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ARCHAEOLOGICAL EXCAVATIONS IN NEW CALEDONIA

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INTRODUCTION

The authors, granted leave in 1952 from duties at the University of California, Berkeley, by the Regents and President Robert Gordon Sproul, went to New Caledonia to excavate in aboriginal sites. The expedition, sponsored by the Universities of California and Arizona and approved by the Pacific Science Board of the National Research Council, was financed largely with funds from the Wenner-Gren Foundation for Anthropological Research, New York City. The work in New Caledonia had the approval of His Excellency, Governor Raoul Angamarre, the Institut Français d'Océanie, and the Société d'Études Mélanésiennes, and followed the pattern of comparable work done by the senior author in Viti Levu, Fiji, in 1947 (Gifford, 1951).

The four members of the expedition were the authors and their wives, Mrs. Delila S. Gifford and Mrs. Mary E. Shutler, who assisted in the enterprise. At all excavations we employed native laborers for the digging and screening. The crews employed at sites 19 and 20 were Loyalty Islanders from Lifou. At all other sites the services of local New Caledonian aborigines were utilized. The expedition arrived in New Caledonia on February 3, 1952, and departed on August 29.

We lacked time and opportunity to investigate tumuli, agricultural terraces, stone alignments, and petroglyphs, which have engrossed the attention of earlier investigators. Our efforts were devoted first to reconnaissance, during which fifty-three sites were examined, then to excavation in eleven of the most promising of these. The approximate locations of the fifty-three sites visited are shown on map 1; underscored numbers indicate the eleven sites excavated. All the sites were too large to be excavated completely in the brief time at our disposal.

The areas investigated on the west coast lie between the Rivière des Pirogues in the south and Pagoumène in the north; on the east coast, between the village of Touaourou in the south and Hienghène in the north. Of the eleven sites excavated, six are on the west side of the island, five on the east. Except west coast site 26 and east coast site 51, none was occupied when we worked there. The two inland sites, 44 and 51, lay but little above sea level, as indicated by the presence of mangrove trees and by the fact that the level of the adjacent streams was affected by the flooding and ebbing of the tide.

Our aim was to fill in gaps in the knowledge of New Caledonian archaeology. However, we were unable to work in the extreme north and south ends of the large island—La Grand Terre, as the French residents call it in contrast to the small Ile des Pins and the Loyalty Islands. We had hoped to excavate in Ile des Pins, where Mr. M. H. Lenormand (Lenormand, 1948) found elaborately decorated pottery, but we lacked the time.

Archaeological deposits investigated comprised coastal kitchen middens, inland middens, and cave sites. Favorite habitation sites were on the coast or at the bases of the mountains. Out of respect for the feelings of the aborigines, we did not investigate the ossuaries situated in rocky hillsides. Had we been able to do so, we feel sure that the inventory of types of artifacts would have been materially increased.

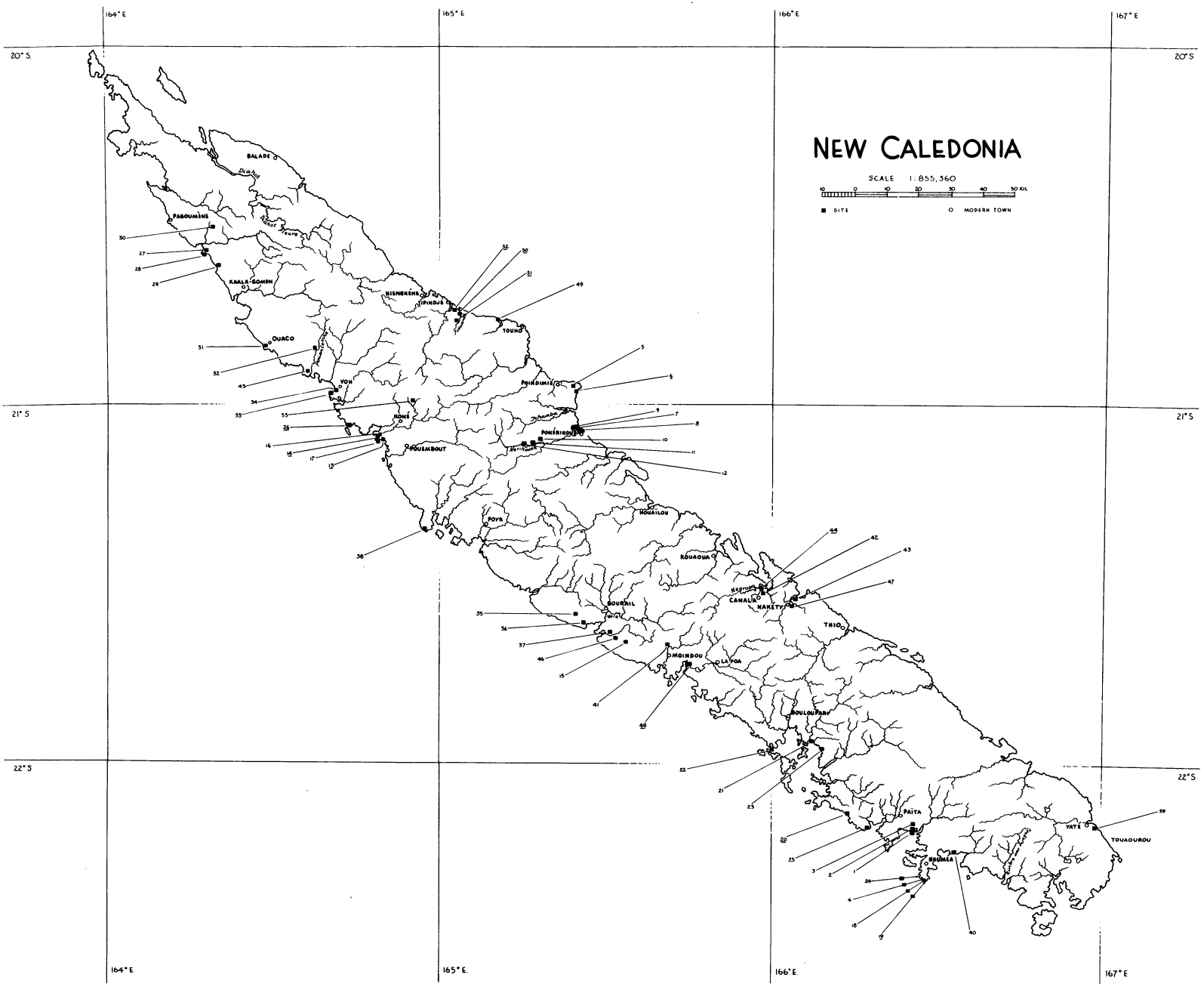
The coastal kitchen middens preponderate among the fifty-three sites visited, as will become apparent from the descriptions. These formed part of the coastal plain and usually looked level, but could be recognized by the shells and potsherds visible on the surface. As a rule there was potable water in the vicinity. Proximity to the sea with its rich stores of food for man was evidently a major advantage. However, this was only half the story, for farm land was also available at or near all sites visited except site 48. Location A of site 13 had last been used as a yam garden, as indicated by the parallel ridges running across it.

In no site did black midden material extend to the bottom of a deposit. Usually, below twelve or eighteen inches the color of the deposit was brown. In middens near the shore on the coastal plain the black and brown midden material usually rested on a substratum of beach debris, in which, however, potsherds were also found. This points to the conclusion that the original settlement at such sites was on the beach debris (sand, shell, coral fragments, etc.) and was at first perhaps only temporary and intermittent, followed later by more permanent residence.

On the surface and in the upper layers of all excavated sites fragments were found of objects of European manufacture, comprising metal, clay tobacco pipes, glass, chinaware, bricks, concrete. Also glass beads and sawed animal bones were encountered. These objects were chiefly on the surface or, where they had been ploughed or spaded under, a few inches deep. These had been left by French settlers and by natives using European articles. In New Caledonia, unlike Fiji, no pottery is made by the aborigines today although it was manufactured by certain villages until early in the twentieth century (Leenhardt, 1930, p. 33).

Potsherds were by far the most numerous of all artifacts recovered from the excavations. Shell artifacts were next in abundance. Ground and polished stone implements and chipped stone implements were scarce. Only one bone artifact was found. Human burials were rare in the sites excavated. The custom of exposing the dead on stone platforms or in banyan trees and subsequently placing the bones in crannies probably accounts for the paucity of burials in middens.

In order to have comparable data from all sites, uniform methods were used for all the excavations. Thus the following account of the field methods employed applies to all eleven sites systematically excavated. The



Archaeological Sites in New Caledonia. Underlined numbers indicate sites excavated in 1952.

grid areas were staked out in rectangles 6 by 3 ft. In excavating, the deposits were removed in 6-in. layers. From one or more pit walls at each site, earth samples were taken at 6-in. intervals for the analysis of the components at the various levels, beginning at 3 in. below the surface. Pits were usually dug a little below the depth which yielded potsherds or other archaeological specimens in order to be reasonably certain that the bottom of the cultural deposit had been reached. All the excavated deposit was sifted through a screen of 1/2-in.-square mesh, and also, whenever advisable, through a screen of 1/4-in.-square mesh, in order to insure that no cultural material was overlooked. A still smaller mesh, 1/16-in., was used at first but proved impractical. In the course of excavation at the eleven sites, 849 6-in. levels were dug and screened, comprising a total of 7,641 cu. ft. of deposit.

In the diagrams 1 to 23 the numbers entered for the rectangles indicate the depth in inches to which these rectangles were dug. Rectangles without numbers were not excavated.

All compass readings given in the text and diagrams are based on magnetic north.

For comparatively level excavated sites no gradient is given. For excavated sites with a noticeable difference in elevation the gradient is given in the site description. The gradient refers only to the grid area excavated.

In order not to interrupt the text the detailed analytical tables are placed at the end of sections: tables 1-12, giving the composition of sites, on pp. 21-27; tables 13-31, distribution of natural history specimens, on pp. 33-62; tables 32-41, occurrence of artifacts, pp. 77-83. Tables 43-45, presenting data on the types and traits shared by various sites, and table 46, radiocarbon dates, will be found in text.

In most of the tables depth in inches is expressed by a single figure which represents the lowest depth of a 6-in. block, thus: 6 in. means the 0-6-in. block, that is, surface to 6 in.; 42 means 36-42 in.; and so on. The tables giving composition of sites are exceptions; in these, the single figure for depth is the depth at which the sample of midden material was taken.

For the convenience of the reader the accompanying tabulation gives the lowest depth to which each site was excavated and the total cubic feet of deposit screened in each.

Site	Depth	Cu. ft. screened
19	24 in.	612
20	60 in.	927
48	48 in.	99
13	48 in.	495
14	78 in.	414
26	48 in.	1,053
44	42 in.	837
6	96 in.	1,791
50	90 in.	882
52	42 in.	153
51	42 in.	378

In the text the catalogue numbers preceded by 12- refer to the University of California Museum of Anthropology catalogue 12 (human skeletal material); all other numbers, unless otherwise specified, refer to catalogue 11 (Oceania).

ACKNOWLEDGMENTS

The Institut Français d'Océanie generously supplied living accommodations and laboratory space through the good offices of its consecutive directors, Dr. Francis Bugnicourt and Dr. Michel Legand, who also aided the expedition in other ways. Sir Brian Freeston, Secretary-General of the South Pacific Commission, made it possible for the members of the expedition, which included Mrs. Gifford and Mrs. Shutler, to enjoy the dining-room facilities of the Commission on occasions when they were in Nouméa. Dr. Jean Guiart, ethnologist of the Institute, rendered valuable aid based on his profound knowledge of the native tribes of New Caledonia. He conducted us on our first extensive reconnaissance trip. Mr. Luc F. Chevalier, curator of the Musée Néo-Calédonien, generously gave of his time to accompany the authors on several occasions and took part in certain of the excavations. Dr. Marc Tivollier, president of the Société d'Études Mélanésiennes, took us to sites on the southeast coast of the island and assisted us in other ways.

In the United States we had the benefit of advice from three seasoned visitors to New Caledonia, Dr. Harold J. Coolidge, Professor Felix M. Keesing, and Dr. Edwin H. Bryan, who supplied us with a large map of New Caledonia in eight sections.

To various New Caledonians, both French and aboriginal (see Gifford and Shutler, 1953), we owe thanks for aid, hospitality, gifts of specimens, and, above all, permission to excavate sites on their properties. Excavations were made in eleven sites, of which six were on the west coast and five on the east coast.

Site 19: At Anse Vata, a suburb of Nouméa. Owner, Dr. Raymond Magnin.

Site 20: At Anse Longue, .38 mi. by road from Nouméa. Owners, Messrs. Joseph and André Cheval.

Site 48: On Banu Island, near Teremba. Owner, Mr. Joseph Banuélos, who generously transported us there in his gasoline launch.

Sites 13 and 14: On Foué Peninsula, near Koné. Owner, Mr. Alfred Girard.

Site 26: Aboriginal village of Oundjo, between Koné and Voh. Excavations were approved by Chief Bome, who supplied us with a crew of villagers.

Site 44: On coffee plantation of Mr. Benjamin Nicholls and his son-in-law, Mr. Ernest Eugene Féré. One km. from Canala.

Site 6: Near Cap Baye. Owners, Mr. Alfred Volcy and Mrs. Antoinette Kabai.

Sites 50 and 52: At Tiouandé. Owner, Mr. André Ragot.

Site 51: Aboriginal village of Tiouandé. Excavations were approved by chiefs Bwaé and Galé.

Others to whom we are indebted are the following. Mrs. Andrée Mouledous of the staff of the Institut Français d'Océanie, made long-distance telephone contacts for us, forwarded our mail, and was always solicitous of our welfare. We are also indebted to Mr. Piriou and Mr. Tonazi in the same office. Miss Yvonne Crenn, geophysicist of the Institute, kindly supplied us with stakes for laying out grids for excavating. Mr. Pierre Deligny, postmaster at Poindimié, arranged for our living quarters at Tiouandé, where Mr. André Ragot and his mother hospitably took us into their home for three weeks, there being no hotel in the region.

Mr. Arthur Hudson, of Amity Point, Brisbane, Queensland, the contractor who was constructing the New Zealand

cemetery for war dead near Bourail, arranged with his New Caledonian colleague, Mr. René Tavernier, to take us to a quarry which had served as an ossuary in aboriginal times.

Colonel H. P. Dix, manager of the meat-packing plant at Ouaco, kindly supplied us with a four-wheel-drive truck and a driver, Mr. Gustave Martin, to explore the western coastal plain between Ouaco and Voh.

