocks of Letite peninsula, referred to above, there is in Charlotte county an axis of older rocks, which, from the occurrence of limestones in Frye's Island, and other lithological features, may represent a second parallel belt of rocks equivalent to the so-called Laurentian of St. John. It may be traced from the head of the Long Reach, near the mouth of Jones' Creek, south-west to the L'Etang Harbour. The extension of the Kingston group (Division 5) west of the St. John River presents precisely the same character as is seen on the east, being composed principally of felsite, felsite schist and diorite. These rest upon the northern side of the syenite and gneiss axis of the Laurentian (report of 1870-71), with a dip of N.W. $<$ 70°, and show an exposed breadth along the river of about three miles. The rocks are well exposed on two roads running west from the river road to the Finlay settlement, about two and a half miles from the river. On the more northerly of these two roads a reverse dip $<$ S. 55° E. $<$ 70° is seen, showing that the synclinal structure of the centre of the Kingston peninsula is maintained westward; a little further west the dip again changes to the north-west, indicating the extension of the anticlinal which runs along the south shore of the Long Reach. Between Finlay settlement and Lepreau River the rocks of this group have not been traced, but on that river they again appear directly on the strike and present precisely similar characters. West of the Lepreau, good sections are presented along the St. Andrews post-road, as well as on the road leading down to the mouth of New River, the general dip on both these roads being S. 30° E. $<$ 40°-70°. They extend in a continuous section to Barnaby's Head on the west side of Lepreau Harbour, near the extremity of which is a reverse dip to N. 60° W. $<$ 50°, which may possibly indicate the southern line of contact with the syenitic gneiss described in former reports as extending west from St. John to Lepreau.

Eastern extension of Kington Rocks.

The eastern extension of the main ridge of Kingston rocks terminates at the road leading from Norton station to Belleisle corner, when it becomes covered over by Lower Carboniferous sediments, which occupy the greater part of the Kennebecasis valley to the eastward;

but at two points at least the older rocks reappear and form the ridges known as Jordan's and White's mountains in eastern Kings county, and again at Indian Mountain, in Westmoreland, where the characteristic red felsites of the group appear.

Pre-Cambrian rocks on line between Kings and Queens.

Another belt of pre-Cambrian rocks is found extending along the county line between Kings and Queens. These are of the usual type of felsite, petrosilex, schist and felspathic ash rock with conglomerate. West of the St. John River they are seen in the prominences known as Blue Mountain and Broke-Neck, as well as several other hills in the vicinity of Jones' Creek. These hills are principally composed of highly crystalline felsite, the depressions being filled with fossiliferous Silurian rocks resting unconformably upon them. On the eastern side of the river, Huronian rocks, which are probably the continuation of those on the north side of the Long Reach, extend up the south shore of Belleisle Bay and as far east as Snyder Mountain, beyond which they become obscured under the great mantle of Carboniferous rocks. In the vicinity of the East Scotch settlement, and on the road to the English settlement, these pre-Cambrian rocks have a breadth of three to four miles, and comprise felspathic, micaceous and talcose schist, petrosilex and other felspathic rocks, with felsite ash conglomerate. Small areas occur on Carmichael's, Ryan's, and Lunn's brooks, where the felsite and schist are well exposed, but the areas are limited by the Lower Carboniferous and Millstone Grit sediments. In Queens county, in the parish of Wickham, felspathic and petrosiliceous rocks with black slate occur, which form ridges, surrounded by the Cambro-Silurian beds of this vicinity.

The general strike of all these ridges of pre-Cambrian rocks is very nearly N. 65° E. Their physical characters and detailed structure have been given in former reports. (See reports of 1870-71, 1875-6, 1876-77, 1877-78.)

II. Cambrian, or Primordial Silurian.

General distribution.

The rocks of this age are developed principally to the east of the St. John River. They occupy basins or trough-like depressions among the older hills of pre-Cambrian rocks. The early history of these rocks has been given in the General Report, 1870-71, under the heading of "St. John, or Acadian Group." Since then their distribution has been more carefully studied, principally by Prof. Bailey in 1877. They were found to occur in six parallel bands, occupying basins, sometimes of considerable but at others of very limited area. The most northerly belt is seen on the St. John & Maine railroad, just south of Nerepis station. Here the rocks consist principally of the purple sandstone

Six troughs.

and conglomerate which constitute the basal beds of this formation. The second area, which is also one of the largest in the southern part of the province, is well developed along the north shore of the Long Reach. It is seen about the mouth of the Nerepis and along the line of railroad at that point, and can be traced eastward along the shore as far as Caton's Island, when it is covered by the waters of the River St. John, but reappears again on the south side at the end of Gorham's Bluff. A further extension of these beds may possibly occur about Tenant's Cove, on the east side of the river. This suggestion was mentioned in the report of 1870-71, when the lithological resemblance of the rocks surrounding the cove to those of the St. John group was noted, but as no fossils have yet been found in this band it has been deemed best to include it in the Cambro-Silurian. Characteristic fossils of this group are found at several points along the Reach, notably at Caton's Island and near Westfield church, in a small brook. Some of these have been determined by the late Mr. Billings, and descriptions have been published in former reports. Going south and crossing the Kingston peninsula, we find the third and fourth bands on the north and south shores of Kennebecasis Bay. The more northerly of these occurs in small wedge-shaped basins on the eastern end of Kennebecasis Island, Milkish Head and Long Island, overlaid by Lower Carboniferous sediments and resting upon syenites of supposed Laurentian age. At the south side of the bay these rocks are found at Sand Point and on the shore west of Torryburn station. They here dip towards the crystalline limestones, and their contact is probably marked by a fault. Crossing the ridge of syenitic gneiss of the Laurentian, we come to the fifth and most important area. This belt extends from the town of Carleton, west of the St. John River, eastward to and beyond Handford Brook, a distance of over thirty miles, and with a surface breadth, in places, of from three to four miles in its widest portion. It is seen to rest upon the old ridges of the Coldbrook division of the Huronian. Fine sections are afforded at several points, especially at Handford Brook, in the eastern area, which have been given by Prof. Bailey. (See report for 1877-78, pp. 18 and 31.) Characteristic fossils of this group may be collected at several places, notably at Handford Brook, Porter's Stream, Ratcliffe's Millstream, and in and around St. John city.

Distribution of the troughs.

The sixth and most southerly band of this group is found south of Loch Lomond, between the Black River and Quaco roads. It consists of the usual fossiliferous black slates, and has a breadth of about 150 feet only. Its extension eastward through the Willow Grove settlement is seen overlying the Coastal rocks of Division 4.

Besides these well recognized belts of Primordial or Cambrian rocks,

Rocks of uncertain age.

others whose age is not so certainly known are found; one of these, already mentioned as occurring about Tenant's Cove, has been described. Stratigraphically, it is apparently superimposed upon the pre-Cambrian belt, which extends along the north side of Belleisle Bay, and it is again seen in the eastern part of the Scotch settlement, occupying a basin in the old pre-Cambrian rocks of that vicinity. The slates and shales are dark, and often ochreous, but no fossils have yet been discovered. Further north in Wickham, about one mile south of Golding's Landing, black slates, which have been supposed to belong to this age, are seen. They apparently, in so far as examined, contain no fossils, but occur on the southern side of the pre-Cambrian ridge which extends eastward along the county line.

Black slates, which apparently underlie the Upper Silurian of Oak Bay, in Charlotte county, are also found near the head of the bay, on the road from St. Stephen to St. Andrews, but, as in the rest of these undetermined cases, they have all been included in the general colour which represents the Cambro-Silurian.

III. Cambro-Silurian.

Dark argillites.

The rocks included under this head comprise the dark argillite group which is largely developed in western and northern Charlotte county, as well as in southern Queens, west of the River St. John; also a large body of what was in 1870-71 described under the head of Laurentian, and which was then considered an upper series or the equivalent of the Montalban group of Dr. Hunt, and which occupies the south-western area of Charlotte, in the parishes of St. Stephen and St. David. The greater part of the latter group is highly metamorphic, and consists of gneiss, quartzite, mica schist, hornblende, and actinolite schist, with some argillite. It presents, in many respects, a strong resemblance to the pre-Cambrian of other portions of the province. This group is overlaid, near Oak Bay, by black slates, which have been compared to the St. John group, and which, in turn, underlie the fossiliferous Silurian about the head of the bay. The slaty or dark argillite portion occupies principally the northern part of the area and eastward, crossing into Queens county, where it may be traced to the St. John River, at Hampstead, and across through the parish of Wickham. Fossils have not been found in this group, and great uncertainty exists as to its exact horizon, some portions resembling closely the Silurian, and even seeming to shade off into the overlying supposed Devonian on its northern flank. As a group, however, it may be said to be intermediate between the pre-Cambrian and the fossiliferous Silurian.

No fossils.

East of the St. John River, in Kings county, we have included in this group a variety of beds whose relations are not yet clearly made out. Among these, in addition to the beds described on page 6 D under the head of Cambrian, are rocks, between Tenant's and Jones' Coves, a portion of which present marked Huronian characters, but which are so intimately associated with other slaty rocks that their separation is almost impossible. These rocks are described in the report of 1870-71, page 70. Associated beds of bright silvery slate, black carbonaceous slate, chloritic and petrosilicious rocks are also seen, but the country, in places, is so wooded, and the exposures so few from this cause and from the covering of drift, that their relations are doubtful. For the present, therefore, it has been deemed advisable to include all these various rocks whose stratigraphical relations are uncertain in our general group of Cambro-Silurian. In our examinations of this region fossils, of undeterminable forms, were discovered, only at one point, on the back road near where it is crossed by the Pascobac, about three miles north-west of Callina corner. The beds here appear to occupy a narrow trough between ridges of pre-Cambrian rocks.

Beds of uncertain age.

IV. Silurian. (Upper Silurian of former reports.)

The rocks belonging to this formation have not, with one exception, been recognised with certainty east of the St. John River. Certain areas in Wickham were formerly provisionally assigned to this horizon, but as no fossils have ever been found among them, and their lithological characters differ markedly from those of the fossiliferous beds, which are so largely developed west of this river, they have now been assigned to the Cambro-Silurian formation. It is possible that limited areas or patches may exist among the older rocks in that locality, but owing to the extensive covering of Lower Carboniferous beds that are superimposed upon the Cambro-Silurian and pre-Cambrian, any rocks of this age that may have been deposited have been concealed. West of the St. John River, however, several Silurian areas occur in Queens, Kings and Charlotte counties. Of these, the most prominent is that extending west from the Mistake, on the St. John River, along the northern flank of the pre-Cambrian ridge north of the Long Reach, until it is terminated by the granites. These Silurian beds sweep around the eastern end of the granitic axis, and are seen occupying shallow basins in the vicinity of Jones' Creek, in Queens county, where they surround the bosses of Huronian felsite known as Blue Mountain and Broke-Neck, as well as others further west. Their northern limit can be fixed with considerable accuracy. On the St. John River, at the

Scarcely represented east of St. John River.

Areas west of St. John River.

Mistake, the beds are seen to change their course and to extend down the Reach, where a narrow fringe is seen, holding fossils of this age, along the eastern shore from the mouth of Bostwick's Brook to Carter's Point. They are here seen abutting against the older rocks of the Kingston peninsula, and their unconformability is well marked. They probably rest upon the Cambrian beds which are developed along the western shore of the Reach, and which, doubtless, form a synclinal occupying the eastern side of the river, the anticlinal being well marked on Caton's Island, on which the Silurian beds rest unconformably. The discovery of the Silurian age of these beds is due to Mr. Matthew, who first found fossils in them at Whelpley's Point, in Elmsdale. The character of the rocks, however, differ from the usual slaty aspect of the Silurian, in being more of the nature of ash beds, resembling in many respects some of the rocks of pre-Cambrian age in the coast range.

Fossiliferous beds.