We are indebted to the following scholars for identification of natural history specimens. Unless otherwise indicated, the specialists listed are on the staff of the University of California at Berkeley.

Seth B. Benson, Zoölogy; mammals.

Annetta M. Carter, Herbarium; candlenut specimens.

Robert A. Cockrell, Forestry; wood specimens.

Robert L. Crocker, Soils; lime-cemented midden material.

J. Wyatt Durham, Paleontology; corals, echinoderms, lime-cemented midden material.

William K. Emerson, Paleontology; marine mollusks.

Henry W. Fowler, The Academy of Natural Sciences of Philadelphia; fishes.

Emanuel Fritz, Forestry; wood specimens.

G. Dallas Hanna, California Academy of Sciences; land mollusks.

Leo G. Hertlein, California Academy of Sciences; marine mollusks.

David H. Johnson, United States National Museum; rodents and bats.

Robert M. Kleinpell, Paleontology; foraminifera.

J. M. Remy, Muséum National d'Histoire Naturelle, Paris; decapods.

Donald E. Savage, Paleontology; mammals.

Joseph R. Slevin, California Academy of Sciences; reptiles.

Malcolm Smith, British Museum (Natural History); snake vertebra.

Francis J. Turner, Geology; lime-cemented midden material.

John W. Wells, Cornell University; corals.

Alexander Wetmore, United States National Museum; birds.

Howel Williams, Geology; pumice and other lithic materials.

In Berkeley, research assistants aided in classifying and cataloguing the collection: Robert J. Squier, James T. Davis, Mrs. Sheilagh Thompson Brooks, and Miss Chérie Grégoire. The catalogue records also benefited by the scrupulous care and accuracy of Miss Rachel K. Eckman, senior typist-clerk of the Museum of Anthropology. Likewise, this paper has benefited by the ministrations of the editor, Mrs. Mary Anne Whipple.

Various French articles were translated by Mrs. Mary E. Shutler, Miss Gabrielle G. Chanquet, and Mr. F. J. Grover. The excellent photographs of specimens are the work of Mr. Victor G. Duran, of the University Photographic Department.

EXCAVATIONS ON THE WEST COAST

All six of the west coast sites excavated were on the shore of the Coral Sea. The southernmost (site 19) was in the environs of Nouméa; the northernmost (site 26), the inhabited aboriginal village of Oundjo, was about two hundred miles by highway to the north of Nouméa. Four of the sites were sandy kitchen middens, one (site 48) was a small islet with the midden lying on an outcrop of bedrock, and the northernmost (site 26) covered a low rocky promontory between the modern towns of Voh and Koné.

The sandy kitchen middens on both west and east coasts have been, no doubt, the most vulnerable to disturbance by wave action during hurricanes. The occurrence of such features as hearths indicates that these at least were not disturbed. In the descriptions of all sites excavated on both the west and east coasts attention is called to such undisturbed features.

SITE 19: ANSE VATA

Site 19 is on the narrow coastal plain below the coast road which runs from Anse Vata east around the hill to the eastern side of Nouméa. It is on the property of Dr. Raymond Magnin, half a mile from the creek where site 4 is situated. The surface shows black earth, potsherds, and shell. The site is only a few feet above the sea, on level, sandy terrain, and is itself nearly level, but a little lower at the inshore end (A1-B1 of diag. 1) than at the sea edge.

This site extends to the east into adjoining property; to the west it may perhaps be regarded as continuous with site 18. There is close to a half-mile stretch of coast which shows shallow midden. At high tide the sea practically touches the southern edge of the midden, indicating erosion of a formerly greater area; indeed, Dr. Magnin told us the midden had been eroded away by the sea. Excavations were begun on February 26 with a crew of six Lifou Islanders, and continued, with interruptions, until March 10.

The part of the site selected for excavation lies in a combination barnyard and orchard, where there were chickens and turkeys, as well as a sheep, along with coconut trees, manioc, sweet potato, castor bean, and papaya plants. This fenced area measures approximately 180 by 135 ft.

About the center of this area a strip nearly 10 ft. wide was cleared of vegetation, and stake line A1-44 was laid out on a north-south line. Stake A44 was about 12 ft. from the sea at the south end of the grid.

The depth of the cultural deposit ranged from 12 to 24 in. (see diag. 1). About every third pit was dug to sterile beach deposit except near the center of the grid, where a coconut tree and a water pipe prevented it (pl. 1, a). After this was done, the rest of the rectangles were dug 0-6 in. to obtain the cultural content. All deposit from pits dug to sterile soil was screened through 1/2-in. and 1/4-in. meshes. Pits dug only 0-6 in. were screened through the 1/2-in. mesh only.

A fire lens of burned stone, 18 by 8 in., was encountered in rectangle A22-23 B22-23, resting on the 24-in. level. There was no charcoal or bone. An earth oven, full of heat-fractured stones, was encountered 10 in. north-east of a burial, described below. There was no evidence, however, that the human remains found had formed part of a cannibal feast.

The burial (catalogued as 12-8588) lay sixteen paces west of stake B44, just outside the fence enclosing the barnyard, on the sea side. The femora were found exposed in the beach cut. The burial was flexed, oriented south, with the skull missing. Vertebrae, pelvis, some ribs, leg and foot bones lay undisturbed. The vertebrae and pelvis lay under the femora, indicating that the burial had been placed on its back. The rest of the bones found were scattered in soil under the burial. The skull may have eroded out or may not have been placed with the burial. The burial lay at the junction of the beach debris and the cultural layer.

Sixty-eight 6-in. blocks were dug at site 19, comprising 612 cu. ft. of deposit. Twenty-one midden samples for analysis were taken from six pit walls, the three deepest samples coming from 21 in., the other eighteen from 3, 9, and 15 in. Table 2 presents the percentages of materials segregated from the levels in the six pit walls.

Datum for site 19: Banyan tree, 223 ft. from stake A1 and 20° north of west from it. The tree is just west of the gateway to Dr. Raymond Magnin's residence.

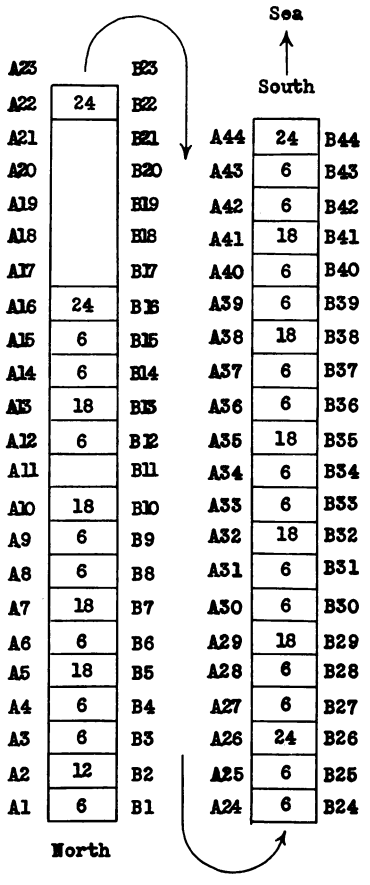


Diagram 1. Excavations at site 19.

SITE 20: ANSE LONGUE

We first visited this site and three others (sites 21, 22, 23), on the west coast between Paita and Bouloupari, on February 15.

Site 20 is an extensive kitchen midden with abundant sherds and shells showing in the stream cuts. It is reached by a dirt road from Nassandou junction, just northwest of St. Vincent, and is on the shore 8.5 mi. from the paved highway, on the cattle ranch of Mr. Joseph Cheval. The site is intersected by at least three small streams flowing from a range of hills to the northeast and is probably several acres in extent, the grassy cover preventing a more exact estimate. It fronts directly on the sea at Anse Longue. Midden to a depth of two to three feet in places could be seen in stream banks. Mr. Cheval's house is on the highest part of the site, which is nearly level. The fact that the midden is lapped by the waves at high tide probably indicates erosion of a formerly larger area.

The part of the site selected for excavation lies between the main ranch house and the sea shore, between a lane of coconut trees on the west and an orchard of custard-apple trees on the east. Excavations were begun on March 14, and continued, with interruptions, until March 31. A crew of six Lifou Islanders was employed.

A strip of ground approximately 7 ft. wide was cleared of grass and weeds, and stake line A1-25 was laid out on a southwest-northeast line at right angles to the sea shore. Stake line A1-B1 was 27 ft. 9 in. from the shore edge of the deposit.

Beginning with rectangle A1-2 B1-2, the pits were dug to sterile light-colored beach sand or to cemented beach debris. The site slopes up gently from the shore, stake A1 being 24 in. lower than stake 19, at the highest point of the grid. Contour measurements were taken every 6 ft. between stake A1 and stake A25. A lateral extension was dug from wall B21-25, as shown in diagram 2.

The datum for site 20 is the block of concrete forming a corner of the house, the southeast wall of which is in line with stakes B25-1. This concrete block lies 7 ft. 8 in. northeast of stake B25.

One hundred and three 6-in. blocks were dug at site 20, comprising 927 cu. ft. of deposit. Artifacts were found in the sand down to the greatest depth dug, 60 in. in rectangle A20-23 B20-23. Molluscan shell content was much higher than at the four comparable depths in site 19. The occurrence of potsherds also was greater than in site 19.

The top of a fire lens comprising blackened earth, burned shell, potsherds, and stones, but no charcoal, was encountered at a depth of 27 in. in rectangle A19-20 B19-20. It was basin-shaped, 28 by 12 in., and 6 in. thick.

In rectangle A14-15 B14-15, 24 to 30 in. deep, a lens of gray consolidated ash containing 28 Placostylus shells was found, 3 in. above a pure sand stratum. Evidently the snails had been collected inland and brought to the site for cooking. The shells were encrusted with a limey deposit.

Evidence that a part of our excavation may have been in a modern garbage pit or other disturbed soil is indicated in table 17 by the occurrence of bones of the introduced deer at levels down to 54 in.

SITE 48: BANU ISLAND

Site 48, a shell midden about a mile across the bay from Teremba, on the property of Mr. Joseph Banuélos of La Foa, is a small mosquito-ridden islet one half-acre in extent, overgrown with acacialike shrubs, in the midst of a mangrove swamp. Mr. Banuélos kindly took E. W. Gifford and Luc F. Chevalier there in his launch on May 29. Mr. Chevalier said that the islet is 800 m. north of the mouth of the La Foa River. It has been named Banu Island by Mr. Banuélos' French fellow-citizens, who also abbreviate his name in the same fashion.

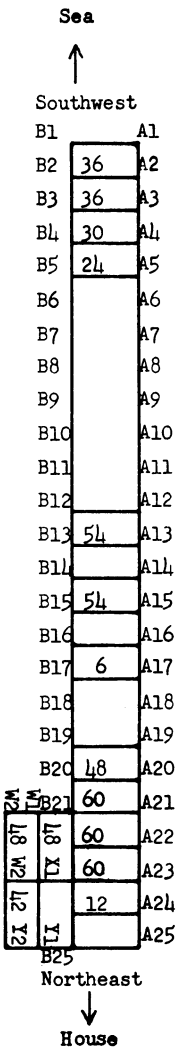


Diagram 2. Excavations at site 20.

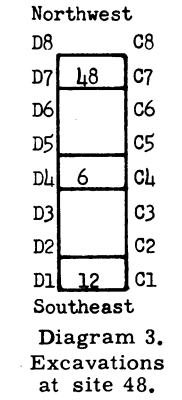


Diagram 3. Excavations at site 48.

The island is wholly shell midden, comprising vast numbers of oyster and Arca shells, with scattered sherds laid down on a rock outcrop. The outcrop is visible only at the shore, being buried under midden elsewhere. A few feet back from the shore we probed the midden deposit with an iron bar and found the bedrock at 2 ft.

A surface collection of sherds was made on May 29 and again on July 22, when Gifford, Shutler, and Chevalier made a one-day excavation (see grid diagram). The highest part of the tiny island was selected for the trench digging. The upper foot or so was extremely ashy and dusty, but full of shell. The excavations were carried down to 48 in. in rectangle C7-8 D7-8, when the approach of dusk forced us to stop. However, a small pit was dug through yellowish mud and ground water until bedrock was encountered at 70 in. From this accumulation on bedrock eight samples were taken from one pit wall. The two most abundant materials were stone and molluscan shell. Shell was more abundant here than in other sites which we dug. Compare table 4 with tables 2, 3, 5-12.

The site must have been used only as a camp for gathering mollusks rather than as a permanent village for there is no available fresh water here. Drinking water is transported to the islet today, as it probably was in ancient times.

Datum for site 48: Occupied house 30 yds. west of grid area. The grid area is about 60 yds. from the water's edge at high tide on the west side of the islet. Stake line D1-8 lies on compass bearing 30° west of north. Eleven 6-in. blocks were dug, comprising 99 cu. ft. of deposit (see diag. 3).

In the 24-30 in. block of rectangle C7-8 D7-8, human bone fragments were found, which were, according to our native workman, the remains of a cannibal feast.

Rattus norvegicus bones occur at the 30-in. level (table 17). This species is an active burrower and its presence in the deposit at this level is probably due to its activities rather than to human disturbance of the site.

SITE 13: LAPITA

Site 13 is on the beach on the Coral Sea side of Foué Peninsula, between 4 and 5 mi. from Koné on the road to the wharf in Koné Bay. A fence and cattle guard in the road, exactly 5 mi. from Koné, are near the western edge of the site, which is largely on the low isthmus connecting the hill end of the peninsula with the mainland. The isthmus is flat, varying from 200 to 500 ft. in width, with the Coral Sea on one side and mud flats on the other. The shore edge of the midden is being eroded by the sea (see pl. 2, b). The site extends for more than a quarter-mile along the beach and across the isthmus to the mud flats of the dry lagoon which flanks it on the inland side. The low area between the beach and the mud flats is heavily overgrown with lantana.

Excavations were made at two places in this site, from July 26 through August 2 with some interruptions. The first excavation was of a small sloping area at the beach edge, west of the fence, to which was given the site designation 13. The second was east of the fence on the relatively level isthmus connecting the low hill slopes to the east and west; this area was designated location A. Fifty-five 6-in. blocks were dug, comprising 495 cu. ft. of deposit.

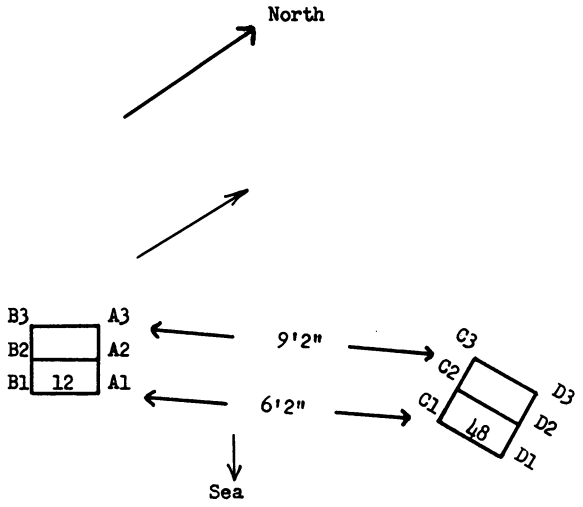


Diagram 4. Excavations at site 13, first location.

The top two feet at the first excavation were black adobe merging into brown adobe and beach debris below. The grids were located on the bank at the beach edge, west of the fence running across the isthmus to the cattle guard, at the base of the gently sloping hill to the west. In the upper layers molluscan shell was less abundant than at location A, as table 5 shows. Stone was next in abundance but did not amount to much.

Datum for site 13: Stake D1 is 192 ft. from the telephone pole near the cattle guard, the telephone pole being on compass bearing 38° east of north.

All of the quarter-mile of exposed midden along the beach to the east of the fence is called location A. This was the richer part of the site. Sherds were taken from the exposed and sea-eroded front. Excavations at location A were made a quarter-mile to the southeast of the first location, on the inshore side of the road which closely skirts the shore. There, dark midden material was about 15 in. deep, below which was beach debris yielding artifacts to a depth of 42 in. As shown in diagram 5, two lines of pits were staked. The C-D line proved unprofitable, so work was concentrated on the A-B line. These pits were dug in what was formerly a yam field with low parallel ridges about 8 ft. wide and about 15 ft. apart running across the isthmus from the seashore to the mud flats.

Datum for location A is the seventh telephone pole east along the road to Koné from the cattle guard on the property of Mr. Alfred Girard. From stake B1 the telephone pole is on compass bearing 15° east of south and is 39 ft. from stake B1. The telephone pole is on the shore side of the road. Stake B1 is 10 ft. from the inland edge of the road. From stake C1 the telephone pole is 65° east of south, and distant about 60 ft. (see diag. 5).

Almost ten times as many sherds were excavated at location A as at the western end (site 13). At location A all three types of sherds (plain, incised, relief) were found from top to bottom of the deposit, except that relief sherds were lacking between 30 and 36 in.

Location A yielded a total of 1,335 oz. of excavated sherds. The average percentage for the three types are not far from those in the western end. The comparison is as follows, figures for the first location being first in order, for location A, second: plain sherds, 60 per cent, 64 per cent; incised sherds, 40 per cent, 33 per cent; relief sherds, none, 3 per cent. This would seem to indicate that the two locations were really parts of one site, rather than two separate, overlapping sites.

Talus slope collections of potsherds made along the seaward face of the midden totaled 81 oz., but these are not included in tabulations since the depth from which each may have come is uncertain. Of the talus slope collection, 64 per cent were plain sherds, 25 per cent incised sherds, and 10 per cent relief sherds.

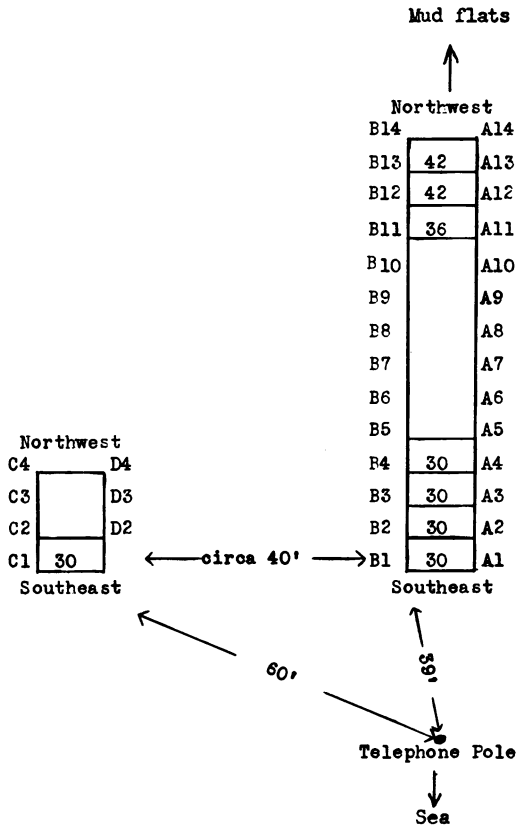


Diagram 5. Excavations at site 13, location A.

SITE 14: PODTANÉAN

This midden site, first visited on February 10, is the deepest of the three seen on Foué Peninsula. It lies on the Coral Sea shore between sites 13 and 16, and is reached by a cow trail southwest over the hill about one-quarter mile from the road near the Koné Bay wharf. It lies at the mouth of a small, mangrove-bordered creek or slough, extends a considerable distance up the hill, and is about three acres in extent. Potsherds and chipped stone were recovered from the surface and the talus slope. The dark surface soil did not have the adobe consistency of the soil at the western end of site 13.

Excavations at the eroded shore edge of this site were conducted from August 4 to August 7, when heavy rain stopped operations. The cultural deposit ended at 78 in. Forty-six 6-in. blocks were screened at site 14, comprising 414 cu. ft. of deposit (see diag. 6). Although this

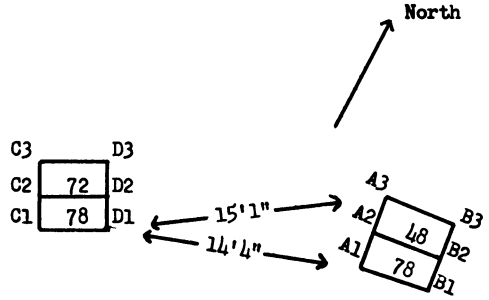


Diagram 6. Excavations at site 14.

site is only an air-line mile from site 13, the potsherds here were mostly undecorated, in contrast to the incised ware so abundant at site 13. Whether this difference is one of age or of cultural antecedents of the occupants is not clear.

Grids were begun on the bank at the beach edge, about 30 ft. from the sea edge at high tide. The two grid areas were about 15 ft. apart. The edge of site 14 was about 4 ft. above high tide level on August 7, 1952. However, ground water was not encountered until we reached 72-78 in.

At 42-48 in. in rectangle C2-3 D2-3 a hearth composed of heat-fractured blackened stones was found, indicating an undisturbed level. However, some potsherds at 42-54 in. were waterworn, as though cast up by the sea. Also, they were imbedded in consolidated beach debris and had a limey coating.

In wall C2-D2, black soil extended down to 25 in. Then followed 5 in. of sand, 3 in. of black soil again, and sand again down to 48 in. Below that was consolidated material for 12 in.; thereafter, coarse sand with much coral down to 78 in., where ground water was encountered.

Stone and molluscan shell were the two most abundant materials in site 14, shell exceeding 50 per cent of the sample taken at 3 in. deep, but dropping to 5 per cent at 9 in.

Our informant, Reverend Auguste Wabealo, told us that the native name of site 14 is Podtanéan and that it was occasionally visited by people from site 13 for fishing.

SITE 26: OUNDJO

Site 26, estimated to be ten acres in extent, is on a low rocky promontory jutting into the Coral Sea below Mt. Kafeate. The village of Oundjo, of which Bome is chief, is 8.3 mi. by the west coast highway southeast of Voh, somewhat less than halfway to Koné, the next town to the south. A rocky cliff, from 10 to 30 ft. in height, extends along most of the eastern and southern part of the promontory. On the western side it slopes down to a stream or slough. When we visited the site with Mr. Chevalier on February 19, the women and children of the village flocked around and helped us collect surface potsherds, resulting in an accumulation of 246 oz. These are useless for statistical comparison, since the villagers made a special effort to collect decorated sherds. At the lower seaward edge on the northwestern section of the peninsula near the creek mouth, the shell midden extends down to sea level, and digging showed that it continued slightly below present sea level. The shell midden extends completely around the shore of the promontory. The creek may have been the source of drinking water in ancient times.

Unlike many other coastal sites, Oundjo is not on a substratum of beach sand. The three separate locations at which we dug (A, B, C) were based on bedrock. A and C were out of reach of wave action and it seems likely that even at B most of the molluscan shell was deposited by man rather than by waves. At rectangles A-B of location B, mud and ground water made it difficult to penetrate to the rock. In these rectangles house posts were found, apparently preserved by the continually wet and muddy subsoil.

The dominant structure today in Oundjo is the church, which occupies the highest part of the promontory, estimated to be 65 ft. above the sea. It served as our point of orientation, since it overlooks both the village and the sea. The northeast corner of the church is the main datum for site 26, and the three excavated areas are located in relation to this point (see diag. 7).

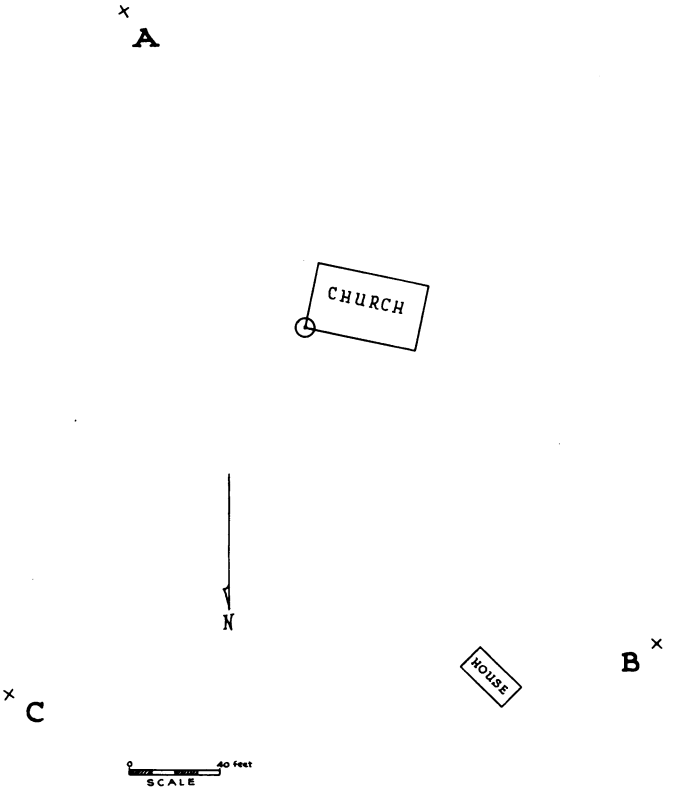


Diagram 7. General plan of site 26.

The three locations dug at site 26 show such uniformity in pottery types as to suggest their contemporaneity. If the houses on the site were distributed as widely in ancient times as they are today, this uniformity is understandable.

On April 8, with the permission of Chief Bome, we began the excavation of location A, which lies 168 ft. to the southeast of the church, on a steep slope, the lower end (A1-B1) approximately 10 ft. above high-tide level and 15 ft. from the water's edge at high tide at 7:30 a.m. on April 10. Work was begun with a crew of seven men supplied by Chief Bome. Three and one-half days were sufficient to sample location A. It proved to have little depth of cultural material before bedrock was reached; the deepest deposit was 18 in. at the lower end. On the upper part of the slope, bedrock was only 6 in. below the ground surface. The midden was dark brown, not black, throughout.

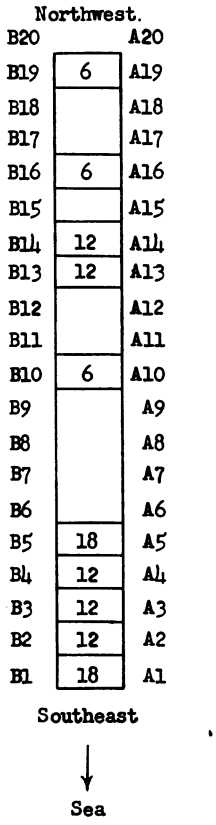


Diagram 8. Excavations at site 26, location A.

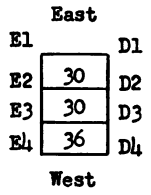
Deposit samples were taken from three walls and, although location A was on a rather steep slope, the samples seemed fairly uniform. The average percentages of weight for the three more abundant materials at depths of 3, 9, and 15 in. are as follows (see also table 7): stone, 14, 7, 7; molluscan shell, 23, 18, 12; residue, 60, 72, 80.

There was a rather steep gradient at location A. Stake B1 was 14 ft. 6 in. lower than stake B20, the two stakes being 57 ft. apart. Stake line A1-20 was laid on compass bearing 29° west of north (see diag. 8). Two native houses are situated 3 and 10 ft., respectively, northeast of the line of A stakes.

Location B, the second area excavated (see diag. 9), lies 177 ft. 6 in. northwest of the church and about 336 ft. northwest of location A. The surface of the A-B rectangles is approximately 18 in. above high tide (18.5 in. at high tide on April 12, 1952). The water table was encountered at about 15 in. in each pit of the A-B series, and thereafter bailing was necessary. The fact that the bottoms of the deepest pits (A-B rectangles) were below sea level possibly warrants the hypothesis of a sinking coast line. However, the alternative hypothesis of the gradual accumulation of midden on the rocky bottom may be more valid.

Stake line A1-15 was laid on an east-west line on level ground, more or less parallel to the sea shore, which at stake A1 was only 66 in. to the south and was a bank of black earth and clay, more or less solidified by grass roots. Stake line D1-4 was laid out on an east-west line with stake D4 47 ft. 6 in. from stake A15, on a compass bearing 27° east of north, and 74 ft. 2 in. from stake A1, on compass bearing 59° east of north. The D-E rectangles were on a slight slope at the base of the hill east of the A-B rectangles, with stake D4 approximately 2 ft. higher than stake A1. A week was spent digging at location B.

At location B deposit samples were taken from three walls. The average percentages of weight of the more abundant materials are given in the accompanying tabulation (see also table 7).



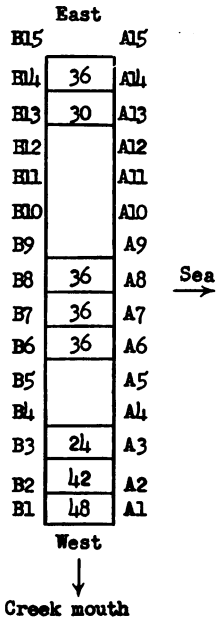


Diagram 9. Excavations at site 26, location B.