The characters of the Silurian rocks west of the St. John have been already described in the report of 1870-71. They contain abundance of fossils throughout their whole extent from the mouth of Jones' Creek, along the back road and the line of the St. John & Maine (formerly Western Extension) railway. These beds are seen to change their character as they approach the granite, and to become more siliceous and flinty, but the fossils can be easily distinguished even in their altered portions. North of the granite the extension of these beds has been determined in so far as the wooded character of the country would permit. The stratigraphical relations of the fossiliferous Silurian to the Siluro-Cambrian, including the dark argillites, indicate that the former belongs to a higher horizon, and it probably lies in basins unconformably upon the latter.

Silurian of Charlotte.

In Charlotte county the principal areas of Silurian are about the head of Oak Bay, around the eastern and northern shores of Passamaquoddy Bay, and about the islands and peninsula of L'Etang Harbour. The Mascarene series, described in the report of 1870-71 as of uncertain age, has been assigned to this formation on the evidence of fossils found at Pembroke, in the State of Maine. (See report of 1874-75.) In former reports (1875-77) a portion of the Kingston group was assigned to this horizon, but subsequent examinations have referred it back to the Huronian, both on lithological and stratigraphical evidence. In so far as our examinations have extended in this province, the metamorphic rocks are generally found to belong to horizons older than Silurian, and when metamorphism has occurred among beds of Silurian age its cause is generally local and the areas limited. Moreover, the Silurian beds, wherever met with in the southern and northern portions of the Province, are plainly distinguished by abundance of

Pre-Silurian metamorphic rocks.

fossils and a generally unaltered character, and in nearly every case they rest unconformably upon more or less metamorphic rocks.

V. Devonian.

The areas of Devonian occurring in southern New Brunswick may be stated as follows:—

Areas of Devonian.

1. A large basin, or double synclinal, east of St. John Harbour, occupying the valley of the Mispec, with a southern area extending north-easterly across the Black River, near the forks of the East Branch.

2. Isolated outcrops on Coal Creek and on Canaan River and North Fork, presumably of this age, but lacking evidence of fossils.

3. Small areas about St. John and Carleton, with possibly Partridge Island.

4. A small area about the eastern extremity of Spruce Lake, on the St. Andrews railroad.

5. A belt stretching west from Musquash Harbour to Lepreau Harbour, in which is contained the so-called anthracite mine of Belas Basin, with a smaller detached area along the shore from By Chance Harbour to Dipper Harbour.

5. A large area in the northern part of Charlotte county, embracing the former pale argillite series and extending into Queens county.

Typical area.

Of these the first, or area east of St. John Harbour, may be styled the typical Devonian of the province. Its division and characters are stated in full in the report of 1870-71, the estimated thickness of the four divisions being given at 7,500 feet. This formation has a particularly rich fauna and flora, whose details have been very carefully worked up, principally by the late Professor C. F. Hartt. The fossils especially abound in the Dadoxylon sandstone and Cordaite slate, the former containing, in addition to the plant remains, several crustaceans and wings of insects. Many of the plant stems are graphitized, and at Belas Basin, in Lepreau Harbour, a bed of graphitic anthracite has been opened.

Coast west of Musquash Harbour.

West of the St. John Harbour, the principal surveys made on this formation, since the report of 1870-71, include the area extending from Musquash Harbour to Lepreau. On the coast west of Musquash the rocks of this age are first observed about midway between Little Musquash and By Chance Harbour, where purple and grey sandstones and slates are seen skirting the eastern side of the harbour, dipping S. 80° E. $< 15°$-$20°$, and resting unconformably upon the crystalline limestones, syenite and felsite of the pre-Cambrian. From this point they occupy the shore as far as the west side of Little Dipper Harbour, being well developed about Chance Harbour. On the west side of

Little Dipper Harbour they are seen to dip off from the northern flank of hard crystalline greenish and purple porphyritic felsites of pre-Cambrian age, which occupy the extremity of the western side of the harbour, and which extend thence along the shore to the northern side of Dipper Harbour, where the Devonian rocks again touch the shore. These Devonian rocks are seen to occupy a shallow synclinal, their northern edge resting upon the pre-Cambrian (Laurentian) ridge that extends from St. John to Lepreau, and dipping southward at a low angle. The surface breadth of this belt is about one mile. This southern or coast area terminates just at the telegraph road to Point Lepreau.

The northern or larger area has a maximum breadth of two and a half miles. It rests unconformably upon the Laurentian gneisses both on the north and south. At least two anticlinals, with several faults, are observable. Both the Dadoxylon sandstone and Cordaite slates are represented in this belt, the rocks being principally dark purple and grey sandstone and conglomerate, with bands of dark blackish grey slate and thin bands of purple, red and bluish grey limestone. The grey beds, which are often of a glassy quartzose character, form the base of the series in this direction, and represent the Dadoxylon sandstone of the Mispec section.

Continuation toward Lepreau

On the Telegraph road, from the St. Andrews road to Dipper Harbour, they are seen to form a sharp synclinal with a dip of S. 10° E. $<$ 70° along the northern margin about Musquash, which is reversed to N. 20° W. $<$ 70° on the road to Dipper Harbour. These are overlaid by the purple sandstones and conglomerates, with shales of the Cordaite division, the contact being probably marked by a fault. These purple beds also form a synclinal, with their southern margin resting upon the syenitic and porphyritic felsites of the ridge north of Chance Harbour, over which they fold and again reappear on the slope of the hill overlooking the harbour, the crest of the ridge having been removed by denudation. This belt may be traced westward without interruption to the waters of Lepreau Harbour, where it has an exposed breadth of about one mile, extending from the south side of Belas Basin to the north side of Boyle's Beach, on the north side of Ragged Head. At this place, as well as on the Little Lepreau, the broken character and faulted structure of these beds is well shewn. At the point where the

Lepreau.

road from Lepreau village to Hanson's coal mine crosses the Little Lepreau River, the grey beds (quartzites) which form the base of the formation in this area are seen to dip S. 15° E. $<$ 90°, resting against the Laurentian syenitic gneiss. Going south, the dip changes to S. 10° E. $<$ 75°, and at Little Lepreau Basin the contact of the grey and purple beds is observed with the same dip—S. 10° E. $<$ 75°

Crossing the narrow peninsula between Little Lepreau and Belas Basin, in which the coal mine is situated, we find the grey beds again in contact with the purple, but this time apparently overlying them. This would indicate a slight overturn of the beds at this point, the dip being nearly vertical, or S. 10° E. < 80°, by which the lower grey beds are brought into an apparently higher position. Crossing the bridge over the Belas Basin, the purple beds are again seen, in their regular position above the grey beds of the Dadoxylon division, and apparently dip towards the syenites and limestones of the pre-Cambrian axis of Mace's Bay. At the south side of Boyle's Beach the grey beds of the Devonian are seen to be unconformably overlaid by the red conglomerates and sandstones of the Perry group at the base of the Lower Carboniferous, the dip of the former being to S. 10° W. < 40°, and of the overlying beds N. 70° W. < 30°. Just at the water line, at the contact of the grey and purple beds on the north side of Belas Basin, the irregular deposit of carbonaceous shale and graphitic anthracite is found, upon which work has been carried on for the last four years. During this time several shafts have been sunk, the deepest of which in 1878 had reached 140 feet. The thickness of the seam is stated by the miners to be in places twenty feet, but by far the greater portion of this is carbonaceous shale of no value whatever. The western extension of this seam can be seen in a small cove just beyond the entrance to the basin and just south of McPherson's house, where a fault is observed between the grey and purple beds, and a seam of black carbonaceous shale six inches thick is exposed. Another exposure occurs on the south side of the basin, and about one-fourth of a mile inside the head of the sea-wall, where a thin seam of black carbonaceous clay or shale of no value is seen at the contact of the porphyritic felsites and the red conglomerates of Point Lepreau.

Rocks in vicinity of Lepreau mine.

Character of coal seam.

At the mine, two of the shafts were sunk on the main seam; one of these followed the inclination of the beds. In the first 110 feet the inclination was to the north at an angle of eighty degrees, when it bent round to the southward and continued at the same angle. This would tend to confirm the supposed overturn which was noticed in these beds at the surface. The harder portions of this seam, or the coal proper, burn readily with a good draught until the carbonaceous matter is consumed, leaving a large quantity of reddish ash. Analyses of samples from its outcrop, by Dr. Harrington, gave 36.88 per cent. of ash, and the quality in going down does not appear to improve. From its position in the Devonian, in connection with its graphitic character and irregular occurrence, it is exceedingly doubtful if coal of sufficient purity for marketable purposes will be obtained. This locality was first noted by Dr. Gesner in his reports to the New

Lepreau mine.

Brunswick government, and attention was drawn by him to the occurrence of the coal in what he then considered to be rocks of the age of the New Red Sandstone. From the reefs at Ragged Head beautifully preserved specimens of Devonian plants are obtained, many of which are graphitized. Some of these have been described. (See report of 1870-71.)

Similar coal in Massachusetts and Rhode Island.

A similar case of the occurrence of anthracite in rocks of presumed Devonian age may be mentioned as existing in the states of Massachusetts and Rhode Island, and is described in the report of Dr. Edward Hitchcock on the Geology of Massachusetts for 1841. In this he describes the occurrence of coal of precisely similar character to that of Lepreau, glazed with plumbago, and occasionally converted into that mineral; very irregular in its distribution, and in rocks lithologically resembling those in which the Lepreau mine is situated. These rocks which probably correspond with the grey quartzites of the New Brunswick Devonian, he caracterizes as greywacke and greywacke slates, while the other members of the Devonian are represented by soft black, brown and grey shales, slates and sandstones. Although reports on this coal at the time of its discovery were quite favourable, it does not seem to have been ever worked with any degree of success, and its large percentage of ash, as with the Lepreau anthracite, was probably fatal to its successful development.

Devonian of northern part of Charlotte.

The largest area of rocks of this age is that occurring in the northern part of Charlotte county, and extending eastward into Queens county. These rocks have been described in the report of 1870-71, and are also briefly mentioned in the report of 1876-77. They comprise the former so-called pale argillite group. They are superimposed upon Cambro-Silurian rocks, and extend from the St. Croix River, near Sprague's Falls, to the Charlotte county line, and thence into York. At the line of contact the dips are nearly vertical, but there is in places an apparent conformability between the dark argillite portion of the Cambro-Silurian and the series under discussion. It is probable, however, that faults occur at the line of contact, as the beds of fossiliferous Silurian so well developed about Oak Bay, on the south side of the Cambro-Silurian belt, are entirely wanting along the northern margin. The Devonian age of these rocks has been based by Mr. Matthew upon the occurrence of remains of *Lepidodendron* found in Cox's Brook, a small branch of the Magaguadavic River, as well as from certain graphitic films, supposed to be the impression of fern leaves, found in the eastern extension of these beds into Queens county. They also possess many points of resemblance, lithologically, to the typical Devonian of Mispec, and hence they have been provisionally assigned to this horizon. Their exact relations have not as yet been determined, the unfavourable nature of the country rendering their examination, except at distant intervals, very difficult, and they may be therefore stated as resting unconformably upon rocks presumably of Cambro-Silurian age, and underlying the Lower Carboniferous sediments which surround the central Carboniferous basin.

VI. Lower Carboniferous.

General distribution.