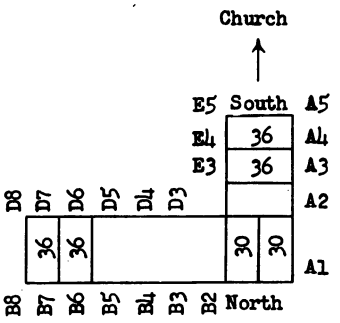


Diagram 10. Excavations at site 26, location C.

	Percentages of Weight						
	3 in.	9 in.	15 in.	21 in.	27 in.	33 in.	39 in.
Stone	9	11	12	9	14	22	26
Molluscan shell	8	7	11	25	11	11	15
Residue	81	81	74	63	73	66	55

Location C, in the clear central part of the village, lies in front of Chief Bome's house, on a slight slope below it, and 71 yds. roughly north by east of the church. Location C was laid out in an L-shape (see diag. 10), the long arm running east and west (A1-B8) across an old house mound, the short arm running north and south (A1-5) on ground on which there had been no houses. Stake A1 is 3 ft. 1 in. lower than stake A5. Large quantities of fish bone, decapod, and shell, along with sherds and charcoal, were recovered from location C. One pottery handle fragment, the

only one found at site 26, was recovered at 18 in. deep in a test pit at location C.

At location C only one pit wall was sampled. Stone and molluscan shell were the two most abundant materials (see table 7). At 33 in. there was no molluscan shell, only stone and residue being recorded. In the first four levels, however, a heavier concentration of molluscan shell was found than at corresponding levels in locations A and B, as shown by the following percentages of weight: 3 in., 49; 9 in., 62; 15 in., 24; 21 in., 28; 27 in., 1.

At the three locations of site 26, 117 6-in. blocks were dug, comprising 1,053 cu. ft. of deposit. Work at the site was begun on April 8 and discontinued on April 25.

The finding of bones of deer and pig, both introduced mammals, at levels down to 30 in. (as shown in table 17), indicates that part of our excavation was in disturbed soil, perhaps in a modern refuse pit.

EXCAVATIONS ON THE EAST COAST

Of the five sites excavated on the eastern side of the island, three (6, 50, and 52) were sandy coastal middens on the shore line; two (44 and 51) were inland sites a mile or more from the sea. Part of the southernmost site (44), near Canala, was an alluvial deposit on the edge of a low rocky eminence. Site 51 is the inhabited aboriginal village of Tiouandé, at the base of a crag 300 feet high on the left bank of the Tiouandé River, a mile from the mouth.

SITE 44: NÔWÉ

Site 44, the former village of Nôwé, was visited on April 2 by the Giffords and Mr. Luc F. Chevalier. The French house on the site, now occupied by Mr. Ernest Eugene Féré and family, was built in 1874. It is 1 km. by road from the Mayet Hotel at Canala. The site is on a triangular peninsula formed by a bend of the small Ouen Nekoué River, just above its confluence with the Negropo River. The stream at site 44 was at sea level, as indicated by the rise and fall of the tide. The peninsula, a low rocky knoll composed of a nucleus of serpentine bedrock, is estimated to be 30 ft. above the river at the highest point, apparently well above flood waters. The lower parts of the peninsula along the Ouen Nekoué are overlaid with alluvium. The bedrock is exposed only on the higher parts, although it was encountered a few inches below the surface at locations A and C on the southern slope. At location B, in the alluvium on the north side on the bank of the Ouen Nekoué River, we failed to encounter bedrock, even in the deepest hole, which was dug down 5 ft. in an attempt to reach bedrock.

Site 44 is several acres in extent, and most of it is now planted to coffee and shade trees. It looks as if the village may have been placed here originally because of the strategic location, with water on two of its three sides. The site is about 2 mi. from the head of Canala Bay, with much swampy land between.

As nearly as could be judged with the dense vegetation, the highest point of the site was the spot surmounted by a large circular house mound, 30 to 40 ft. in diameter, said to have been the chief's house. We were told that Araucaria cooki trees were growing there as late as the early 1900's. Some yards away was an 8-ft.-square stone platform at ground level, with a slightly higher border made of small undressed stones with a few bricks near the edge. This was the butchering place for human bodies, according to one story; according to another, the floor of a stable.

Tuesday morning, May 6, with a crew of six men, excavation was begun at site 44. At all locations on this site the soil was moist and earthworms were abundant, even in the first six inches. The moisture caused the clayey soil to form little balls when the screens were shaken, so the more difficult material was taken to the river to be washed through the screens.

We began digging at location A about a hundred yards west of an old engine house. Bedrock was nowhere far below the surface at this spot (see diag. 11). The lower corner of one pit, A11-12 B11-12, was dug to 30 in. The surface at stake B12 was 27 in. lower than at stake B1.

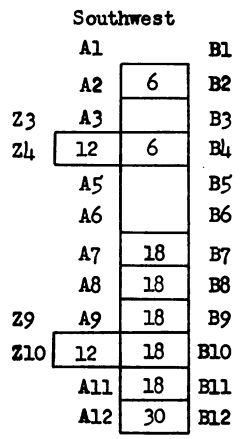


Diagram 11. Excavations at site 44, location A.

This shallow location did not prove very productive, so a new area, location B, was selected for sampling.

Location B, about 5 ft. above high-tide level, on the bank of the river, is approximately 300 ft. northwest of location A. The upper 6 to 12 in. is composed of black shell midden with sherds, charcoal, and some bone. Below this black shell stratum was brown alluvial clay of undetermined depth, which included occasional sherds, shell, and charcoal down to 42 in. Worked and unworked flakes of nephrite came from depths of 24 in. and more. No artifacts were found below 42 in. At location B (see diag. 12), only the 1/4-in. mesh screens were used, and material from all levels was washed in the river.

After four days at location B, it was felt necessary to move to location C, where, according to Mr. Féré, there was a considerable depth of deposit; it lay downslope from the old engine house, 96 ft. east of location A. It was soon discovered that here, as at location A, bedrock lay not more than 18 in. below the surface (see diag. 13). Two days were considered sufficient to sample location C; thereafter we moved back to location B, in order to get as much material as possible from the lower alluvial levels. Work at site 44 was discontinued on May 24.

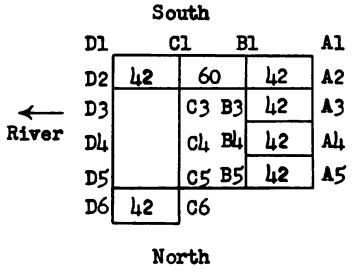


Diagram 12. Excavations at site 44, location B.

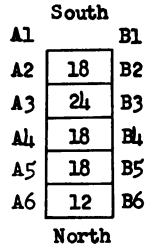


Diagram 13. Excavations at site 44, location C.

A total of ninety-three 6-in. levels were dug at the three locations sampled at site 44, comprising 837 cu. ft. of deposit. The study of the potsherds indicates no significant differences between the three locations.

The site, being inland, yielded little molluscan shell, except in the two upper 6-in. blocks of location B. Locations A and C were

shallow deposits on bedrock, and samples taken at C showed only a trace of molluscan shell, samples at A, none. Although location B was excavated down to 60 in., stone and molluscan shell were virtually absent below 12 in. The deposit at location B resembles that of Fijian site 26 described by Gifford (Gifford, 1951, p. 205, table 2) where black shell midden overlay an alluvial deposit.

Table 8 presents a detailed analysis of twenty-seven deposit samples from locations A, B, and C.

The occurrence of cattle, pig, and goat bones down to the 18-in. level probably indicates some modern disturbance of part of the excavated area. See table 17.

On the morning of May 5, Mr. Ernest E. Féré took us to the site of a former market village on a low tongue of land projecting into a mangrove swamp, a mile east of site 44, toward the head of Canala Bay. A ceremonial avenue, flanked by coconut trees and leading to the chief's house mound, was a conspicuous feature of this site, which seemed too close to water level to warrant excavating. Near by in the mangrove branches was the hull of a dugout canoe with a long projecting bow. This site, according to Mr. Féré, was one where the aborigines traded inland farm produce for sea foods brought there in canoes. The site of this former village was indicated by a few house mounds and a taboo post with a carved human face. No potsherds were seen here and no number was assigned to the site.

In the late forenoon of Thursday, May 22, Mr. Féré took us in his rowboat to a gravel bar in the Negropo River, about 3/4 mi. below the confluence of the Ouen Nekoué and Negropo rivers. This gravel bar lies immediately below a stretch of very deep water, between two bends of the Negropo, which accounts for its being built up at this location. The bar is approximately 450 ft. long and on it are found sherds and mineralized crabs, of which a collection was made. The source of the sherds and crabs collected is unknown.

SITE 6: BAYE

Site 6 lies 6 mi. south of Poindimié, a mile or two south of Cap Baye, and 1.5 mi. south of Paama (site 5) by the east coast highway. It is on the property of Mr. Arthur Volcy and Mrs. Antoinette Kabai, who very kindly gave us permission to excavate in the fallow and uncleared sections; a good deal of the site was planted to coconuts, papayas, manioc, sweet potatoes, onions, lettuce, yams, and carrots. We first visited site 6 on February 9, returning to begin excavations on June 4 and continuing until June 14.

The site is a well marked kitchen midden several acres in extent. Shell was conspicuous on the surface, as well as sherds, which we collected on our first visit.

The black midden extended to a depth of 12 to 18 in. only; below was coral and sand. In the upper black levels there was a great deal of pumice, which had presumably been borne in by the sea. It was present, but to a much less degree, in lower levels. Throughout the site coral fragments were abundant, exceeding stone (see table 9). There were few fish bones. According to our aboriginal informant, Marcel, a schoolteacher, this was because they had been burned by the former inhabitants. A number of fire hearths were exposed in digging. Parts of this site that we dug are 10 to 12 ft. above normal high-tide level. We dug at five locations: first, near the base of the hill, then at locations A, B, C, D (see diag. 14).

Our first excavation was at the base of a rocky hill, used formerly as a depository for the bones of the dead (see pl. 4, b). We began work with a crew of four men, later increased to nine. The main datum for site 6 is the telephone pole located approximately 6 ft. in front of this large rock outcrop. The telephone pole stands on the west side of the road, 58 ft. 5 in. from stake A11. The grid area of this location lies approximately 30 ft. from the curve in the road, which skirts the base of the rock outcrop, between the grid area and the main datum telephone pole. The sea is about 300 ft. away to the eastward. After several days of excavating in this roadside portion of the site (see pl. 4, c, for picture of a pit wall), we moved to an area 300 to 400 ft. northeast, where we excavated in four separate spots, called locations A, B, C, and D in close proximity to one another (see diag. 14).

Location A: The grid area has a gradual slope, ground level at stake A31 being approximately 18 in. lower than ground level at A1, which is on an old house mound (see pl. 4, d, for picture of a pit wall). From stake A31 it was 154 ft. to the upper edge of the beach. From there the beach slopes at about a 30° angle for 44 ft. to the edge of the water at normal high tide.

A depressed area running north and south was said to have been the avenue through the village; the native workers referred to it as "la route." Rectangle A22-23 B22-23 lay west of it on the inland side, A25-26 B25-26 lay in it, and A30-31 B30-31 lay east of it about 100 ft. from the shore. Rectangle A5-6 B5-6 lay in about the center of what was said to be the chief's house mound. Excavation was undertaken in A25-26 B25-26, but no potsherds were found below 12 in. and very few above. Evidently the middle of the "street" was not the place for potsherds. Rectangle A5-6 B5-6, on the other hand, lay in about the center of the chief's house mound and was so productive that we dug down to 96 in. Rectangle A30-31 B30-31 was as unproductive as the middle of the "street."

Location B: Stake A1 at location B is 336 ft. 7 in. from stake B1 at the first location at the roadside (diag. 15). The ground is level and lies in front of a rock outcrop on the seaward side of the road.

Location C: Stake A1 at location C is 118 ft. 4 in. from stake B1 at location B. The ground is level.

Location D: Location D also lay on level ground. Stake A1 at location D is 72 ft. from stake A7 at location C.

A total of 199 6-in. blocks was excavated at the five locations sampled at site 6, comprising 1,791 cu. ft. of deposit. The midden samples collected show coral and molluscan shell at every level down to 93 in., where the deepest sample was taken. The percentage of pumice is much higher than at sites 50 and 52, also on the east coast. This difference may be due to the fact that site 6 is more exposed to the sea than sites 50 and 52, which are on the shores of relatively sheltered Tiouandé Bay.

The presence of both fresh potsherds and wave-worn sherds at the same levels would seem to indicate that the sea at times invaded the inhabited areas, perhaps during hurricanes. Presumably the wave-worn sherds are older than the fresh sherds. However, there seem to be no diagnostic differences. The occurrence of hearths, on the contrary, suggests a lack of disturbance through wave action.

The following features were observed in the course of excavations at the roadside location. In wall A3-4 a column of gray sand from 24 to 30 in. deep looked like a house-post core. At 66 to 72 in. was a pocket of gray soil, suggesting ash. In rectangle A8-9 B8-9 a fire hearth was exposed at the 60-in. level. In rectangle A9-10 B9-10 fire lenses were encountered at depths of 30 and 36 in., the last lens extending downward to the 48-in. level.