The general distribution of the Lower Carboniferous of Queens and Sunbury counties has been stated in the report of 1872-73. The formation, as seen in these counties, differs largely in the character of its sediments from its recognised development in the southern and eastern areas, in the presence of large areas of trappean and other volcanic rocks, soft felspathic ashes or claystone, as well as harder felspathic beds. These are found not only along the southern border of the central Carboniferous basin, but are seen obtruding through the grey sandy beds around the head of Grand Lake, forming hills and ridges often of considerable elevation, which furnish conspicuous landmarks in the otherwise generally level surface. In the counties of Queens and Sunbury the rocks of this age form generally a margin of no great breadth around the southern edge of the coal basin, but in Kings they spread out and occupy the greater part of the valley of the Kennebecasis Bay and River, having an exposed breadth in some places of twenty miles. East of Penobsquis station, on the Intercolonial railway, they are covered by the grey beds of the Millstone Grit, but to the westward they extend beyond the St. John River. The basin-shaped character of this formation is well-marked; the rocks lying unconformably upon the pre-Cambrian, Cambrian and Devonian beds. Areas of less extent exist among the pre-Cambrian hills of Kings and Albert, and in the latter county they sweep around the eastern extremity of the pre-Cambrian ridge at the Albert Mine, and thence extend down the valley of Demoiselle Creek and westward along the shore to the mouth of Point Wolf River. Smaller patches are likewise found at the mouth of Goose Creek and Martin's Head, in St. John county, and at the latter of these places there is a deposit of fibrous gypsum of considerable extent. In Charlotte county this formation is but sparingly developed. The deposits of Lepreau and St. Andrews, with outliers about the shores of Passamaquoddy Bay, are the principal. These are interesting as containing in their lower portions fossils of Devonian type, while the beds themselves are unconformably superimposed upon the true Devonian, and otherwise possess the characters of the Lower Carboniferous rocks, the several members of which, as developed in southern New Brunswick, may be described in descending order as follows:

Subdivision.

1. Red and grey conglomerates, with thin reddish shales and beds of gypsum, and flaggy, often bituminous, limestone.

2. Red and grey calcareous and argillaceous beds in frequent alternations, with thin conglomerates, and heavy beds of rubbly brownish-red and fine-grained shales towards the top.

3. Grey and red conglomerates of varied composition, with beds of greyish and brownish oil-bearing micaceous and bituminous sandstones.

4. Calcareous and bituminous shales, grey and dark brown, including the so-called Albert shales, with an underlying set of greenish-grey conglomerates. This series is overlaid unconformably by reddish or brownish sandy shales, which form the basal beds of No. 3.

Horizon of Albert shales.

Stratigraphically, the beds of Albert shales, or Division 4, as developed in Albert and Westmorland counties, may belong to a lower horizon than the Carboniferous, and may constitute an upper portion of the Devonian, but the prevailing fossils, both fishes and plants, seem to indicate a Lower Carboniferous age. Bituminous shales, however, are found to occur interstratified with undoubted Lower Carboniferous sandstones and conglomerates further west in Kings county, on the South Branch of the Kennebecasis, as well as on the South-west Branch of Trout Creek. On the latter stream the felsites of the mountain are overlaid by red conglomerates and limestones, dipping northward at an angle of 20°. These, at the road crossing to Dutch Valley, contain an interstratified band of highly bituminous shales of the same type as those of the Albert Mines and Elgin, with numerous scattered remains of the genus *Palæoniscus*. They are again brought up by a fold about one mile down the South-west Branch, and are associated with the ordinary red sandstones and conglomerates that mark the rocks of this age. Further down on Ward's Creek, about one and a quarter miles south of Sussex station, these bituminous shales are again brought to the surface by another undulation. Further west, about two miles below Norton station, the extension of this anticlinal is seen on the post-road, where it crosses the Moosehorn Brook. North of the railroad the bituminous shales have not been met with, but on the road running west from Butternut Ridge to Queensville, on Price's Brook, about five miles west of the Ridge Corner, bituminous limestones similar to those of Hillsboro' and the Albert Mines are seen, and would lead to the inference that the shales extend in a broad sheet across the intervening country, brought up at intervals by the series of gentle undulations which have affected the rocks of the central basin. In addition to the localities already described, as well as those mentioned in the report of 1876-77, in Albert and Westmorland counties, shales of this character are met with on the South Branch of the Kennebecasis, about six miles from Penobsquis station. They are here reported to contain a vein of albertite. Another deposit in Mechanic settlement is very interesting, and occurs on what is known as the Haley farm. Here Lower Carboniferous sediments appear in a depression among the green chloritic slates of the pre-Cambrian series. These slates dip N. 65° W. $<$ 50°, and disclose a narrow trough-like basin ninety paces in width, filled in with greenish-grey conglomerates, the pebbles of the old slates and other metamorphic rocks being cemented together with a fine dark paste, full of particles of albertite, and intersected by very fine seams of the same. An irregular vein of albertite occurs in a fissure among these conglomerates, no shales being visible, but the deposit is very limited, and may be styled a local pocket rather than a regular vein. A crack in the older slates, however, which underlie the bituminous beds, has become filled with albertite, which at first sight almost looks as if it had been injected from below along a line of fault, but it has probably been filled by infiltration; and on Martin's farm, on the north side of the road, the granitoid rocks which there underlie the Lower Carboniferous, disclose the same peculiarity, being impregnated to the depth of an eighth of an inch with bitumen, while the numerous joints which intersect the rock are also filled with particles of albertite. As the bituminous matter has been shown, in former reports, to belong to the Lower Carboniferous strata, we must, of necessity, infer that the albertite or bituminous matter in the granitoid and slaty rocks has been derived from the overlying bituminous shales and conglomerates. Economically speaking, this deposit is of no value.

Albertite in older rocks.

In the report of 1876-77, the distribution of the Albert shales in western Albert was given, and their similarity to the albertite-producing beds of the Albert Mines led to the formation of a company in 1876 for the purpose of proving this area by boring with the diamond drill. A number of holes were put down about Elgin and in Mapleton, but no traces of albertite were found. Although the character of the beds is identical with those of the Albert Mines, both in lithological aspect and in the presence of bitumen, yet the physical features of the two areas are very different. No strongly marked anticlinals occur in the beds in the western part of the county, like that seen at the Albert Mines, nor does the general character of the formation tend to warrant the expenditure of any considerable sum of money in underground exploration. From our examinations of the whole area occupied by these shales, we can only say that we consider the occurrence of albertite at the Albert Mines due almost entirely to peculiar local conditions that, so far as we have seen, do not exist elsewhere to the same extent. The explorations carried on at Beliveau and Taylorville during the past four years tend to confirm this opinion.

Exploration for albertite.

Gypsum and manganese.

Besides the albertite, this formation contains gypsum and manganese. The distribution and mode of occurrence of the former mineral are given in the report of 1876-77. Of manganese, several deposits exist. Of these, that at Markhamville is, so far as known, the most important. It has long been worked with varying success, and mining on it is still in progress. Its position is near the contact of the Lower Carboniferous conglomerates and limestones with the felsites and slates of the pre-Cambrian ridge. At Quaco Head also a small deposit occurs in rocks of the Lower Carboniferous age, preparations for working which are already being made on quite a large scale. On the east side of Salisbury Bay, in Albert county, there is also a small deposit near the contact of the Lower Carboniferous and Triassic sandstones, and at Hillsdale, about five miles south-west of Elgin corner, large pieces of fine ore are picked up, but the vein has not yet been discovered. Bog manganese also occurs at various points, but no deposits of any particular value have been found.

Disturbances during Lower Carboniferous

During the time that the rocks of Lower Carboniferous age were being deposited, violent disturbances occurred. These appear to have been quite local and to have affected principally the rocks in Albert county, where the lower portion of the formation has been extensively folded and faulted, and in places penetrated by dykes of igneous rocks. The upper members, however, occur in nearly horizontal beds. In the central or Kings county basin the rocks of this formation lie in several folds, but do not give evidence of any extensive disturbance. At Quaco, the Lower Carboniferous limestones have been penetrated by dykes of trap of large size, probably of Triassic age, by which the limestones have been thrown into an anticlinal and changed to a highly crystalline rock.

Fossils.

Over many parts of the area covered by the rocks of this formation, fossils peculiar to the time are found. Reference has already been made to the fossil fishes of the genus *Palæoniscus*, which are so plentiful in some portions of the Albert shales. In 1877, among the specimens obtained from this belt, was a new species, which has been described by Principal Dawson under the name of *P. modulus*, and figured in the appendix to the Acadian Geology. Beautiful specimens also occur in some of the nodules from the shales, one of which, in nearly perfect condition, measured 10 inches in length and 3¼ inches in breadth, the breadth at the dorsal fin being about equal to that at the shoulder, and diminishing rapidly to the tail. In this specimen the crystalline lens of the eye is preserved in calcite, and shows its structure. This is especially interesting, as being the first instance known of the preservation of the eye of a palæozoic fish.

Among the limestones also, which constitute a considerable portion of the formation, especially in its upper part, specimens of *Terebratula sufflata* and *T. sacculus*, with other forms, occur. Good localities for these are at Rush Hill, in Wickham, and at Hampstead, on the shore of the St. John River, a short distance below Otnabog Lake. Many of these have been mentioned in the report of 1870-71.

VII. Middle Carboniferous.

In addition to the remarks on this group in the report of 1870-71, a special report was published, having reference principally to the Grand Lake coalfield, in 1872-73. The group was then subdivided into Millstone Grit, Middle Carboniferous and Upper Coal Measures, though on no very good grounds, as no distinct line of demarcation between any of the groups can be drawn, and it now seems highly probable, from investigations made since that report, both from the character of the rocks as compared with those of Cape Breton and Nova Scotia, as well as from the Millstone Grit age of many of the fossils from the Grand Lake and elsewhere, that the great bulk of the sediments composing the central Carboniferous basin of the province, as well as those along the southern shore, are of Millstone Grit age, and that the higher members of the formation, if ever deposited, have been since denuded. The general horizontality of the measures would indicate an almost entirely undisturbed condition of things since the deposition of the beds in the central area, and would lead one to infer that the Carboniferous rocks of central and eastern New Brunswick, although spreading over a great area, are not only very thin but probably constitute simply the western shallow border of the great Carboniferous basin which underlies the waters of the Gulf of St. Lawrence, and which is bounded by the southern shore of the Gaspé peninsula on the north, and by the high ridge of the Cobequid Hills and the coast ranges of western Cape Breton on the south and east, and upon which the Triassic sandstones of the Island of Prince Edward were subsequently deposited. One might, on this hypothesis, reasonably expect to find more favourable conditions for the occurrence of thicker seams of coal along the eastern coast of the province, where these rocks are more closely associated with the productive measures of Nova Scotia, but this area has never been proved, and only very general surface examinations made at one or two points.

Subdivisions.

General aspect.

The area, as contained in the counties of Queens and Sunbury, has been pretty thoroughly explored. Borings with the diamond drill were carried on at a number of points from 1872 to 1876. The localities tested by this means were Newcastle bridge; Newcastle Creek, on the shore of Grand Lake, about one mile below the steamboat land-

Explorations for coal.

ing; Otnabog Bridge; Clones, on the headwaters of the Nerepis River; Three-Tree Creek, and Tracy. The deepest of these borings (600 feet) was made at Three-Tree Creek, while in the Grand Lake area the holes ranged from 170 to 400 feet. In no case did these bore-holes disclose the existence of any lower seam of coal, and it is quite evident that in this area at least this mineral is confined to what is known as the "Surface Seam." The extent of this seam, however, is great. Besides the frequent outcrops along the Newcastle Creek, Salmon River and Salmon Creek, and Coal Creek, which constitute properly the Grand Lake coal area, other exposures, which may be the southern outcrops of the same seam spreading over a larger area, are found. Among these the most westerly is on the North-West Branch of the Oromocto, about one and a half miles above the mouth of the Yoho Stream, where, in the cliff, a seam of four to five inches is disclosed, dipping at a moderate angle to the north-east, and which probably marks its western limit. Further east, a continuation of the same seam is reported on the Mersereau Brook, near its forks with the Oromocto, and again about three miles up in a small branch from the south. It next reappears in Clones, on the head waters of the Nerepis, and has here been proved by the diamond drill, with a thickness of about 10 inches, though reported in one place at 30 inches. East of the St. John River the only outcrop known is near the mouth of Long's Creek, on Starkey's place, where it has a thickness of 10 to 12 inches, but very impure. The Carboniferous beds sweep around the eastern extremity of the pre-Cambrian ridge that extends along the county line of Queens and Kings and fill in a part of the basin or valley of the Kennebecasis; and at one place at least, Dunsinane, between Penobsquis and Anagance, on the Intercolonial, they contain a seam of impure coal of the usual thickness, 18 to 20 inches, and resembling in character many of the outcrops in Queens county. It is probable that all these outcrops belong to the same horizon, and on this supposition this seam, thin as it is, from its spreading over so great an area, would contain an enormous quantity of coal. Assuming the average thickness of the surface seam around the head of Grand Lake at 20 inches, and allowing the available yield of coal for a seam one foot thick to be 1000 tons per acre, we have from the coal basin of Newcastle and Coal Creek, and Salmon River, which may be stated to contain about 100 square miles, a total available yield of coal, due allowance being made for waste, of over 100,000,000 tons for this limited area alone. As this seam is worked, and it is to be supposed profitably, by the present owners of the different mines, at a number of points over the area, it may fairly be presumed that, with economical management and a proper system of working, a large portion of this enormous quantity might be profitably extracted. If we consider also

The 'Surface Seam.'

Quantity of coal.

that this seam has been found at a great number of points, not only around the entire rim of the Carboniferous basin of the province but also at various places in its interior area, leading to the supposition that it covers an area of several thousands of square miles, the quantity of coal underlying the surface, even if no lower seams should be discovered at any point in the Carboniferous basin, is enormous.

The other areas occupied by rocks of this formation are but small. In southern Albert they are seen to occupy the shore as far west as Herring Cove, with some few breaks which are occupied by rocks of Lower Carboniferous age; this area is the westward extension of the lower part of the celebrated Joggins section, and the beds are in many places tilted up on edge and affected by faults often of considerable extent. About Quaco and to the west as far as Gardener's Creek, rocks of Millstone Grit aspect are seen overlying the red beds of the Lower Carboniferous; and at Tynemouth Creek attempts have been made with a diamond drill to find coal, without meeting with any success. In Charlotte county, the only known area is a small rim of the central basin, which extends across the northern line of the county.

Triassic.

Distribution and character.

The Triassic of southern New Brunswick is limited in extent, small areas only occurring in St. John county at Red Head, Quaco and Martin's Head, while in Albert county there is a small patch on the east side of Salisbury Bay. In Charlotte county also, the western part of the island of Grand Manan is occupied principally by traps of this age, with a few exposures of red sandstone. The characters of the rocks at these various localities are described in the report of 1870-71, and the only additional information on this subject since then has been derived from the deposit which occurs at Martin's Head. The deposit at this place was discovered in 1877, and is especially interesting as containing lignite. The rocks are soft dull-red sandstones, succeeded by soft greyish-yellow beds and soft brown shales with thin bands of fine brownish conglomerate, which form a synclinal trough, resting upon Lower Carboniferous sediments. The lignite is found principally in the soft brown shales, and has been examined by Principal Dawson. He says:—"The specimens are of coniferous wood, with one large row of disks in the cells, and of the same type with silicified wood from Quaco, as also of the same type as *Dadoxylon Edvardianum* from Prince Edward Island, and similar to fossil wood from the Mesozoic of Virginia.

Lignite.

The Triassic of Quaco is confined to a small margin along the coast at the Head and in the vicinity of the village. At the Head, the soft red sandstones of this age are seen to abut directly against the conglomerates of the Lower Carboniferous, their contact being indicated by a well-marked fault, which may, in the section through the village, be concealed by drift, or they may lie in shallow unconformable basins of very limited area upon the Lower Carboniferous beds.

Syenite, Diorite, Felsite, &c.

An extended report on these rocks is deferred pending their microscopic examination, but their general distribution and modes of occurrence may be briefly stated. Syenites of different characters and age are found at various points in southern New Brunswick. The largest area is occurs in the county of Charlotte, and has been described in the report (G. S. C.) for 1870-71 under the head of Nerepis Granite. It has been considered as of probably intriusive character, and its age as probably about the close of the Devonian. Scattered or detached bosses also occur at points throughout the western portion of the country. In places, as it approaches the slaty rocks on either side, it is seen to shade off or to merge into a body of felsite or granulite, which, in turn, appears to graduate through petrosiliceous rocks into fossiliferous Silurian or other rocks. Near the contact of the Silurian beds also, the slates have been metamorphosed and crystals of andalusite and staurolite produced.

Syenite.

This belt extends eastward into Queens county. Its prevailing colour is pink or reddish, but at the St. John River, below Hampstead village, where a considerable area of syenite rocks, probably a spur of the large mass to the west, is found, the colour is generally grey, though pink shades also occur. This granite is extensively quarried for building purposes; while in the main area, in the vicinity of St. George, in Charlotte county, extensive quarries are carried on,—a large quantity of the stone being polished. The St. George works have been described in the report of Mr. G. F. Matthew, 1876-77.

Granite.

Throughout the great belt of metamorphic rocks of pre-Cambrian age, syenites, granites and diorites are found. Of the syenites many are evidently of metamorphic origin, the gradual passage from chloritic slates, through schists and felsites, being plainly visible. They are often chloritic or talcose, and have been described in former reports under the head of protogine, but pinkish and grey granites and syenites are also common. These differ from the former in character, and often occur as dykes or veins. In the limestone, or upper portion of the so-called Laurentian, in the vicinity of the Kennebecasis Bay, these syenites are frequently seen cutting the limestones as well as the overlying Cambrian slates. No attempt has, however, been made to separate them on the map from the other pre-Cambrian rocks, as they are in many places so intimately associated as to render their distinct delineation on so small a scale an impossibility.

Diorite.

Diorites are found at various points throughout all the formations from the Laurentian to the Triassic inclusive. They are abundant in the pre-Cambrian, especially in Division 5, the former Kingston, a large portion of which is made up of apparently interbedded felsite and fine-grained diorite. In some places the diorites are very coarsely granular and contain much magnetic iron in grains, as at the Scotch settlement, in northern Kings county, and on the Pollet River, south of Elgin corner, in Albert county, typical diorites some of which are almost black from the abundance of hornblende, are found at Mechanic settlement post office and westward, while throughout the pre-Cambrian belt north of Quaco and elsewhere diorite and dioritic ash-rock, with amygdaloid, are very frequent. It has, however, been thought better not to attempt the separation of all the areas of these intrusive rocks on so small a scale, as their exact limits cannot be determined definitely from the unfavourable nature of the country.

Carboniferous and Triassic intrusions.

In the Lower Carboniferous also, rocks presumably of intrusive character are found not only around the southern edge of the central Carboniferous basin, but at various scattered points of the basin itself. They often obtrude through the generally flat beds of the Carboniferous in dome-shaped hills or ridges of dolerite, while felsitic ashes and hard crystalline felsite also occur; the most prominent area of these latter rocks is seen in the northern portions of Charlotte county, whence they extend across into Sunbury. These intrusions were probably not later than the middle of the Lower Carboniferous period.

In the Triassic also, as at Quaco, intrusions of trap similar to that of the North Mountain range of Nova Scotia are seen breaking through the Lower Carboniferous limestones of the Head. The area is, however, but small. A general description of the dioritic rocks of the Lower Carboniferous is given in the report of 1872-73.

ECONOMIC MINERALS.

A full account of the economic minerals of the southern part of the province was given in the report of 1870-71, in so far as they were known at that time. Since then discoveries of more or less importance have been made, but nothing of any special value has been met with.

Iron.

The only new locality where this mineral has been found is on Deer Island, near Lord's Cove. The ore is a nearly pure magnetite of superior quality, and occurs in a vein from two to three feet thick in slates and conglomerates of pre-Cambrian age. It is exposed crossing a narrow promontory, and is only a few feet above tide level.

Copper.

The principal deposits of copper have been already described in the reports of 1870-71, and nothing has been done of late towards the development of any of the localities therein mentioned.

Manganese.

Deposits of this mineral occur at several places in Albert, Kings and Westmorland. They may thus be described:—

Shepody Mountain.—Deposits near the contact of pre-Cambrian chloritic slates and Lower Carboniferous conglomerates, worked in former years quite extensively, but of late nothing has been done.

East Side of Salisbury Bay.—Deposit near the contact of Triassic sandstone and Lower Carboniferous rocks, worked some years ago by the company owning the Markhamville mine, but shortly abandoned.

Hopewell Corner.—Deposit near the contact of Millstone Grit and Lower Carboniferous; about one mile west of Hopewell corner. Soon exhausted.

Hillsdale.—About five miles south-east from Elgin corner. Deposit yet unexplored but fine surface indications.

Petitcodiac, about two miles north-west from Petitcodiac station. Near the contact of Lower Carboniferous limestone and gypsum, vein only about one inch exposed thickness.

Jordan Mountain.—Near the contact of Lower Carboniferous sediments with the pre-Cambrian of the mountain. Good surface indications. Locality not developed.

Markhamville.—Near the contact of Lower Carboniferous limestones and conglomerates with pre-Cambrian. Location long worked. Most extensive deposit as yet known in the Maritime Provinces.

Quaco Head.—Deposit in Lower Carboniferous rocks. Not yet developed, but preparations are now being made for mining at this locality.

Henry's Lake.—Surface indications reported, but deposit not located.

Argentiferous Galena.

Several localities are mentioned in the report of 1870-71 as affording galena in small quantity. Of these, the only one that has been examined for silver is that on Hammond River, at Wanamake's, which has been found to yield a fair proportion.

A new locality, which was opened in 1878, is on the west side of Musquash Harbor, in Laurentian syenites. Here veins, of eight inches to one foot, of white quartz carry yellow sulphuret of copper and galena. The latter has been assayed by Dr. Harrington, and found to yield a little over $14 to the ton. (See report of 1877-78, p. 529.) The extreme hardness of the country rock and the smallness of the vein are against the profitable working of this location.

Bituminous Coal.

No new developments have been made in this department since the report of 1872-73. The amount annually raised varies but little, and no attempts have yet been made to carry on the mining in any more systematic manner.

Anthracite.

Within the last four years considerable money has been spent in developing the seam of anthracite which occurs in the Devonian rocks of Belas Basin, Lepreau. Four shafts had been sunk up to 1878, the greatest depth then reached being 140 feet, but the character of the coal did not seem to improve sufficiently to warrant the investment of any further capital. A similar deposit occurs at Clinch's post office, Musquash, in rocks of the same age and character, but this is of no value. The large percentage of ash—36 per cent.—is strongly against the reported good quality of the mineral as a combustible, while its irregular distribution and impure character are also strong obstacles to its successful development. A large part of what has been called coal is nothing but carbonaceous shale, and this constitutes the bulk of the seam, the thickness of the harder or anthracite band being only a few inches.

Albertite.

With the exception of the deposit of this mineral at the Albert Mines, no body of albertite has as yet been found in quantity sufficient for working. Since the report of 1876-77 on this deposit, explorations have been carried on at several places. Borings were made at Elgin corner and Mapleton with the diamond drill in the Albert shale, but without finding any trace of the mineral sought. The most extensive operations have, however, been carried on by the Beliveau Mining Company. At Beliveau a shaft has been put down to the depth of 200 feet, and tunnels driven north and south across the measures, without finding anything of importance. Borings were then begun at Taylorville, about one mile to the east, since which we have not visited the scene of operations. Reports, however, do not indicate any great measure of success.

Gypsum.

Gypsum occurs at various points both in Albert, Westmorland and St. John counties; the deposits of Hillsborough have been described in the report of 1876-77, since which new openings have been made at Hopewell Hill, where a splendid deposit of the fibrous variety occurs.