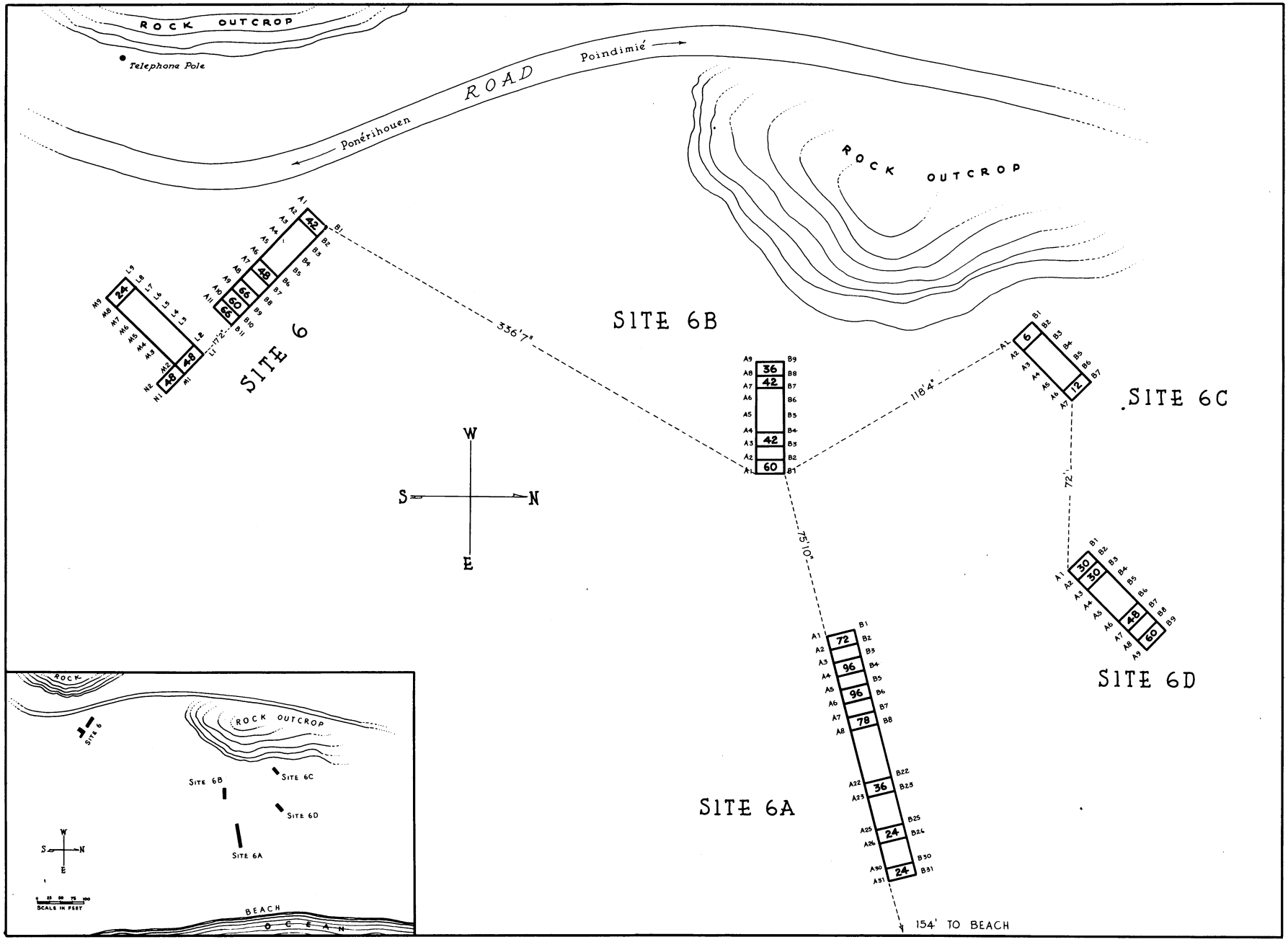


Diagram 14. General plan of site 6

SITE 50: DOWALWOUÉ

This level coastal kitchen midden starts at the northwest end of the Tiouandé River bridge (pl. 5, a) and extends along the coast for probably half a mile, comprising an area of several acres. Its inland extent was not determined. The main east-coast highway to Hienghéne runs through it parallel to the crescentic shore of Tiouandé Bay, which has a sandy beach a mile in length. There is no shore coral reef as there is at site 6 (Baye).

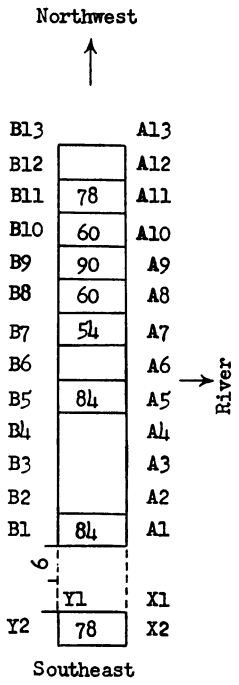


Diagram 15. Excavations at site 50.

The main excavation (A1-13 B1-13) of site 50 was begun on July 2 and was discontinued on July 7. Another rectangle, X1-2 Y1-2, was dug on July 14. (See diag. 15.) The elevation is only a few feet above sea level and ground water is reached at 66 in. The area excavated was evidently once an inlet of the sea, later filled in by river and sea deposit. The whole terrain is sandy, but the upper 18 inches, more or less, is black, owing to human occupation. (See pl. 5, b.) Below this is sand, which caves in all too readily and which caused us no end of trouble, especially after we had dug down to ground water. However, potsherds were found down to the 84-90 in. block.

The portion excavated was in Mr. André Ragot's front yard, some 120 ft. directly in front of his store and 119 ft. from the near corner of the northwest end of the Tiouandé River highway bridge, which is the datum point for site 50, and which bears due north from stake B13 of the excavation area.

Stake line B1-13 was laid on compass bearing 45° west of north. Tiouandé Bay lay 267 ft. northwest of stake A13 at high tide, and the bank of the Tiouandé River lay 81 ft. northeast from stake A1 at high tide.

Ninety-eight 6-in. blocks were dug at site 50, comprising 882 cu. ft. of deposit. Excavations were conducted with the aid of Mr. Chevalier.

Special features noted in the course of excavation at site 50 were the following. In Rectangle A1-2 B1-2 a considerable mass of peatlike vegetable material containing charcoal was encountered at 72-84 in., below which was blueish mud. Similarly, in rectangle X1-2 Y1-2 a small amount of peatlike material, brought up from a depth of 78 in. in ground water, was probably an extension of the layer found in rectangle A1-2 B1-2. Professor H. R. Crane obtained a radiocarbon date of 73 A. D. plus or minus 350 years from a sample of charcoal from this peatlike material.

In rectangle A7-8 B7-8 an ash pocket 10 in. in diameter found at 42-48 in. suggested the remains of an ancient fire.

The site had little stone, coral, or molluscan shell, with a complementary increase of residue. At no level was pumice more than 1 per cent of the total weight of the deposit (see table 10).

The occurrence of deer and cattle bones to a depth of 12 in. (see table 17) indicates disturbance in modern times of part of the excavated area.

SITE 52: OUAPA

This site lies at the base of the crystalline limestone crag of the same name (pl. 5, c), which stands about 300 ft. from the shore of Tiouandé Bay, 0.7 mi. by road northwest of the left bank of the Tiouandé River at the end of the highway bridge. It is on the road to Hienghéne and on property owned by Mr. André Ragot. The part in which excavations were made is directly at the bottom of the huge crag which faces the sea on the inland site of the highway. A test pit was dug under a banyan tree on the shore side of the highway, but it yielded no potsherds, although the soil was slightly dark as though from fire. All excavations were made on July 12; soil samples were taken on July 13.

A house mound close to and southeast of the monument to the dead of the 1917 insurrection was dug only 6 in. and proved so unprofitable that it was abandoned. The sandy soil was only slightly dark.

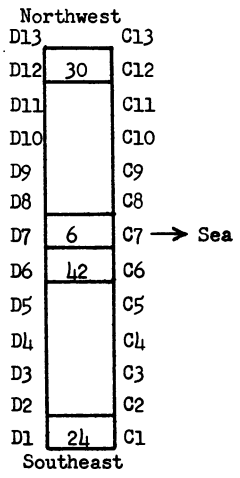


Diagram 16. Excavations at site 52.

A test pit was dug about 300 ft. to the northwest of the monument showed dark soil down to 32 in. and sand below that. Further excavation showed that the test pit had been made in a pocket of midden material, possibly an old post hole, which was unusually deep, the general run of black soil being about 12 to 15 in. Two sets of samples were taken from wall C7-D7. The deeper sample (3-39 in.) was taken down through the 32-in. dark midden material. The second (3-21 in.) was taken elsewhere in the wall and more accurately represents the composition of the site.

Datum for site 52: Large fallen rock in center of cave mouth behind grid area. Stake D1 was 37 ft. 7 in. from the top center of this rock, on compass bearing 62° west of south. The grid area was on level ground, approximately 4 ft. above sea level at high tide. Stake line D1-13 was laid on a line exactly 45° west of north (see pl. 5, d).

Seventeen 6-in. blocks were dug at site 52, comprising a total of 153 cu. ft. of deposit. This site is rather similar in composition to site 50, also on the shore of Tiouandé Bay, but it yielded less coral. The amounts of stone, molluscan shell, and residue, are not very different in the two sites, as a comparison of tables 10 and 11 shows.

In addition to excavated sherds, 166 oz. of sherds were collected from the floors of small rock shelters in the crag which forms a prominent feature of this site. All of these sherds were plain except for 1 oz. of incised ware. Informants at Tiouandé (site 51) said that pottery was formerly made at site 52.

SITE 51: TIOUANDÉ

This second inland site was first visited in June. Like Oundjo (site 26) it is occupied. We were accompanied by Chief Galé of Tekenpaek village, a few miles to the south on the main east coast highway. (We did not, on this occasion, meet Bwaé, the half-caste chief of Tiouandé, who is inferior in rank to Galé.) Galé assured us that the place had been inhabited "since the beginning of the world" on account of the defensive refuge afforded by the great crag of gray crystalline limestone, 300 ft. high, and the adjoining hill. The crag resembles the one at Vunda in Viti Levu (Gifford, 1951, pl. 15, a, b). It rises from the edge of the mangrove swamp on the left bank of the Tiouandé River about a mile from its mouth (see pl. 5, e). The modern village of Tiouandé lies at the foot of the crag, on the north and south. We did not visit the southern part of the village, which is reached either by the trail over the hill or by the trail around the base of the crag at the edge of the mangrove swamp.

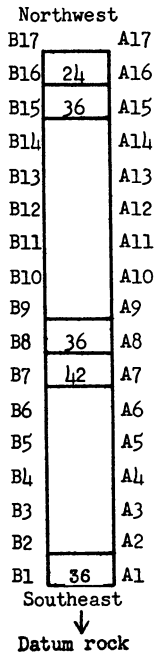


Diagram 17. Excavations at site 51.

Although it was said that Tiouandé had never been deserted by its inhabitants, the excavations indicated no great antiquity. The house mound at location A had a house on it when the present chief Bwaé (now perhaps 60 years old) was a boy. Clay tobacco-pipe fragments were recovered there.

Excavations were carried on in the village on the north side of the crag from July 8 to 11 inclusive. The first excavation was in the inhabited part of the village at the base of the crag in a sort of bay in the rock mass looking to the north (diag. 17).

The surface of the grid area of site 51 sloped in three general terracelike contours. Stake B17 is 6 ft. 4 in. lower than stake B1. Stake line B1-17 was laid on compass bearing 38° west of north. The datum is a white rock with a hole in the center above a rock shelter in the great crag directly above the grid area. The distance from stake A1 to the hole in the white rock is, in an air line, about 56 ft. After digging to 36 in. in rectangle A15-16 B15-16, cultural material being nil in the last 6 in., a narrow pit was dug down to 72 in. without our encountering anything but yellow clay.

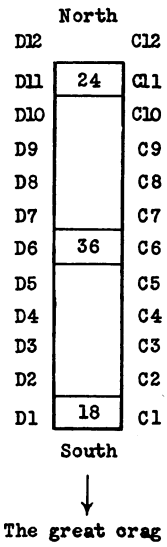


Diagram 18. Excavations at site 51, location A.

The second excavation, location A (diag. 18), was made about 900 ft. to the west, 90 ft. northwest from the base of the crag, in an abandoned part of the village about 150 ft. west of the modern cemetery. A few yards away was a taboo spot marked by a clump of bamboo, planted by the old men because of some association with the dead. Crannies in the great crag were reported to contain many human bones. The grid area, covered by dense bush, included part of a house mound; some of the area lay between two other house mounds. Stake line C1-12 was laid on an approximate north-south compass bearing.

Forty-two 6-in. blocks were dug at the two locations sampled at site 51, comprising 378 cu. ft. of deposit.

Below the shell midden, which stopped at 12 in., the soil was chiefly alluvial deposit laid down in past centuries by flood waters of the Tiouandé River. It is presumably comparable with the alluvium at site 44, location B.

Location A, according to native tradition, was occupied only after the rebellion of 1878 and by people from Ouapa, site 52. If the tradition is correct, eighteen inches of deposit have accumulated since 1878. It is probable, however, that there may have been an earlier occupation that the natives have forgotten.

COMPOSITION OF SITES

In taking samples of midden deposit from pit walls in excavated sites no selection was exercised. Whatever came—stone, shell, sand, earth, coral, potsherds, etc. —was bagged for the samples. These varied in weight from 161 gm. to 1,337 gm. Beginning at 3 in. below the surface, samples were taken at 6-in. vertical intervals.

The physical analysis of the midden samples was made by Robert J. Squier, Chérie Grégoire, and Sheilagh Thompson Brooks. It consisted of screening the samples through a wire screen with meshes 3 mm. square. The materials intercepted by the screen were segregated: stone, pumice, coral, charcoal, vegetable matter, fish bone, other bone, molluscan shell, decapod shell, Marginopora, potsherds, other artifacts, and residue. The residue consisted of fine fragments of the materials just enumerated, plus soil, sand, and ash which passed through the screen. The various constituents segregated were weighed. The percentages of the total weight are presented beyond, and in tables 1-12 following this section. The analyses may be compared with those already published for Fiji (Gifford, 1951, pp. 202-205), except for some constituents of the New Caledonia sites—for example, pumice, coral, and Marginopora—which were not segregated in the Fijian samples.

In five coastal middens (sites 20, 13, 14, 6, 50) we encountered lime-cemented debris—a layer of indurated sand, pebbles, coral fragments, and shell, so hard that a pick had to be used to cut through it. A sample of this material from a depth of 51 in. in site 20 was submitted to Professor J. Wyatt Durham, of the Department of Paleontology, University of California, for his opinion. He reported that such consolidated material was usually formed during a dry period, when the ground water evaporated, depositing the lime that caused the cementation. Given particular climatic conditions, such a layer could be formed in a relatively short time. On the open sandy beaches there is an abundance of such material in large slabs above the normal high-tide level. Potsherds were occasionally found incorporated in the cemented debris as well as in the loose material beneath it, indicating that the cementation in those instances, at least, had taken place during man's residence on the island.

Robert L. Crocker, Professor of Soil Morphology, and Francis J. Turner, Professor of Geological Sciences, agreed with Professor Durham that lime-impregnated waters were the cementing agency, but like him they were unable to assert positively when the cementation took place.

At beach sites 19 and 52 no such consolidated material was encountered. We dug here to a depth of only 24 and 42 in., respectively, and perhaps did not reach the cemented layer. Such consolidated material was also absent at sites 48 and 26, where the cultural deposits had accumulated on bedrock, and was of course not found in the two inland sites (44 and 51).