At Fawcett's Brook, about two and a half miles north-west of Petitcodiac station, a large deposit of the fibrous variety is found, which has been locally worked for agricultural purposes for some years. The quality is excellent, and the deposit should be of considerable value.

Granite.

The granites of Charlotte county, at many points, afford abundance of excellent stone for building and polishing, but the quarries near St. George, on the Magaguadavic River, are as yet the only localities which are worked. Full descriptions of these, with the polishing works, are given in the report of 1876-77, page 346.

Infusorial Earth.

Deposits of this substance are found occupying the bottoms of lakes in several places. Among these were specially noted two in eastern Kings county—Pollet River Lake, in Mechanic settlement, and Pleasant Lake, about six miles to the south-west. The deposit in Pollet River Lake is said to be about four feet deep, and the earth is exceedingly fine, of a greyish-white colour when dry, and admirably suited for polishing the finest substances. The lake can be easily drained, or the substance can be removed with a shovel or small dredge.

GEOLOGICAL SURVEY OF CANADA.
ALFRED R. C. SELWYN, F.R.S., F.G.S., DIRECTOR.

CHEMICAL CONTRIBUTIONS

TO THE

GEOLOGY OF CANADA.

FROM THE

LABORATORY OF THE SURVEY.

BY

CHRISTIAN HOFFMANN, F. Inst. Chem.

Chemist and Mineralogist to the Survey.

PUBLISHED BY AUTHORITY OF PARLIAMENT.

Montreal:
DAWSON BROTHERS.

1880

Alfred R. C. Selwyn, Esq., F.R.S., F.G.S.,

Director of the Geological Survey of Canada.

Sir,—I herewith beg to lay before you the results of the work carried out in the Laboratory of this Survey during the past year. It embraces all such analyses as were considered likely to prove of general interest. As will be seen, attention has been mainly directed to the examination of such minerals, etc., etc., as promised to prove of economic value. Such analyses or assays as have been made by my zealous Assistant, Mr. Frank D. Adams, have in all instances been duly credited to him; those not otherwise designated having been made by myself.

I have the honour to be,

Sir,

Your obedient servant,

CHRISTIAN HOFFMANN.

Montreal, May 31st, 1880.

CHEMICAL CONTRIBUTIONS

TO THE

GEOLOGY OF CANADA,

FROM THE

LABORATORY OF THE SURVEY.

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CHRISTIAN HOFFMANN, F. Inst. Chem.

MISCELLANEOUS MINERALS.

CYANITE.

From the North Thompson River, British Columbia.—Collected by Alfred R. C. Selwyn, Esq.

The mineral was imbedded in a granular quartz which, in addition, contained a few scales of a silvery-white mica. It, for the most part, occurred in in the form of radiated columnar aggregates, the colour of which was in parts pure blue, passing into greenish-grey; occasionally, but rarely, almost colourless—the other portions were of a uniform light bluish-grey colour. Lustre vitreous. Subtransparent. Specific gravity, 3.6005.

The material selected for analysis was found, after drying at 100° C., to have the following composition: of Cyanite.

Silica	36.288
Alumina	62.254
Ferric oxide	0.552
Lime	1.064
Magnesia	0.355
	100.513

Previous to the finding of this specimen, cyanite was not known to occur in Canada.

LAZULITE.

Found three-quarters of a mile east of the mouth of the Churchill River,—District of Keewatin. Collected by Dr. R. Bell.

Occurs massive in veins, having a maximum width of seven millimetres, traversing a greyish-white, in parts milk-white, subtranslucent quartz. Colour fine deep azure-blue. Lustre vitreous. Fracture uneven. Brittle. Streak white. Subtranslucent. Hardness very nearly but not quite 5.5. Specific gravity—3.0445. Before the blow-pipe colours the flame pale bluish-green; swells up, whitens and falls to pieces, but does not fuse.

Analysis of lazulite.

The material upon which the analysis was conducted, although selected with great care, and apparently pure, was nevertheless found to contain 3.808 per cent. silica; in calculating the results this has been excluded; the composition of the mineral dried at 100° C., then being as follows:

Phosphoric acid	46.388
Alumina	29.140
Ferrous oxide	2.091
Magnesia	13.838
Lime	2.829
Water	6.468
	100.754

This is the first time that this interesting mineral has been met with in Canada.

GRAPHITE.

In continuation of Report on Canadian Graphite (*Report of Progress* 1876-77, *p.* 489).

1.—DISSEMINATED GRAPHITE.

Graphitic shale.—From Glendale, River Inhabitants, Inverness County Nova Scotia. Collected by Mr. Hugh Fletcher.

Colour bluish-grey. Lustre of fracture across the plane of deposition, dull; that of the fracture coincident with the lamination, submetallic glistening. The graphite is very evenly disseminated through the rock; it occurs in the form of minute scales of a steel-grey colour and metallic lustre.

Analysis of "disseminated graphite" from Nova Scotia.

This shale was found to contain:

Graphite	13.965
Rock matter	85.799
Hygroscopic water	0.236
	100.

The graphite was separated and weighed as such. On igniting the powdered mineral it leaves a light reddish-white coloured residue.

"Disseminated graphite."

2.—DISSEMINATED GRAPHITE.

In their report on the geology of southern New Brunswick (Report of Progress 1870-71, p. 230), Messrs. Bailey and Matthew state that graphite or plumbago, in a finely divided state, is not unfrequently disseminated through the more altered rocks of the southern counties of that province, and at a few points is found in beds available for economic purposes. The largest of these are in connection with the rocks of the Laurentian system, in the vicinity of St. John, appearing at the Narrows of St. John River, Lily Lake, and other points. At the old opening at the Falls, known as the "Split.Rock Plumbago Mine," the facilities for mining and shipment are all that could be desired. The mineral is extracted chiefly from one principal bed, with laterel deposits of minor importanee. The working of the mine would appear to have been very irregular, having been abandoned from time to time; considerable quantities have, however, been taken out since its first opening, notwithstanding which it is stated that there is no diminution of the supply, and that the quality of the mineral is better now than when operations were first commeneed.

A specimen of the disseminated graphite from the aforementioned "Split-Rock Plumbago Mine" was collected for me by Mr. Wallace Broad for examination; it had a loose shaly structure and readily parted into, although somewhat irregular, yet, more or less lenticular fragments. It was greyish-black in colour, had a submetallic lustre, and gave a black streak. This sample contained a rather large amount of pyrites, and although the greater part of this was confined to some few of the more earthy, and what might justly have been regarded as extraneous fragments, there was, nevertheless, a by no means inappreciable amount pretty evenly diffused through the graphitic rock proper. Specimens of this latter which had undergone lengthened exposure, were much weathered, had a greenish-grey colour and exhibited but a very feeble lustre. In preparing the material for analysis, the earthy fragments above alluded to, and which amounted to about six per cent. of the sample, were excluded.

It was found to contain:

Analysis of "disseminated graphite" from New Brunswick

Graphitic carbon	48.775
Rock matter	50.058
Hygroscopic water	1.167
	100.

"Disseminated graphite."

The graphitic carbon was separated and weighed as such; it had a greyish-black colour, was devoid of lustre and apparently amorphous; when pressed in a mould the surface of the resulting form had a bright metallic lustre.

This compressed graphite gave a fairly black and shining streak. The powdered rock leaves on ignition a light brownish-grey coloured residue. Considering the high percentage of graphite contained in this rock, it appeared to me very desirable to ascertain if the dressed graphite prepared from this latter could be used in electrotyping or for the manufacture of black-lead-pencils. It would doubtless be adapted for some of the other purposes for which graphite is employed; it has however, to be borne in mind that, in this instance, the cost of extraction would in all likelihood preclude its advantageous employment for other purposes than those for which a suitable graphite commands a high price. Having extracted a quantity of the graphite and assured myself of its comparative freedom from foreign matter, samples of the same were forwarded to England for the purpose of having it practically tested. The gentlemen to whom it was sent—and who, from their long experience in the employment of graphite, for the purposes above specified, may justly be considered competent authorities—have favoured me with their opinions upon the same, and these may be briefly stated as follows:

Adaptability of the graphite for the manufacture of lead-pencils and for electrotyping.

In the one case—that examination has shown the graphite to be of fair quality and adapted for the manufacture of the commoner kinds of lead pencils; although its "quality and nature" does not equal, as far as suitability for pencil making is concerned, the graphite obtainable in Bohemia and some other places.

In the other—and as regards its employment in electrotyping—the trial did not give a very good result; it was not considered so good as that which they were in the habit of using for this purpose.

The graphite forwarded was under the most favourable conditions, that is to say, it contained only 0.16 per cent. of a light grey-coloured ash, and therefore, as far as purity was concerned, left nothing to be desired. That it should not have proved better adapted for the purposes for which it was specially tried, may be reasonably ascribed to its state of aggregation, and it is, in all probability, this physical character which was intended to be implied by the use of the above quoted words, "quality and nature."

INFUSORIAL EARTH OR EARTHY TRIPOLITE.

The occurrence of this material in southern New Brunswick has been alluded to under the heading of "Economic Minerals," by the Messrs.

Bailey, Matthew and Ells, in their report (present Report of Progress) on the geology of that region. Infusorial earth from New Brunswick

The sample, the results of the examination of which are here given, came from Pollet River Lake, Mechanic Settlement, King's County, New Brunswick, and was collected by Mr. R. W. Ells. It occurs in considerable quantity, the deposit in this lake being, it is stated, about four feet deep, and can be readily obtained, either by dredging or draining the lake. A couple of slides of this material were prepared and placed in the hands of Mr. J. F. Whiteaves for microscopic examination. This gentleman informs me that the deposit would appear to be of fresh-water origin; that it contains siliceous spicules of *Spongilla* in great abundance, also quantities of frustules of diatomaceæ, mostly detached, among which he has recognized the following genera, viz: *Pinnularia*, *Surirella*, *Stauroneis* and *Himantidium*.

In texture it resembled an earthy chalk; very fine grained but harsh to the feel; adheres to the tongue; colour light greyish-white. Heated in the closed tube, assumes a dark-grey colour, due to the separation of carbon,and gives off an abundance of a somewhat ammonical, light brownish-yellow coloured water—the material evidently containing nitrogenous organic matter. After ignition, with free access of air, its colour is reddish-white; if treated with hydrochloric acid previous to ignition, the colour is white or at most has a just perceptible reddish tinge.

When digested, either before or after ignition, with a boiling solution of caustic potash or soda, the silica readily passes into solution, leaving a small amount of insoluble residue, which after ignition has a light reddish-brown colour. The insoluble residue readily subsides from the solution, this latter, if the material has been treated before ignition, has a brownish-yellow colour; if after ignition, and consequently when free from organic matter, the solution is colourless.

This sample had been kept in the dry atmosphere of the laboratory for a lengthened period, and was regarded as perfectly air-dried. At 100° C., the oxygen of the air exercises a modifying influence upon this material, so that, in order to ascertain the correct loss by water at this temperature, it is necessary that the operation should be conducted in an atmosphere of hydrogen or carbonic acid.

Analysis of infusorial earth from New Brunswick

An analysis of the air-dried material gave the following results:

Silica	80.487
Alumina	3.146
Ferric oxide	0.951
Lime	0.342
Magnesia	0.283
Carbonic acid	0.011
Phosphoric acid	?
Potash and soda	?
Water[1]—combined and hygroscopic, and organic matter	13.321
	98.541

1.—Water and organic matter.

a. Loss on drying over sulphuric acid	6.535
b. Loss (in addition to that of *a.*) on drying at 100° C., in a current of pure and dry hydrogen	3.582
c. Loss (in addition to that of *a.* and *b.*) on ignition (and after correction for carbonic acid)	3.204
Total	13.321

The air-dried material left, on treatment with a boiling solution of caustic potash, 7.994 per cent. insoluble residue of a light reddish-brown colour (after ignition).