On the west coast we encountered the consolidated hard layer at sites 20, 13, and 14, as follows.

> Site 20: rectangle A12-13 B12-13, 48-54 in.; rectangle A14-15 B14-15, 55-57 in.; rectangle A20-21 B20-21, 58 in.
>
> Site 12, location A: rectangle A3-4 B3-4, 24-30 in.; rectangle C1-2 D1-2, 27-30 in. Large blocks of consolidated material lay on the beach in front of the site.
>
> Site 14: rectangle A1-2 B1-2, 42-54 in.; C1-2 D1-2, 48-60 in.; C2-3 D2-3, 54-60 in.

On the east coast we encountered the consolidated hard layer in sites 6 and 50, as follows.

> Site 6: rectangle A8-9 B8-9, 84 in.; location A, rectangle A1-2 B1-2, 84 in., with ground water and potsherds below it; rectangle A5-6 B5-6, 84 in.
>
> Site 50: rectangle A1-2 B1-2, some lumps at 54-60 in., solid between 60 and 66 in.; rectangle X1-2 Y1-2, 48-54 in., some consolidated sand requiring use of pick, 54-60 in., consolidated lumps, 60-66 in., small consolidated lumps, 66-72 in., ground water.

In the process of analyzing midden samples, small lumps of this cemented material were found to occur at various levels in sites 13, 14, 6, and 50.

Sites not based on beach sand were usually somewhat clayey or adobelike. This was true of site 26, locations A and B, but less so of location C, where the large amount of shell probably tended to make the soil looser. At site 48, the large amount of ash and shell kept the midden material loose. On the east coast, clayey soil predominated at inland sites 44 and 51. Site 13 (except location A) and site 14, although based on sand, also had dark clayey overlay.

The significance of the constituents into which the midden samples were segregated deserves comment.

Stone.—The varying amounts of unworked stone present probably have no cultural significance, and may be due in part to the differences of locale.

Pumice.—In analyzing midden samples, we kept the pumice separate from the rest of the stone because of the chronological significance which may be attributed to it by vulcanological study. It was noticeably present in sites 19 and 6, both at exposed beaches; scarce, though present, in sites 20, 48, 13, 14, 26, 50, 51, 52; and absent in inland site 44.

Professor Howel Williams, Department of Geological Sciences, University of California, kindly examined a series of fifteen pumice samples from site 6, location A, wall A6-B6, taken at 6-in. intervals from 3 in. to 93 in. (except that there was no sample for 33 in.). Professor Williams reported as follows.

> Except for specimen 15127 (basaltic scoria), all pumice appears to be dacite of approximately uniform composition; I cannot say, however, whether product of a single eruption or several. [Specimen 15127 was from a depth of 3 in.]
>
> All fragments are waterworn, presumably floated to position by wave action. Hence, much of the material may be reworked beach débris and thus of no value for correlations. The last (topmost) ejecta are quite distinctive. [He refers to no. 15127.]

His report on the individual specimens follows.

> 11-15127, depth 3 in. Hypersthene-rich basaltic

scoria. Abundant prisms of hypersthene and fewer crystals of plagioclase and a little augite in vesicular greenish to brownish glass (refractive index about 1.57, corresponding to approximately 52 per cent silica).

11-15128, depth 9 in. Hypersthene dacite pumice. Pale gray to white pumice fragments darkened on the outside by fire (?). Cellular, colorless glass (refractive index, about 1.52, corresponding to approximately 65 per cent SiO_2) with a few crystals of plagioclase and hypersthene.

11-15129, depth 15 in. As above.

11-15130, depth 21 in. White pumice (probably dacite). Refractive index of glass approximately 1.52. Except for rare plagioclase crystals, entirely of colorless, vesicular glass.

11-15131, depth 27 in. Like 11-15130.

11-15133, depth 39 in. Dacite pumice. Rare crystals of augite and plagioclase, and fewer of hypersthene and biotite, in colorless, vesicular glass (refractive index approximately 1.52).

11-15134, depth 45 in. Almost pure dacite pumice glass (as above).

11-15135-42, depths 51 to 93 in. All appear to resemble dacite pumice described above.

From Dr. Jacques Avias, Université de Nancy, we have the following comment, in his letter of October 3, 1953, concerning the archaeological pumice recovered in our excavations.

> I have, myself, reported specimens analogous to yours, although less systematically collected, and the results [of Dr. Howel Williams' examination] that you sent me interest me very much; they confirm the analysis made by fire by Mr. Lacroix, Professor of Mineralogy at the Museum, but this scholar has, he believes, demonstrated that most of the floating pumice came from very much farther away than the New Hebrides, carried as they were by currents. (Certain pumice from Krakataua floated more than 6,000 kilometers in less than a year.) Lacroix demonstrates that "the pumices of various spots of New Caledonia did not come from the New Hebrides, as a number of people think, but from islands very much farther away, such as Falcon Island, for example, situated nearly 2,000 kilometers to the north of New Caledonia."

(See Avias, 1950b, p. 226.)

Coral.—This stonelike material was a significant constituent of midden composition, though its presence may be largely due to natural agency. The natives use it, after calcining, for bleaching the hair, but this would account for only a small amount. The midden yielding the largest amount of coral was site 6; site 51 yielded none. In site 6 the average weight percentage of coral at all levels was 22, probably because this site is on an exposed stretch of coast.

Charcoal.—If we discount bush fires, the presence of charcoal indicates human occupancy of the levels at which it was found. The amount of charcoal isolated from all but seven midden samples was less than half of 1 per cent by weight. Of those seven samples, only two had 2 per cent, the rest 1 per cent.

Vegetable matter.—Although a large amount of uncarbonized vegetable material, somewhat peatlike, was excavated from a deep layer at site 50, it was otherwise rare in the samples of midden material. Candlenut shells were the most frequent thing found, as they were in Fiji. They are evidently resistant to bacterial attack.

Molluscan shell.—As is to be expected, shells of mollusks were more abundant in midden material from the nine coastal sites than from the two inland sites (44 and 51). In discussing marine shells excavated in two Fijian midden deposits, it was possible for Gifford to state that their presence was apparently all due to human agency (Gifford, 1951, p. 203). In New Caledonia this categorical statement can be made only for inland sites 44 and 51, for bedrock locations A and C at site 26, and perhaps for site 48. At all other sites much shell was without doubt deposited by the sea, especially in the lower levels excavated. Small terrestrial mollusks may have inhabited the sites, but most of the large Placostylus, of which several species were found, were probably brought to the sites as food. Today these are eaten by the present population, both indigenous and colonial.

Decapod shell.—Crabs and lobsters constitute an important item in native diet today and evidently did in ancient times, judging from the fragments of their shells found in some of the midden samples. In a few samples these exceed half of 1 per cent of the sample by weight: in sites 19 (1 per cent), 20 (1 and 3 per cent), 26 (1, 2, and 3 per cent).

Marginopora.—This large disk-shaped foraminifer, identified by Professor R. M. Kleinpell, of the University of California Museum of Paleontology, as Marginopora cf. vertebralis Blainville, is a species with a time range from the Miocene to the present; it occurs commonly on both coasts of New Caledonia. When we first found dead specimens in site 19, we thought that we had discovered aboriginal shell beads, since most of them had a central opening. Dr. Jean Guiart quickly disillusioned us by pointing out that many Marginopora are found dead on the beaches and that the natives do not use them as beads. However, in returning the samples sent for identification, Professor Kleinpell wrote:

> All specimens lack the early planispiral stage, so that microspheric and megalospheric stages cannot be distinguished with assurance. The centrally located early planispiral chambers are of delicate shell material, and are often lacking after death in nature; yet their absence here seems too thoroughly consistent to be considered entirely natural.

In the midden samples, Marginopora never exceeded half of 1 per cent of the sample by weight, and was usually far less; in actual weight it never exceeded 1.2 gm. and was usually much less. The species was not found in midden samples from sites 48, 14, 44, 50, 51, and 52, although one was found in a screenful of material at site 44, to which it must have been carried by man, perhaps along with other marine material. Sites 19, 20, 13, 26, and 6 all yielded examples. In addition to those in midden samples, Marginopora were also collected during the actual process of screening the deposit dug and were found at the same depths as those in the analyzed midden samples. One addition, obtained by screening, was at site 6, rectangle A8-9 B8-9, at 24-30 in.

Fish bones.—In a region as well provided with marine fishes as New Caledonia, it was puzzling to find little in the way of fish remains in the sites, except at site 26, where in three samples fish bones constituted 1 per cent by weight. The weight of the fish bones in all other samples was always less than half of 1 per cent. This pretty well duplicates the picture in Fiji, where all bone rarely exceeded half of 1 per cent of the total weight of the mid-

den samples (Gifford, 1951, pp. 204-205, tables 1 and 2).

Bones of other vertebrates.—Midden samples from both west and east coast sites yielded very little bone of creatures other than fishes. The following seven sites yielded none whatever: 19, 20, 48, 13, 14, 44, 6. Four sites (26, 50, 51, 52) yielded bone of other vertebrates, all of it less than half of 1 per cent of the total weight of the samples.

Potsherds.—Compared with the two Fijian sites dug in 1947 (Gifford, 1951, pp. 204-205, tables 1 and 2), our midden samples yielded fewer potsherds per sample. The highest Fijian percentage by weight was 17, the highest New Caledonian was 5.

Other artifacts.—Artifacts other than potsherds were rare in the midden samples and came from sites 26, 44, 6, 50, 52. The European fragments, usually found in the upper levels, are of scant value for dating purposes, since colonists as well as natives have utilized the sites.

Residue.—Beyond its possible future use for chemical analysis of ash and powdered charcoal content, the residue has no cultural significance.

Table 1 compares the five principal constituents in the composition of the seven coastal sites laid down on sandy beach material; sites 19, 20, 13, 14, 6, 50, and 52. Several soil samples were taken at each site and the weight of each constituent was obtained. Its percentage of the total weight of the sample was then calculated and the percentages for the several samples were averaged to obtain the figure entered in table 1. Averages of less than half of 1 per cent are represented by x.

On the whole, the average amount of stone is greater in upper and lower levels than in middle layers. Coral usually increased in quantity below the upper 6-in. layer. Its low averages in upper layers may be due to the growing height of occupied sites, which would render it more difficult for the sea to cast it up. Pumice is commoner in the upper layers than the lower. It would be interesting to know whether this difference is correlated with active and quiescent stages of volcanoes in Oceania. Molluscan shell diminishes with depth. The larger amounts in upper levels are no doubt due to the use of mollusks as food. In lower levels it is often impossible to distinguish between shells used by man and those cast up by the sea. The range of averages for residue at the seven sites is from 58 per cent at 81 in. (site 6 only represented) to 90 per cent at 33 in.

TABLES 1-12

TABLE 1

Principal Constituents of Seven Sandy Coastal Sites: Percentages of Weight
(x, less than 1/2 of 1 per cent)

Constituents (depth in inches)	Site							Average
	19	20	13	14	6	50	52	
Stone								
3.....	11	1	4	9	11	4	6	7
9.....	10	3	11	1	9	5	4	6
15.....	25	3	4	1	7	1	7	7
21.....	11	2	3	2	7	5	2	5
27.....		3	2	6	2	1	2	3
33.....		x	5	x	2	5	2	2
39.....		x	4	3	2	2	2	2
45.....		1	3	4	5	2		3
51.....		1		8	7	x		4
57.....		3		5	7	x		4
63.....				15	6	3		8
69.....				6	14	2		7
75.....				25	14			19
81.....					13			13
87.....					19			19
93.....					5			5
Pumice								
3.....	5	1	1	2	9	x	0	3
9.....	8	1	1	x	11	1	x	3
15.....	10	x	1	1	10	x	x	3
21.....	7	x	1	0	1	x	x	1
27.....		x	x	x	1	x	0	x
33.....		x	x	x	1	x	0	x
39.....		x	0	x	1	x	0	x
45.....		x	0	0	x	x		x
51.....		x		0	3	x		1
57.....		0		x	x	x		x
63.....				0	x	0		x
69.....				0	x	1		x
75.....				0	x			x
81.....					x			x
87.....					0			0
93.....					x			x
Molluscan shell								
3.....	2	19	12	51	8	2	1	13
9.....	4	20	9	5	9	1	1	7
15.....	2	9	12	16	5	1	2	7
21.....	1	5	8	10	3	1	1	4
27.....		1	5	20	4	1	x	5
33.....		6	7	1	2	2	1	3
39.....		1	15	4	3	1	0	4
45.....		1	2	13	2	2		4
51.....		1		6	1	x		2
57.....		5		6	2	x		3
63.....				7	2	2		4
69.....				4	2	1		2
75.....				3	1			2
81.....					1			1
87.....					3			3
93.....					1			1
Coral								
3.....	2	x	1	2	10	2	0	2
9.....	1	1	1	x	12	2	x	2
15.....	2	1	1	x	14	1	x	3

TABLE 1
(continued)

Constituents (depth in inches)	Site							Average
	19	20	13	14	6	50	52	
Coral (continued)								
21.....	1	1	1	x	26	x	0	4
27.....		x	1	1	31	x	0	6
33.....		1	2	x	9	8	0	3
39.....		1	45	3	24	x	0	12
45.....		2	2	21	25	3		11
51.....		x		17	31	x		12
57.....		4		19	35	x		15
63.....				17	26	1		15
69.....				12	24	3		13
75.....				9	14			11
81.....					28			28
87.....					19			19
93.....					13			13
Residue								
3.....	80	78	81	34	61	92	93	74
9.....	77	74	79	94	59	91	94	81
15.....	57	86	83	82	65	98	91	80
21.....	79	91	87	87	63	94	96	85
27.....		91	91	73	63	98	98	86
33.....		93	84	99	86	86	95	90
39.....		98	36	90	70	97	98	81
45.....		95	93	63	68	94		83
51.....		97		68	57	100		80
57.....		78		70	55	100		76
63.....				61	65	96		74
69.....				78	60	94		77
75.....				63	71			67
81.....					58			58
87.....					59			59
93.....					80			80