Economic uses of,

As regards the economic value of this infusorial earth, it may be said to constitute an excellent polishing material; and although no experiments have been made to determine its absorbent power, it may reasonably be expected to prove well adapted for the preparation of dynamite. Again, the extreme facility with which it is dissolved by caustic alkalies (potash or soda), would suggest its advantageous employment for the manufacture of what is commonly known as "water-glass" or "soluble-glass," a preparation which meets with many important applications in the arts, as for instance, as a cement for the manufacture of artificial stone; for the hardening and preserving of building stones; in fixing fresco colours by the process of stereochromy; as an addition to soap in the preparation of the so-called "silicated soaps," etc.

KAOLIN.

Kaolin.

The material here alluded to occurs on a property belonging to Mr. Paul Trottier, situated in Grand Frenier, County of Two Mountains, Quebec.

The locality was visited by Mr. James Richardson in July, 1879, with the object of ascertaining its precise mode of occurrence, the probable extent of the deposit, and also for the purpose of procuring a sample for examination and analysis.

Mr. Richardson informs me that it occurs in a dyke of from one to two feet thick, dipping northward at an angle of about 50°, and cutting through flat massive beds of Potsdam sandstone. That at the time of his visit Mr. Trottier had excavated about twenty feet in depth and the same in length, the produce of which appeared to be about two tons. It was stated that at the depth of twenty feet, the thickness appeared to be increasing, inasmuch, however, as there were several feet of water in the excavation, Mr. Richardson had no opportunity of satisfying himself on this point. The sample received was in the form of compact friable masses, with a greasy feel, and fine earthy texture. Colour light brownish-yellow mottled with white. Adheres to the tongue. Forms with water an exceedingly plastic paste.

After drying at 100° C., its composition was found to be as follows: Analysis of kaolin.

Silica	32.009
Alumina	29.907
Ferric oxide	14.023
Chromic oxide	0.554
Titanic acid	9.558
Lime	0.411
Magnesia	0.247
Potash Soda	Traces
Water (direct estimation)	13 005
	99.714

All the iron has been calculated as ferric oxide, the amount present as ferrous oxide not having been determined.

On carefully washing a large quantity of this clay, there ultimately remained, mixed with a little of the coarse material, a very small quantity of a heavy black granular powder which, upon examination, was found to consist, for the greater part, of chromite; a small quantity of titanic acid was also detected in this powder; it was not, however, satisfactorily determined if this was present in the form of Ilmenite or no.

In order to test its refractory quality, some of the clay was moulded into the form of minature bricks, the edges of which were left as sharp as possible; these having been carefully dried, first by exposure to the atmosphere and then to a temperature of 100° C., were subsequently inserted in a covered crucible, and this latter placed in an air-furnace, the temperature of which was gradually raised until at the expiration of about an hour, an incipinent white heat had been obtained, at which temperature it was maintained for an additional hour. On examining the contents of the crucible after cooling, it was found that the edges of the bricks remained perfectly in tact, showing no indication even of incipient fusion. The bricks which, at the time of their insertion, were light-brownish-yellow, had now assumed, externally a purplish-brown, and internally a blackish-brown colour. They were sonorous and exceedingly hard and tough.

ALUNOGEN.

Collected by Mr. Scott Barlow from an old heap of shale at the "Scotia Mine," Springhill coal-field, Cumberland County, Nova Scotia.

Analysed by Mr. Frank D. Adams.

This specimen was in the form of a crust of from five to five and a half centimetres thick. Colour white, in some places light yellow. Taste inky-astringent. Melts in its water of crystallization and at a higher temperature gives off sulphuric acid. Soluble in water.

Analysis o alunogen.

Its analysis gave the following results:

Sulphuric acid	36.935
Alumina	13.479
Ferric oxide	2.888
Ferrous oxide	.157
Lime	.140
Magnesia	.138
Potash	.087
Soda	.131
Ammonia (small quantity)	Undet.
Water	45.109
Insoluble matter	.235
	99.299

NATURAL WATERS.

WATERS OF THE ASSINIBOINE AND RED RIVERS.

Waters of the Assiniboine and Red Rivers.

Geological character of the areas drained by these rivers.—The following information in connection with this subject has, at my request, been kindly furnished me by Dr. G. M. Dawson.

"The Red River, flowing from south to north, runs probably for its whole length over deposits of late date. These are, either the fine silty materials laid down in the bed of the southward extension of Lake Winnipeg, which previously occupied the valley; or clays and sandy clays due to the glacial period. Long and important streams, however, join the Red River, both from the east and west, and the character of the river water is doubtless due to the nature of the country occupied by the springs and sources of these, rather than to the composition of the bed of the main stream, with which the waters passing rapidly and in large volume cannot come very often or intimately in contact. Probably more than half of the water of this river is derived from the Rat, Roseau and Red Lake Rivers and other streams flowing from the wooded and marshy country to the east, and this it may be supposed does not differ much from that found in the rivers flowing from woodland country in eastern Canada. This country is also covered with drift deposits of glacial and post-glacial age, and the streams seldom or never flow over solid rock. The tributaries from the west, including the Shayenne, the Pembina and numerous smaller rivers, are from a region which may be regarded as almost altogether open prairie, and is subject to a rainfall considerably less in amount than that in the east. These streams flow in part over glacial and post-glacial deposits, but in part also over the underlying Cretaceous rocks, of which the shales and clays of the Fort Pierre group cover the most extensive area. Springs, the waters of which come in contact with the Cretaceous rocks also, doubtless feed the tributaries. The Cretaceous shales contain a considerable proportion of disseminated pyrites, which latter when exposed to atmospheric influences undergoes decomposition, ultimately giving rise, in the presence of the calcium carbonate contained in the rocks, to the formation of gypsum, with which mineral—generally in the crystalline form of selenite—many of the beds are in consequence charged. There are also on this side of the Red River, several springs impregnated with common salt; these resemble those of the Manitoba Lake district, and are probably like them derived from the underlying Devonian rocks. Springs of this character are known on the Salt River, south of the Pembina, and it was previously attempted to utilize these as a source of supply of salt. Similar springs are said also to occur on the Scratching River.

Waters of the Assiniboine and Red Rivers, cont.

The country drained by the Assiniboine resembles in most points that described as giving rise to the other western tributaries of Red River. By some of the eastern branches of the upper part of the Assiniboine, from Riding and Duck Mountains, a certain amount of woodland drainage is derived; but by far the greater part of its tributaries bring to it the drainage of prairie land, with a comparatively small rainfall, and in which the saline matters would therefore be supposed to exist in a more concentrated form. Though a comparatively small portion of the total length of the streams can flow in actual contact with the underlying Cretaceous rocks, there is reason to believe that in the prairie region west of the valley of the Red River, a great part of the drainage of the country passes below the drift deposits along the surface of the undelying rocks, and this being brought very inti-

Waters of the Assiniboine and Red Rivers, cont.

mately in contact with these rocks would be likely to be influenced by their composition."

These samples of the waters were collected by Mr. A. S. Cochrane,—at the instance of Dr. R. Bell—on the 26th of October, 1879; that of the Assiniboine was taken from the centre of the river, about a quarter of a mile above its junction with the Red River; whilst the water of latter was taken from the centre of the stream, about a quarter of a mile above where the former flows into it.

The water of the Assiniboine, after filtration, had a faint yellowish tinge. The suspended matter, which had a brownish-grey colour, left on ignition a light reddish-brown coloured residue, this on examination was found to consist of argillaceous matter.

The water of the Red River, after filtration, had a pale yellowish tinge. The suspended matter was of a light brownish-yellow colour, on ignition it left a residue, which, as in the previous case, consisted of argillaceous matter.

The nature and amount of the organic matter contained in these waters was not ascertained,—the quantity of water at disposal being altogether inadequate for the purpose,—apart from which, it is highly probable, that, during the interval of collection and analysis, the organic matter had, to some extent at least, undergone decomposition, the amount of carbonic acid therefore, although estimated, has not been given.

Analyses of these waters.

The analyses of these waters were conducted by Mr. Frank D. Adams, and the following are the results obtained by him, expressed in grains per Imperial gallon:

	ASSINIBOINE.	RED RIVER.
Potassa	0.499	0.549
Soda	5.324	5.028
Lime	6.783	6.912
Magnesia	4.588	5.142
Alumina and ferric oxide(1)	0.084	0.092
Silica	1.571	2.208
Sulphuric acid	4.906	7.093
Carbonic acid	?	?
Chlorine	1.988	3.390
Organic matter	?	?
Oxygen equivalent to the chlorine	0.448	0.765
Total dissolved solid matter, dried at 100° C.	41.09	44.63

Analyses of waters of the Assiniboine and Red Rivers, cont.

Suspended matter—	ASSINIBOINE.	RED YIVER.
Organic	0.692	0.342
Mineral	4.508	3.509
Total	5.200	3.851
Hardness (2)—		
Temporary	13.90	16.03
Permanent	6.70	7.87
Total	20.60	23.90
Specific gravity	1000.64	1000.52

The foregoing acids and bases are most probably combined in the the water as follows:

(Carbonates calculated as mono-carbonates and all the salts estimated as anhydrous.)

	ASSINIBOINE.	RED RIVER.
Chloride of sodium	3.277	5.589
Sulphate of potassa	0.923	1.015
" of soda	8.216	4.727
" of lime	—	6.739
Carbonate of lime	12.112	7.388
" of magnesia	9.635	10.798

1.—Although here given as ferric oxide, the iron was doubtless present in the water as a ferrous salt.—2. Direct method, Wanklyn and Chapman.

In the case of the Assiniboine water there was an excess of soda, above that required for the sulphuric acid, amounting to 0.114 grain (equals 0.084 sodium)—this might be present as carbonate: it would require 0.129 chlorine or 0.147 sulphuric acid in excess of the amounts found of these respective constituents. It has been calculated as, and added to the, sulphate of soda.

COALS.

BITUMINOUS COAL AND BROWN COAL OR LIGNITE.

Coals.

1.—Bituminous coal.—Sent for examination by Mr. Jas. S. Hickman, of Amherst, Cumberland County, Nova Scotia. Exact locality not known, but said to have been taken from "a bank on Black River, following the outcrop of a seam of coal in the bank about twelve feet from the surface."

This coal presented a slickensided appearance; it was traversed by occasional thin bright layers, the prevailing lustre was, however, dull and somewhat resinous; fracture irregular. In parts it

Coals—analyses of, cont.

contained a good deal of iron pyrites, also occasional thin bright laminæ of graphitic-looking matter.

The weight of the sample received was fifty pounds, the whole of this was reduced to powder and intimately mixed, in order to obtain a fair average sample; a portion of this was taken, and afforded by slow and fast coking the following results:

	Slow coking.	Fast coking.
Hygroscopic water	3.73	3.73
Volatile combustible matter	28.01	34.33
Fixed carbon	54.28	47.96
Ash	13.98	13.98
	100.	100.
Coke	68.26	61.94
Ratio of volatile combustible matter to fixed carbon	1 : 1.94	1 : 1.40

By rapid heating a bright and tolerably firm coke was obtained. Colour of the ash purplish-grey. This coal very closely resembles a sample of coal brought by Mr. Scott Barlow from the "Styles Mine."

2.—Lignite.—The locality of its occurrence is stated to be thirty miles west of Fort McLeod,—near the base of the Rocky Mountains, four miles south of Pincher Creek, Old Man's River; within a quarter of a mile of an Indian farmer's house,—North West Territory.

Colour pure black; structure somewhat lamellar; lustre shining resinous, with occasional dull patches; powder black, the same communicated a deep brownish-red colour to a boiling solution of caustic potash.

Analysis by slow and fast coking gave:

	Slow coking	Fast coking.
Hygroscopic water	6.26	6.26
Volatile combustible matter	29.31	31.96
Fixed carbon	55.70	53.05
Ash	8.73	8.73
	100.	100.