TABLE 2

Composition of Site 19 by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall A5-A6			Wall A8-B8			Wall A11-B11			Wall A22-B22				Wall A25-B25				Wall A43-A44			
	3	9	15	3	9	15	3	9	15	3	9	15	21	3	9	15	21	3	9	15	21
Stone.....	18	19	56	21	15	62	17	20	11	7	4	6	24	2	4	10	8	1	1	2	1
Pumice.....	2	4	2	5	5	1	9	11	10	6	13	16	21	5	11	18	1	2	5	13	x
Coral	3	1	5	2	1	2	3	1	x	x	x		1	1	x	x	4	x	x		
Charcoal				x			x			x	x		x		x						
Mollusk	2	2	2	2	2	1	2	4	1	3	2	3	1	2	8	2	1	1	5	5	x
Decapod	x	x	x	x		x	x	1	x	1	x		x	x		x					
Marginopora ..		x	x			x						x	x				x				x
Fish bone.....								x				x						x			
Potsherds																1					
Residue	74	75	36	71	77	34	69	64	77	83	80	75	53	90	76	70	86	96	88	80	98

TABLE 3

Composition of Site 20 by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall B2-B3						Wall B12-B13									Wall B22-B23									
	3	9	15	21	27	33	3	9	15	21	27	33	39	45	51	3	9	15	21	27	33	39	45	51	57
Stone	1	2	3	x	x	x	1	6	2	2	9	x	x	1	x		4	4	3	1	1	x	x	2	3
Pumice	1	x	x	x	x	x	1	1		x		x	x	x	x		1		x	x	x	1			
Coral	x	1	x	1	x	1	x		x	x		1	2	3	x	x	1	4	x			x	2	x	12
Charcoal		x	x		x			x		x	x	x	x	x			x	x	x	x					
Mollusk	13	28	2	x	x	1	21	20	17	5	3	1	1	1	1	22	11	8	10		15	x	2	2	5
Decapod		x	x			x	x	x	3		x					x	x		1	x				x	
Marginopora	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x			x		x	x	x
Fish bone	x	x	x			x		x	x	x	x					x	x	x	x	x					x
Potsherds	x	2					2	x	x		1					1		1	3						
Residue	84	66	95	98	99	97	74	72	79	92	87	99	97	94	99	77	84	84	83	87	84	99	96	96	78

TABLE 4

Composition of Site 48, by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall C7-C8							
	3	9	15	21	27	33	39	45
Stone	8	3	3	10	40	12	14	20
Pumice				2	x	x	x	x
Coral					x		x	x
Charcoal	x	x	x		x	x	x	x
Vegetable matter	x	x						
Mollusk	59	69	69	55	35	48	21	15
Decapod							x	x
Fish bone		x	x	x		x		x
Other bone					x			
Residue	32	28	28	33	25	39	65	64

TABLE 5

Composition of Site 13, by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall C2-D2								Wall A1-B1 (location A)						Wall C1-D- (location A)				
	3	9	15	21	27	33	39	45	3	9	15	21	27	33	3	9	15	21	27
Stone	x	1	3	1	4	5	4	3	10	28	5	5	1	6	5	4	4	2	x
Pumice					x	x			1	x	1	1	x	x	x	1	x	x	x
Coral		x			3	4	45	2	1	x	x	x	x	x	x	1	1	1	x
Charcoal					x	x								x					
Mollusk	x	x	1	1	14	9	15	2	30	21	28	18	1	5	7	5	7	6	1
Decapod						x			x	x		x							
Marginopora														x				x	
Fish bone						x			x		x	x				x			
Potsherds		x	x		3	1			2	1	1	3			1	x	x	x	
Residue	99	98	96	98	76	80	36	93	57	50	64	73	98	89	87	89	89	91	99

TABLE 6

Composition of Site 14, by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall C2-D2												
	3	9	15	21	27	33	39	45	51	57	63	69	75
Stone	9	1	1	2	6	x	3	4	8	5	15	6	25
Pumice	2	x	1		x	x	x			x			
Coral	2	x	x	x	1	x	3	21	17	19	17	12	9
Charcoal					x	x							
Mollusk	51	5	16	10	20	1	4	13	6	6	7	4	3
Decapod	x			x	x								
Fish bone	x			x	x	x	x	x		x	x		
Potsherds	1	x	x	1				x	x	x			
Residue	34	94	82	87	73	99	90	63	68	70	61	78	63

TABLE 7

Composition of Site 26: Percentages of Weight

(x, less than 1/2 of 1 per cent)

Depth	Stone	Pumice	Coral	Charcoal	Vegetable matter	Mollusk	Decapod	Marginopora	Fish bone	Other bone	Potsherds	Other artifacts	Residue
Wall A1-A2 (A)*													
3 in.	7	x		x		25	x	x	x		1		67
9 in.	9		x	x		17	x		x		3		70
15 in.	5					10	x		x				85
Wall A10-A11 (A)													
3 in.	10			x		32	3		1		x		54
9 in.	7	x		x		22	1		x		1		70
Wall A14-A15 (A)													
3 in.	26	x	2	x		11	x	x			1		60
9 in.	4	x		x		16	2		x		4		75
15 in.	9		x	x		15	x		x		1		75
Wall B1-B2 (B)													
3 in.	13		4	x	x	7	x	x	x		1	x	75
9 in.	13			1	x	6	x		x				80
15 in.	1		x	1	x	10	1	x	1				86
21 in.	2	x	x	2	1	45	1		1				48
27 in.	10	x	x	1	x	14	x		x	x			73
33 in.	16		x	x	x	7	x		x				76
39 in.	38		2	x		19							41
Wall B14-B15 (B)													
3 in.	4		x	x		9			x		1	1	85
9 in.	9	1	1	x		7	x	x	x				83
15 in.	18	1	1	x		11	x	x	x		3		67
21 in.	14	1	x	x		21	x	x	x				63
27 in.	19		x	x		7	x		x				73
33 in.	29	x	x	x		15	x		x		2		54
Wall D4-E4 (B)													
3 in.	8	x	x	x		8	x	x	x				83
9 in.	11	x	x	x	x	9	x		x	x		x	79

*Capital letters in parentheses indicate Location A, Location B, Location C.

TABLE 7
(continued)

Depth	Stone	Pumice	Coral	Charcoal	Vegetable matter	Mollusk	Decapod	Marginopora	Fish bone	Other bone	Potsherds	Other artifacts	Residue
Wall D4-E4 (B)													
15 in.	17	x	1	x		11	x		x		1	x	69
21 in.	11			x		10	x	x	x		x		79
27 in.	12	x		x		13	x	x		x	x		74
33 in.	20	x	x	x		11	x	x	x	x	x		67
39 in.	15		1	x		12	x	x			1		71
Wall A4-A5 (C)													
3 in.	6			x		49	1		x				44
9 in.	2			x		62	2	x	x		x		34
15 in.	10		x	x		24	x		x		5		61
21 in.	7			x		28	x		x		1		64
27 in.	11					1	x						88
33 in.	30												70

TABLE 8

Composition of Site 44: Percentages of Weight

(x, less than 1/2 of 1 per cent)

Depth	Stone	Coral	Charcoal	Vegetable matter	Mollusk	Decapod	Fish bone	Potsherds	Other artifacts	Residue
Wall A6-B6 (A)*										
3 in.	37		x					3		60
9 in.	23									77
15 in.	22							4		75
Wall B11-B12 (A)										
3 in.	19							2		80
9 in.	7									93
15 in.	12									88
21 in.	3									97
Wall A1-B1 (C)										
3 in.	12	x	x	x	x	x	x		x	88
9 in.	8		x							93
15 in.	16									84
Wall B1-C1 (B)										
3 in.	9		1		16				x	75
9 in.	x		x					x		100
15 in.	x		x							100
21 in.										100
27 in.										100
33 in.										100
39 in.										100
45 in.										100
51 in.										100
57 in.										100
Wall A3-A4 (B)										
3 in.	44	x	1	x	7	x	x		x	47
9 in.	8	x	2	x	12	x		1		77
15 in.							x			100

*Capital letters in parentheses indicate Location A, Location B, Location C.

TABLE 8
(continued)

Depth	Stone	Coral	Charcoal	Vegetable matter	Mollusk	Decapod	Fish bone	Potsherds	Other artifacts	Residue
Wall A3-A4 (B)										
21 in.	x									100
27 in.	x									100
33 in.										100
39 in.										100

TABLE 9

Composition of Site 6: Percentages of Weight

(x, less than 1/2 of 1 per cent)

Depth	Stone	Pumice	Coral	Charcoal	Vegetable matter	Mollusk	Decapod	Margin-opora	Potsherds	Other artifacts	Residue
Wall A11-B11											
3 in.	6	15	10	x		13			x		56
9 in.	5	16	8	x	x	12					59
15 in.	7	12	19	x		1					61
21 in.	7	x	32			3					58
27 in.	2	1	17	x		4					76
33 in.	1	x	21	x		4		x			73
39 in.	3	1	9	x		1					86
45 in.	2	x	6			1					91
51 in.	1	7	18	x		1					73
57 in.	5	x	27			4					64
63 in.	5	x	38			4					53
Wall N1-N2											
3 in.	13	10	10	x		8			x	x	57
9 in.	4	12	15	x		11	x				57
15 in.	10	14	11	x		11	x		x		54
21 in.	10	x	32	x		3					55
27 in.	1	1	20	x		5			1		73
33 in.	2	4	4			1					89
39 in.	2	1	26			2					69
45 in.	5	x	19	x		3		x			73
Wall A6-B6 (A)*											
3 in.	14	3	10			3					71
9 in.	19	4	14			3					60
15 in.	3	3	11			2					81
21 in.	3	3	15			2					77
27 in.	2	x	56	x		2					39
33 in.	3	x	1			x					96
39 in.	2	x	37			6					55
45 in.	7	x	50			2		x			40
51 in.	14	x	44	x		1					41
57 in.	8	x	44			1		x			46
63 in.	7	x	14			1					78
69 in.	14	x	24			2					60
75 in.	14	x	14			1					71
81 in.	13	x	28			1					58
87 in.	19		19			3					59
93 in.	5	x	13			1					80

*Capital letters in parentheses indicate Location A, Location B, Location C.

TABLE 10

Composition of Site 50, by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall B1-B2												Wall X1-X2											
	3	9	15	21	27	33	39	45	51	57	63	69	3	9	15	21	27	33	39	45	51	57	63	69
Stone	7	9	1	6	x	1	3	3	x	x	6	2	1	1	x	5	1	9	x	1	x	x	x	2
Pumice	x	1	x	x	x	x	x					x	x	x	x	x	x	x	1	x	x	x		1
Coral	2	3	1	x	x	x	x	2	x	x	1	4	1	x	x	x	1	15	x	4	x		x	1
Charcoal	x	x	x	x	x	x					x	x	x	x				x			x		x	x
Mollusk	2	1	1	1	x	1	1	3	x	x	1	1	1	1	x	x	1	2	1	x	x	x	2	1
Decapod				x		x							x											
Fish bone		x		x			x					x	x			x		x						
Other bone	x		x								x			x										
Potsherds	2	x		x									x	1			x							x
Other artifacts	x																							
Residue	88	86	97	93	99	98	96	92	99	99	93	93	97	96	99	95	97	74	98	95	100	100	98	94

TABLE 11

Composition of Site 52, by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall C7-D7 (2 samples)										
	3	9	15	21	27	33	39	3	9	15	21
Stone	7	5	14	5	2	2	2	5	3	x	x
Pumice			x	x					x	x	
Coral		x	x								
Charcoal	x	x	x	x	x	x		x	x	x	
Vegetable matter									x	x	
Mollusk	x	1	4	1	x	1		2	1	x	
Decapod				x	x				x		
Fish bone		x			x	x					
Other bone		x	x								
Potsherds	x	x	1					x	1		
Other artifacts	x										
Residue	93	94	82	93	98	95	98	93	95	100	100

TABLE 12

Composition of Site 51, by Depth (in.): Percentages of Weight

(x, less than 1/2 of 1 per cent)

Constituents	Wall A1-B1							Wall B15-B16										
	3	9	15	21	27	33	39	3	9	15	21	27	33	39	45	51	57	63	69
Stone	5	12	9	21	12	4	2	11	11	4	1	9	8	7	10	15	1	x	x
Charcoal	x	x	x						x										
Vegetable matter	x	x						x											
Mollusk	7	1			x		x	x											
Decapod	x																		
Fish bone	x		x																
Other bone	x																		
Potsherds		x	1	1				x											
Residue	88	87	90	79	88	96	98	89	89	96	99	91	92	93	90	85	99	100	100

NATURAL HISTORY SPECIMENS

We now turn from the analysis of the midden deposit samples to examination of the specimens obtained by screening the excavated material in the field. These fall into two general categories: natural history specimens and artifacts, that is, man-made objects.

UNWORKED BONE

All bone from the eleven excavated sites was saved from the screenings, as a clue to the protein portion of the diet of the early New Caledonians. The total weight of fish bones is 5,651.81 gm.; the total weight of bones of other vertebrates, including mammals introduced by Europeans, is 4,315.62 gm.

Although fish bones totaled 5,651.81 gm. in weight, some sites yielded surprisingly little, e.g., site 6, a seaside site, yielded only 1.93 gm. in 1,791 cu. ft. of screened deposit. Table 13 gives the distribution by weight and depth in the eleven excavated sites.

In Viti Levu the fish-bone yield was slightly more than 1 gm. (1.08 gm.) to the cubic foot, in New Caledonia about 0.75 gm. to the cubic foot. Whether this represents a true cultural difference in the use of fishes as food in Fiji and New Caledonia, or whether it is a fortuitous factor of excavation, or whether the reported practice of burning fish bones is the cause of the smaller New Caledonian yield are questions which we cannot answer with any assurance.

At site 17, location B, in Viti Levu, fish bone was found down to 126 in. In New Caledonia the deepest occurrence was 60 in. at site 14, where no other kind of bone occurred. This may give some support to the statement by one of the workmen that site 14 was used only as a fishing village. The deepest mammal bone was at 54 in. in site 20.

At sites where there are any appreciable amounts of fish bone, the largest quantity is in the top levels and the amount decreases with depth, except at site 14, where the greatest amount was found at medium levels, i.e., 18-24 in. and 24-30 in. The significance of this is not fully clear; possibly it indicates more fishing activity at the particular time of deposition at those levels.

The problem of protein constituents in the aboriginal diet is puzzling, what with the uneven distribution of fish bones in the middens and the absence of domestic animals, except chickens, before European contact. It would seem that mollusks and, to a less extent, decapods must have been the principal sources of protein. Only at site 26 are fish bones and decapod fragments abundant.