Both slow and fast coking gave a pulverulent coke. The ash had a pale reddish-brown colour and agglutinated slightly at a bright red heat.

3.—Received through Dr. G. M. Dawson from Charles Horetzky, Esq.,—the specimen was labelled "Skeena, Station 37, nine miles above the Forks,"—British Columbia.

Coals—analyses of, cont.

Colour black; lustre for the greater part bright, but contained occasional dull layers, consisting apparently of carbonaceous shale. It was rather brittle. Does not soil the fingers. Takes fire in a lamp flame, burning with a bright somewhat smoky flame and evolving an empyreumatic odor: in the closed tube yields water and tarry matter. Colour of powder black with a faint brownish tinge, the same communicated no colouration to a boiling solution of caustic potash.

By slow and fast coking the following results were obtained:

	Slow coking.	Fast coking.
Hygroscopic water	1.05	1.05
Volatile combustible matter	15.35	19.09
Fixed carbon	42.70	38.96
Ash	40.90	40.90
	100.	100.
Ratio of volatile combustible matter to fixed carbon	1 : 2.78	1 : 2.04

By slow coking the under portion of the powder alone was sintered, the middle and upper portions remaining pulverulent. Fast coking gave a firm coke. Ash pale cream-colour.

4.—Received through Dr. G. M. Dawson from Charles Horetzky, Esq.,—the specimen was labelled "Skeena, Station 65, twenty miles above the Forks,"—British Columbia.

Made up of alternate dull layers of what appeared to be carbonaceous shale and a bright black coal, occasionally these latter exhibited a conchoidal fracture, but the greater number showed a very distinct columnar structure at right angles to the plane of bedding. It does not soil the fingers. In the closed tube yields water but scarcely any tarry matter, evolves however a faint empyreumatic odour. Colour of the powder black, the same communicated no colour to a boiling solution of caustic potash.

Analysis by slow and fast coking gave the following results:

	Slow coking.	Fast coking.
Hygroscopic water	1.52	1.52
Volatile combustible matter	7.63	7.20
Fixed carbon	45.61	46.04
Ash	45.24	45.24
	100.	100.
Ratio of volatile combustible matter to fixed carbon	1 : 5.97	1 : 6.39

Both slow and fast coking gave a pulverulent coke. Colour of the ash almost white.

Coals—analyses of, cont.

5.—This specimen of coal was received through Dr. G. M. Dawson from Mr. Hankin, of Skeena Forks, who stated that the locality of its occurrence was about eighteen miles up the Watsonquah River, British Columbia. The sample was a very small one.

Very compact, homogeneous, hard, brittle. Does not soil the fingers Colour black, but not pure black, having a just perceptible brownish tinge. Lustre dull resinous. Fracture conchoidal. Takes fire in a lamp flame, burning with a bright flame (which, however, soon dies out on removal from the source of heat), emission of smoke and a slight empyreumatic odour. Heated in a covered crucible it produces a very large amount of flame. In the closed tube yields a considerable quantity of tarry product. Its powder did not impart the slightest colouration to a boiling solution of caustic potassa.

An analysis, by fast coking, gave the following results:

Volatile matter	40.52
Fixed carbon	57.51
Ash	1.97
	100.

A determination of the water gave 0.85 per cent., as however, owing to lack of material, no control was made, the amount of this constituent is included in the number indicating volatile matter. Rapid heating gave a firm coke. The ash, which was somewhat bulky, had a light reddish-brown colour and agglutinated slightly at a bright red heat.

This is an excellent coal and closely resembles a coal of the true Coal measures. Its geological position, according to Dr. G. M. Dawson, is Mesozoic, most probably Cretaceous.

IRON ORES.

Nos. 5 and 6 were analysed by Mr. Frank D. Adams.

Iron ores—analyses of,

1.—A magnetic iron ore, from Harriet Harbour, Skincuttle Inlet, Queen Charlotte Islands, British Columbia.

Dr. G. M. Dawson, from whom the specimen was received, informs me that this ore there constitutes a very considerable deposit. There were two samples, here designated as A. and B., both from the same locality: A. may be said to represent a pretty fair average of a large bulk of the ore, B. on the other hand must be regarded as a picked specimen.

Massive, with a structure varying from coarse crystalline to fine crystalline-granular in A.—to fine crystalline-granular, almost compact, in B. The gangue in these specimens consisted almost entirely of quartz and calcite; sample A. containing in addition here and there a little iron-pyrites.

Iron ores—analyses of, cont.

These specimens were found to contain—

A.

Metallic iron	58·06	per cent.
Insoluble matter	8·48	"

B.

Metallic iron	69·88	per cent.
Insoluble matter	1·81	"

2.—A magnetic iron ore, from about ten miles up Oukaosipi or Pickerel River, west of Michipicoten, Ontario.

Received from Dr. R. Bell.

Massive, structure fine-granular. Colour dark steel-grey. Streak black. Lustre metallic, glistening. Fracture uneven. Readily attracted by the magnet. It contained:

Metallic iron	63·81	per cent.
Insoluble matter	10·82	"

3.—A magnetic iron ore, from Iron or Magnetite Island, at the Narrows of Knee Lake, District of Keewatin.

The specimen was received from Dr. R. Bell, who states that the deposit is an extensive one.

Massive, structure very fine-granular, almost compact. Laminated. Colour bluish-grey. Lustre dull. On examination was found to contain:

Metallic iron	45·86	per cent.

This specimen was perfectly free from titanic acid.

4.—A specimen of bog-iron ore, from lot sixteen or seventeen of the ninth range of Thurlow, Hastings County, Ontario,—sent by Mr. J. Stewart for examination, contained:

Metallic iron	48·52	per cent.

No other constituents were determined.

5.—A fine crystalline-granular magnetite, from the fifth lot of the sixth range of the township of Lutterworth, County of Haliburton, Ontario. It contained:

Metallic iron	49·26	per cent.
Insoluble matter	26·55	"

Iron ores—analyses of, cont.

This specimen was examined for titanic acid, and found not to contain any.

6.—From the sixteenth lot of the seventh range of the township of Lutterworth, County of Halliburton, Ontario.

A somewhat fine crystalline-granular magnetite.

The gangue in this specimen consisted mainly of calcite and a yellowish-brown mica. It was found to contain:

Metallic iron	46·50	per cent.
Insoluble matter	20·16	"

No titanic could be detected in this specimen.

COPPER ORES.

Copper ores—analyses of,

1.—From Spar Island, Lake Superior.

This specimen will be found fully described under Gold and Silver Assays, No. 9. It contained:

Copper	38·24	per cent.

2.—From lot A, north side of Echo Lake, District of Algoma.

The specimen was received from G. F. Austin, Esq., and was taken from a vein twenty-six feet wide. It consisted of copper-pyrites in a gangue of white subtranslucent quartz, and was for the greater part coated with a thin film of hydrated peroxide of iron, which latter mineral also filled the small cavities and numerous delicate fissures occurring in the specimen. In this instance the associated quartz amounted to forty-four per cent. of the sample. It was found to contain:

Copper	18·74	per cent.

3.—From Poole's Shaft, Skincuttle Inlet, Queen Charlotte Islands, British Columbia.

Collected by Dr. G. M. Dawson. A very fine granular, almost compact, bluish-black magnetite, carrying a little copper-pyrites; with here and there a slight incrustation of green carbonate of copper and an occasional stain of hydrated peroxide of iron. The sample examined was found to contain 21·82 per cent. of insoluble siliceous matter, and:

Copper	1·89	per cent

This ore was assayed for gold and silver by Mr. Frank D. Adams, but without detecting a trace of either.

MANGANESE ORES.

Manganese ore, analysis of,

1.—From Boularderie Island, Cape Breton, Nova Scotia.

The sample weighed twenty-five pounds, and was in the form of porous, friable lumps, varying in colour from dark brown to brownish and bluish-black, with occasional patches of reddish-brown.

In order to prepare a fair average sample for analysis, the whole was reduced to fine powder and then most thoroughly mixed. After drying at 100° C., it was found to contain :

Peroxide of manganese	11·04 per cent.
Sesquioxide of iron	12·49 "
Insoluble matter	57·76 "

It was also found to contain a very small amount of copper—possibly scarcely amounting to more than a trace,—a small amount of nickel, and also some cobalt, the whole amounting to (according to a rough quantitative analysis) about 0·2 to 0·3 per cent., and of which the cobalt is the chief constituent.

GOLD AND SILVER ASSAYS.

Gold and Silver assays. Province of Nova Scotia.

PROVINCE OF NOVA SCOTIA.

Assays Nos. 1 and 2 were conducted by Mr. Frank D. Adams.

1.—From the so-called copper mine, Coxheath Hills, Cape Breton.

Received through Mr. Hugh Fletcher from Mr. J. E. Burchell.

A fine crystalline mispickel, of a light steel-grey colour. The specimen weighed not quite one and three-quarter ounce. It was found to contain:

Gold	Distinct traces.
Silver	1·252 ounces to the ton of 2,000 lbs.

2.—From * * * (Exact locality not stated.)

Examined for Mr. W. H. Weeks of Dartmouth.

It consisted of a somewhat coarse crystalline galena (in parts coated with carbonate of lead), associated with calcite. It was found to contain :

Lead	61·54 per cent.
Silver	1·458 ounces to the ton of 2,000 lbs.
Gold	Mere traces.

Gold and Silver assays, cont. Province of New Brunswick

PROVINCE OF NEW BRUNSWICK.

Assays Nos. 4 and 5 were conducted by Mr. Frank D. Adams.

3.—From Wanamakei, Hammond River, King's County.

A somewhat coarse crystalline galenite, associated with a small quantity of copper-pyrites, in a gangue of white translucent quartz; the latter, in this instance, amounted to seventy-nine per cent. by weight of the specimen. It was found to contain:

Silver .... 3·099 ounces to the ton of 2,000 lbs.

4.—From Middle Landing Falls, Nepisiguit River.

This specimen, which was collected by Mr. R. W. Ells, consisted of a white translucent quartz, holding a large proportion of pyrite. Weight of specimen not quite one and a half ounce. It contained:

No gold or silver.

5.—From the northern part of York County, on the eastern side of the St. John River.

Received through Mr. Wallace Broad, from Mr. Edward Jack of Fredericton.

Galena, associated with calcite and a little quartz. It was found to contain:

Silver.................. 1·893 ounces to the ton of 2,000 lbs.

Province of Quebec.

PROVINCE OF QUEBEC.

Assays Nos. 7 and 8 were conducted by Mr. Frank D. Adams.

6.—From Gilbert River, County of Beauce.

This specimen was sent for examination by Mr. Louis Gendreau. It consisted of a white subtranslucent quartz, more or less stained with oxide of iron and contained a small quantity of pyrite.

It contained neither gold nor silver.

7.—From the seventy-fifth lot of the first range, N. E. Chaudière, County of Beauce, District of St. Francis.

A white subtranslucent quartz, associated with some greyish-black chloritic matter and containing here and there a few specks of iron pyrites. The sample weighed close upon four and a half pounds; the whole was reduced to fine powder and most thoroughly mixed, in order to ensure a fair average sample for assay. It was found tocontain:

Neither gold nor silver.

8.—From the township of Wakefield, Ottawa County. Gold and Silver assays. Province of Quebec, cont

Received through Mr. H. G. Vennor, from Mr. A. Cates, of Pèche village.

A white—with occasionally a bluish or greyish tinge—translucent quartz, traversed by small veins of a light green-coloured apatite, and in parts coated with hydrated peroxide of iron. Native gold was readily discernable, it occurred sometimes in the quartz, and at other times in the oxide of iron or else at the junction of the two. The sample weighed very little more than an ounce. It was found to contain:

Gold.................	11.725 ounces to the ton of 2,000 lbs.
Silver................	52.323 " " " "

PROVINCE OF ONTARIO. Province of Ontario.

Assay No. 13 *was conducted by Mr. Frank D. Adams.*

9.—From Spar Island, Lake Superior.

The specimen, a single fragment, weighed twelve ounces. It consisted of copper-glance in a gangue of quartz and calcite; the surface was to some extent coated with a thin incrustation of green carbonate of copper, also in parts with a slight deposit, oftentimes scarcely amounting to more than a film, of peach-blossom-red arseniate of cobalt. This specimen contained a little native silver. It contained:

Gold.................	None.
Silver................	41.329 ounces to the ton of 2,000 lbs.

The amount of copper in this specimen was also estimated; the results of the determination will be found given under Copper Ores, No. 1.

10.—From Spar Island, Lake Superior.

The specimen, a single fragment, weighed about nine and a quarter ounces. It consisted of a coarsely crystalline calcite, associated with a little quartz, and contained a small quantity of copper-glance and some native silver. It was found to contain:

Gold...............	None.
Silver..............	136.967 ounces to the ton of 2,000 lbs.

11.—From Spar Island, Lake Superior.

This specimen, a single fragment, weighed about one and a half ounce. It consisted of copper-glance in a gangue of coarsely

Gold and Silver assays. Province of Ontario, cont.

crystalline calcite, the latter preponderating; it contained some native silver. Assay gave:

Gold .... None.
Silver .... 108.733 ounces to the ton of 2,000 lbs.

12.—From Spar Island, Lake Superior.

The specimen, a single fragment, weighed about three and three-quarter ounces. It consisted of coarsely crystalline calcite, associated with quartz and holding a very small quantity of copper-glance and a little native silver. It contained:

Gold.................. None.
Silver................. 6.358 ounces to the ton of 2,000 lbs.

13.—From lot eleven, township of McIntyre, between the Duncan Mine and Current River, Thunder Bay, Lake Superior.

Received through Dr. R. Bell from J. Dewé, Esq.

A coarsely crystalline, white, transparent calcite, with a considerable quantity of blende, a little galena and copper pyrites, some dark greenish-black chloritic matter and some quartz. It contained only:

Silver.................... .... Traces.

District of Keewatin.

DISTRICT OF KEEWATIN.

All the specimens from this district were received from Dr. R. Bell.

Assays Nos. 14 *to* 33 *inclusive were conducted by Mr. Frank D. Adams.*

14—From one of a number of veins found about three miles from the south-west extremity of Long Island, east coast of Hudson's Bay.

White translucent vitreous quartz, with light brownish-pink tourmaline and a dark-green massive chloritic mineral; in parts slightly stained with oxide of iron. Weight of speimcen, five and three-quarter ounces.

It contained neither gold nor silver.

15.—From Lake of the Woods, twenty-five miles south-west of Rat Portage.

Presented to Dr. Bell by Inspecting Chief Factor McTavish.

Massive, fine crystalline iron-pyrites, with a little hydrated oxide of iron. Weight of specimen, eleven and a quarter ounces.

It contained neither gold nor silver.

16.—Found six miles north of Richmond Gulf.

Whitish translucent quartz and pyrite, the latter much weathered; the pyrite constituted over half the bulk of the specimen. The latter weighed nearly one pound.

Gold and Silver assays. District of Keewatin, cont.

It contained neither gold nor silver.

17.—From an island in Black Whale Harbour, locally better known as Teska Harbour. Taken from one of a group of veins.

Bluish-grey indurated limestone holding iron-pyrites. The specimen weighed ten and a quarter ounces.

It contained neither gold nor silver.

18.—From the location of Mr. W. Harris, Falcon Lake, near Lake of the Woods.

A somewhat rusty granular quartzite with a little molybdenite. Weight of specimen nearly nine ounces.

It contained neither gold nor silver.

19.—From Fire-steel Rapid, which is twenty-three miles above the Long Portage on the Mattagami River.

Consisted mainly of a fine crystalline pyrite and quartz; much stained on the surface by oxide of iron. Weight of specimen not quite one and a quarter pound.

It contained neither gold nor silver.

20.—Taken from a vein found at God's Lake.

Subtranslucent quartz tinged with oxide of iron and holding a little pyrite. Weight of specimen, thirteen and a half ounces.

It contained neither gold nor silver.

21.—Also from a vein found at God's Lake.

Greenish and light brownish quartz with a few specks of copper-pyrites. Weight of specimen, not quite six ounces.

It contained neither gold nor silver.

22.—Taken from a vein found at Island Lake.

Subtranslucent greyish quartz, with a greyish-green chloritic mineral. Weight of specimen, four ounces.

It contained neither gold nor silver.

23.—Churchill, one mile west of New Fort. Taken from a vein about two feet wide.

A whitish and light grey subtranslucent quartz. Weight of specimen, not quite five ounces.

It contained neither gold nor silver.

Gold and Silver assays. District of Keewatin, cont.

24.—Churchill, half a mile north of the New Fort. From a vein varying in thickness from one to three feet.

Faint greyish-white subtranslucent quartz, with some light green chloritic mineral and a little specular iron. Weight of specimen, seventeen ounces.

It contained neither gold nor silver.

25.—From a vein three and a half miles east of the mouth of the Churchill River. The vein is about three feet wide and can be traced for several hundred yards east and west.

Reddish and light brownish-grey subtranslucent quartz, with a very small quantity of pyrite and specular iron. Weight of specimen, not quite eight ounces.

It contained neither gold nor silver.

26.—From a vein about five miles due east of the mouth of the Churchill River. The vein was stated to be large and somewhat irregular.

A subtranslucent greyish quartz with a little specular iron. Weight of specimen, not quite six ounces.

It contained neither silver nor gold.

27.—From, what was stated to be, a good-sized vein on Eagle Nest Point, about six miles east of the mouth of the Churchill River.

A light grey vitreous quartz. Weight of specimen, rather more than three and a half ounces.

It contained neither gold nor silver.

28.—From the same locality as the last; stated to have been taken from a good-sized vein.

Subtranslucent greyish quartz, in parts impregnated with finely divided specular iron. Weight of specimen, not quite seven ounces.

It contained neither gold nor silver.

29.—From a vein on Battery Point, between one and two miles east of the mouth of the Churchill River.

A greyish and whitish subtranslucent quartz. Weight of specimen, rather more than eight and a half ounces.

It contained neither gold nor silver.

30.—Specimen taken from another vein, same locality as the last.

A greyish opaque quartzite with a little specular iron. Weight of specimen, rather over nine ounces.

It contained neither gold nor silver.

31.—From Inari, not far from Marble Island, west coast of Hudson's Bay. Reported by the Esquimaux to occur in large quantity.

Gold and Silver assays. District of Keewatin, cont.

Fine crystalline iron pyrites in a gangue of light bluish-grey magnesian limestone. Weight of specimen, close on eleven ounces.

It contained neither gold nor silver.

This specimen was also examined for copper, nickel and cobalt; it did not contain a trace of either.

32.—From the northern point of a large island in Lake of the Woods, about twelve miles south-east of Rat Portage. Received through Dr. R. Bell from J. Dewé, Esq.

Quartz, penetrated by delicate needles of hornblende, with some greenish chloritic matter and a little calcite. It contained distinctly visible native gold. Weight of specimen, one and a quarter ounce. It was found to contain:

Gold......................	37.318 ounces to the ton of 2,000 lbs.
Silver......................	1.431 " " " "

33.—From Lake of the Woods; vicinity of Rat Portage. Received through Dr. R. Bell from J. Dewé, Esq.

A somewhat granular, whitish quartzite, rusty on weathered surfaces, carrying a very small quantity of molybdenite, and a little greenish chloritic matter. Assay showed it to contain:

Gold......................	Traces.
Silver......................	0.597 ounces to the ton of 2,000 lbs.

PROVINCE OF BRITISH COLUMBIA.

Province of British Columbia.

Assays Nos. 37, 38 *and* 39 *were conducted by Mr. Frank D. Adams.*

34.—Sent for examination by W. Pollard, Esq., the Secretary of the "Enterprise" Gold and Silver Mining Company, Victoria, British Columbia.

A white subtranslucent quartz coated with hydrated peroxide of iron; some of the fragments were very much honeycombed, others contained numerous angular cavities; these latter, in either case, most probably at one time contained iron-pyrites, and which had been removed by weathering; about one-sixth, by weight of the sample of ore, consisted of pulverulent hydrated peroxide of iron; it further contained a little iron-pyrites and galena, and a few fragments of a dark bluish-grey slaty matter. It was found to contain:

Gold......................	20·096 ounces to the ton of 2,000 lbs.
Silver......................	4·929 " " " "

Gold and Silver assays. Province of British Columbia, cont.

35.—From the Douglas Portage, British Columbia.

The sample was taken from a vein occurring at an elevation of about two thousand feet above the sea level, and about nine miles in a north-easterly direction from the hot springs. The vein, which has a width of five and a half feet, is nearly vertical, runs due north, and is distinctly traceable on the surface for over one mile.

A milky-white quartz, associated with a greyish-green chloritic mineral.

It contained neither gold nor silver.

36.—From the Douglas Portage, British Columbia.

From a vein about five hundred feet to the westward of the one from which the preceding sample was taken. It occurs at an altitude of about seventeen hundred feet above the sea level, has a width of two and a half feet at the surface, and runs due north, with a dip of about thirty degrees to the east. The specimen consisted of a white, subtranslucent quartz, in parts stained with oxide of iron and containing a small quantity of a greyish-green chloritic mineral.

It contained neither gold nor silver.

37.—This specimen, collected by Dr. G. M. Dawson, was taken from the Champion Ledge, near Fort Creek, Omineca.

A white, subtranslucent quartz, with galena, a little pyrite, and a trifling amount of hydrated peroxide of iron—the quartz constituting rather more than half the bulk of the specimen; the latter weighed ten and a half ounces. It was found to contain:

Gold	Trace.
Silver	19·723 ounces to the ton of 2,000 lbs.

38.—From Gnarled Islands, near Dundas Island, northern part of British Columbian coast.

Collected by Dr. G. M. Dawson.

A light greyish quartz, associated with a light brownish calcite and some dark green chloritic matter, with a little copper-pyrites and green carbonate of copper. Weight of specimen one pound one ounce. It contained:

Silver	Trace.

39.—From the Arctic Circle Claim, Boulder Creek, Omineca.

Collected by Dr. G. M. Dawson.

Galena, associated with a slightly rust-stained, subtranslucent quartz; the former contained numerous cavities, holding hydrated peroxide of iron. A portion of the galena, carefully freed from the associated quartz and oxide of iron, was found to contain:

Gold and Silver assays. Province of British Columbia, cont.

Gold	None.
Silver	128·078 ounces to the ton of 2,000 lbs.

It was considered desirable to ascertain if the associated hydrated peroxide of iron carried any gold. For this purpose, such portions of the galena as were most thickly coated with this oxide were selected; this material was found to contain, in addition to the silver pertaining to the galena, in the sample thus prepared:

Gold	Distinct traces.

And which had evidently accompanied the peroxide of iron; the above assay of the pure galena having conclusively proven the same to be entirely free from gold.

MISCELLANEOUS EXAMINATIONS.

Miscellaneous examinations.

1.—Mineral specimen sent by Mr. Gisborne, in order that it might be examined for copper. The locality of its occurrence was stated to be the Big Slide, Fraser River, British Columbia.

It consisted of a mixture, almost in equal proportions, of pyrite and pyrrhotite. It was examined by Mr. Frank D. Adams for copper, nickel and cobalt, and found to contain:

Copper	0.097 per cent.
Cobalt (with a little nickel)	0.060 "

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GEOLOGICAL SURVEY OF CANADA.

ALFRED R. C. SELWYN, F.R.S., F.G.S., Director.

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