The occurrence of bones of other vertebrates is shown in tables 15, 16, and 17. The first of these includes unidentified bone. Table 16 presents species which are assumed to be precolonial, though obviously some of the bird bones may prove to be those of chickens introduced by colonists; chickens were already present in Cook's day (1774). Table 17 presents data on species first introduced by colonists. It is remarkable that no dog bones were unearthed. Deer bone and antler represent an introduced East Indian species, concerning which H. P. Schmidt writes as follows (1944, pp. 82-83):

> About 1867, Rear-Admiral Guillain, who was Governor of New Caledonia, introduced one stag and two does of the Axis species (the hog-deer of India) from the Dutch East Indies, and placed them at the Yahoue Experimental Farm, five miles from Nouméa. A few years later they were let loose with their offspring. They multiplied so well that in 1941 forty-two thousand skins were exported, the yearly average being about 20,000.

Omitted from the bone tables are three species of lizards and one snake, probably the sea snake, represented by a vertebra: gecko, Rhacodactylus, site 26, 0-6 in.; skink, probably Riopa, site 20, 18-24 in.; small skink, site 20, 24-30 in.; sea snake (perhaps Paleophidae), site 20, 24-30 in. Sea snakes are reported as food for man in Hainan Island (Irvine, 1954, pp. 183, 185).

Archaeological evidence of cannibalism in New Caledonia is scanty, compared with that for Fiji. In Fiji, 146 lots of human bone fragments, apparently not from burials, were obtained from 2,880 cu. ft. of screened midden material, whereas in New Caledonia only 22 lots were obtained from 7,641 cu. ft. of screened deposits. In Fiji the deepest occurrence of human bone fragments was at 120 in. (Gifford, 1951, p. 212), in New Caledonia at 42 in. That these figures are to be interpreted as indicating the precise relative frequency and relative age of cannibalism in the two countries is open to question, since some special disposal of the bones in New Caledonia may have reduced the number to be found in middens. Thus, there may have been special places, other than village sites, for eating human flesh, as is exemplified in the account of our visit to Touaourou, site 39 (App. I).

Before the arrival of Europeans the only mammals in New Caledonia seem to have been bats and the "Polynesian" rat (Rattus exulans). Dr. David H. Johnson, Curator of the Division of Mammals, United States National Museum, kindly identified the bones of rats which we obtained in the course of excavation. He writes as follows under date of September 10, 1954.

> As was to be expected, the little "Polynesian" rat, Rattus exulans, predominates in this material. Of the three species of rats in New Caledonia, exulans has the longest history. Of the two larger species that arrived relatively recently, R. rattus is now most abundant and widely distributed on the island, but all of the identifiable specimens in your material prove to be R. norvegicus. There may be a significant habitat difference here, because R. rattus is primarily arboreal, whereas R. norvegicus is a good burrower.

The distribution of Rattus norvegicus is shown in table 17. Rattus exulans bones were found only in three west coast sites as follows: site 19, 0-6 in.; site 20, 0-6 to 30-36 in.; site 26, 0-6 to 24-30 in. It is of interest that only Rattus exulans was found in site 20, which may indicate that this site was abandoned by the aborigines before Europeans arrived, although there is now a farmhouse at this spot. In sites 19 and 26 Rattus norvegicus as well as exulans was found. The significance of the absence of all

rat bones from sites 13, 14, 6, 52, and 51 is not clear.

Turtle bones were found in all the excavated sites except site 14. Table 16 shows the range in depth to be down to 48 in. According to Mr. Joseph R. Slevin, of the California Academy of Sciences, the bones recovered are probably from both the Green Turtle (Chelonia mydas) and the Loggerhead Turtle (Caretta caretta).

Table 17 shows the distribution of bones of mammals introduced into New Caledonia by Europeans. The unusually deep occurrence of certain fragments in sites 20 and 26 is difficult to understand but may be explained at site 20 by the disturbance of the deposit, perhaps by colonial building operations, and at site 26 by native excavation. The deer, although introduced by the colonists, is not domesticated. No bones of introduced mammals were found in sites 13, 14, and 6.

The bird bones obtained by excavation were forwarded to Dr. Alexander Wetmore, of the Smithsonian Institution, who kindly consented to study them. The fragments were mostly too small for identification, but out of the lot nine specimens comprising six species were identified as follows.

Pterodroma leucoptera, Gadfly Petrel. 15546, site 20, 24-30 in. As this is a pelagic species, we suspect that the individual represented may have been washed ashore dead.

Gallus gallus, Domestic Fowl. 15274, site 19, 0-6 in.; 16132, site 26, 0-6 in. These are from presently occupied sites and are probably bones of modern varieties of chickens introduced by the French, rather than of the aboriginal variety present in Captain Cook's day.

Rallus philippensis, Wood Rail. 15533, site 20, 18-24 in.

Porphyrio poliocephalus, Purple Swamphen. 15574, site 20, 30-36 in.; 16538, site 51, 6-12 in.

Thalasseus bergii, Crested Tern. 16565, site 52, 6-12 in.

Tyto alba, Barn Owl. 16160 and 16147, site 26, 6-12 and 12-18 in., respectively.

Dr. Henry W. Fowler, of the Academy of Natural Sciences of Philadelphia, kindly undertook the examination of the bones of fishes recovered in our excavations. Many could not be identified while for others only family or genus could be determined. Of the fourteen species identified Dr. Fowler writes as follows, under date of November 29, 1954.

In answer to your question about the occurrence of the identified species of fishes which I gave you, concerning New Caledonia, I find the following not to have been reported:

Labridae
- Semicossyphus reticulatus (Valenciennes)
- Hemigymnus fasciatus (Bloch)
- Hemigymnus melapterus (Bloch)
- Hologymnosus semidiscus (Lacepède)
- Novaculichthys macrolepidotus (Bloch)

Scaridae
- Calotomus coeruleo-punctatus (Rueppel)
- Calotomus spinidens (Quoy & Gaimard)

Teraponidae
- Terapon puta Cuvier

Myliobatidae
- Aëtobatus narinari (Euphrasen)

The following are noteworthy:

Labridae
- Cheilinus fasciatus (Bloch). Known from New Caledonia by an unidentified specimen of Julis, reported by Jouan in 1861.

Scombridae
- Scomber japonicus Houttuyn? Reported as Scomber sp. and as S. uam, by Jouan in 1881.

Diodontidae
- Diodon hystrix Linnaeus. Reported as D. atinga Bloch by Jouan in 1863 (misidentification).

Galeorhimidae
- Galeolamna melanoptera (Quoy & Gaimard). Reported by Jouan in 1861.

Galaxiidae
- Galaxias neo-caledonicus Weber & Beaufort 1913.

The distribution of identified fishes by site and depth is given in table 14. Fish bones were most abundant at site 26, next in abundance at site 20, and scarce or absent in other sites.

DECAPODS

Decapod shell fragments, chiefly crab with occasional lobster, were very abundant at site 26. Out of a total of 6,550.33 gm. excavated in various sites, 6,368.61 gm. came from site 26, the modern village of Oundjo.

Sites 13 and 52 yielded none whatever. The amounts found in various sites are shown in table 18. In view of their relatively scanty occurrence except at site 26, it appears that decapods did not play too important a part in the ancient dietary. The location of sites may be a factor; for example, site 26 fronts on a vast expanse of shallow water teeming with marine life, site 6 on a coast with only a narrow coral shelf, which drops off abruptly into deep water.

Identification of fragments of decapod shells was kindly undertaken by Dr. J. M. Remy, Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris. He has supplied a technical paper on our material (App. III), which gives the distribution of species by levels and breaks down the distribution figures for the separate locations we dug at two sites: site 26, locations A, B, C; site 44, locations A and B.

MOLLUSKS

Molluscan shell was the most abundant material representing life forms in the kitchen middens (tables 19-31). The species found were identified by Drs. W. K. Emerson, G. D. Hanna, and L. G. Hertlein, the last-named identifying most of them. In listing the species we have taken some liberties: thus, where the malacologists have listed "cf." and the name of the probable species, we have omitted the notation "cf."; for example, "Chama cf. C. nivalis Reeve," we have listed as Chama nivalis. We have included Nautilus with the univalves, although it is not a gastropod.

The species of identified mollusks from the eleven excavated sites total 255 (see table 19). The following lists present bivalves first, univalves second. The six sites listed first (19, 20, 48, 13, 14, 26) are on the west coast; the remaining five sites (44, 6, 50, 52, 51) are on the east coast. The six west coast sites yielded 173 species,

east coast. The six west coast sites yielded 173 species, the five east coast sites 222 species. The east coast was only slightly richer than the west coast in bivalve species, the counts being 68 species for the east coast, 64 for the west coast; but for univalves the east coast was far richer, having 154 species as against the west coast 109 species. Whether these differences are environmental or cultural or both is not apparent. We screened 3,600 cu. ft. of deposit on the west coast and 4,041 cu. ft. on the east coast. Two east coast sites (sites 6 and 50) were dug deeper (90 and 96 in.) than any west coast site (78 in. in site 14), yet only two species (in site 6) were limited to depths below 78 in. This would seem to argue against any environmental or food-habit change during the period of man's occupancy. The one probable exception to this statement is site 48, for which see the discussion of its mollusks beyond.

We can only surmise that all the bivalves and all the larger univalves were used for food. On one occasion, a native woman brought us a large quantity of fresh Strombus canarium shells; she and her family had eaten the animals after boiling. Probably the use of mollusks for food was similar in Fiji and New Caledonia. Large shells with relatively small animals, such as Oliva and Conus, were probably so used. Thus in Fiji we were one day presented with the shells of several Oliva erythrostoma which had been boiled and the animals eaten. Even small univalves of the genus Cerithium were probably eaten, if we may judge by Californian analogy, where in the San Francisco Bay region the related Cerithidea were consumed in vast numbers; to say nothing of other small univalves, e.g., the genus Tegula.

However, if one may judge by relative weights, the Californian aborigines depended more than the New Caledonians and Fijians on mollusks, although these Melanesian peoples were also kitchen-midden dwellers. Unfortunately, there are no data concerning the proportions of protein and carbohydrate constituents in these aboriginal diets. In Californian middens shells averaged 52 per cent by weight (Gifford, 1916, p. 15), in Fijian mounds 13 per cent (Gifford, 1949, pp. 223-224), and in New Caledonian mounds 9 per cent. Can this marked difference between Californian and Melanesian middens represent the contrast between the hunting-gathering economy of the Californians and the farming-fishing economy of the Melanesians?

Site 19.—The inventory of 78 molluscan species found in site 19 is given in table 20. The 0-6 in. blocks yielded 54 species; most of the blocks were dug to this depth. The 6-12 in. blocks produced 48 species; the 12-18 in. blocks 50 species. The 18-24 in. blocks, however, yielded only 23 species. Fewer blocks were dug to this depth, only 4 blocks being excavated as against 37 blocks at the 0-6 in. level. The fact that less than half the species found at the site were encountered in the 18-24 in. blocks is probably explained by insufficient digging at that level. In other words, we have no reason to suppose that certain species were absent from the region in the earliest period of the growth of the site, and appeared later. Eulota similaris, the coffee snail, is an introduced species. Curiously enough, we did not obtain this species at site 44, which is planted to coffee.

Site 20.—Fifty per cent more molluscan species were found in site 20 than in site 19 (cf. tables 20 and 21). The limited depth distribution of certain species in the following list may be due to their rarity. The complete distribution of other species from the surface to the bottom (or nearly to the bottom) of the cultural deposit probably indicates both abundance and use throughout the occupancy of the site. In this site the upper 30 in. yielded 101 species, whereas only 76 were recorded for the lower 30 in. This difference may be due in part to accident and in part to the smaller amount of deposit dug and screened from below 30 in.

Site 48.—The scant inventory of 22 species in site 48 (table 22) is perhaps due to the unusual locale of the site, probably a temporary camp, where the deposit had accumulated on a rocky outcrop in the middle of a mangrove swamp. Perhaps our limited excavation of only one day is partly responsible for the small number of species found; but this is unlikely, since a single day's excavation at site 52 yielded 54 species. The mangrove swamp surrounding site 48 was a bountiful source of oysters (Ostrea), by far the most numerous molluscan species. The increase in the number of Arca scapha shells in the lower levels may indicate an environmental change during man's use of the islet. This increase also suggests that more sandy beach and less mud were exposed in earlier times and that there was then less mangrove swamp than today. This assumption was corroborated, as we dug deeper, by the decrease in the number of Potamides semitrisulcatus, a species which lives on the mud in mangrove swamps and is eaten by the modern aborigines.

Site 13.—This ancient site, with an abundance of a unique type of decorated pottery, yielded a fair number of molluscan species, 74 in all. Although the pottery is unusual, there is nothing noteworthy about the assemblage of molluscan species (see table 23).

To obtain some indication of the relative frequency of the various kinds of shells found in the New Caledonian shell middens, all shell was saved from rectangle C1-2 D1-2, in the first location dug at site 13. These specimens have been identified and counted and the frequency by species is shown in table 24. Of the 58 different genera and species present in the various levels of this rectangle, Arca scapha and Gafrarium tumidum were present in really large quantities, which indicates that they were probably used as food by man. Fewer, yet not insignificant, numbers of Cerithium moniliferum, Chama nivalis, Donax tinctus, Mesodesma glabratum, Ostrea commercialis, Ostrea gradiva, and Potamides semitrisulcatus indicate that they also were useful to man as food. The count for bivalves should be halved, since each individual mollusk is composed of two valves; it is assumed that both valves are present in our material.

The heaviest concentration of species was found consistently in the 24- and 30-in. levels. This would seem to indicate that the site was most intensively occupied at the period when the deposits at these levels were laid down, a period determined by carbon 14 dating as approximately the sixth century B. C.

Site 14.—Seventy-one species were identified from this site, which native informants said was a fishing site in recent times. Fish bone and molluscan shell were more abundant here than at site 13 a mile away, as an examination of tables 13, 24, and 25 will show.

Site 26.—The occupants of the thriving village of Oundjo daily exploit the shallow waters which stretch on two sides of the promontory on which the village is situated. Ninety-nine molluscan species were identified in the midden material dug here (table 26), apparently an indication of the thoroughness of the exploitation, as were also the vast quantities of fish and decapod remains (see tables 13 and 18). This village was also a center of manufacture of shell bead money and shell rings, both made from species of Conus.

Site 44.—In spite of its distance from the sea this island site yielded 70 molluscan species (see table 27). The species were mostly of marine derivation, Cyrena and Placostylus being the exceptions. These, however, were no more abundant here than in other sites.

Site 6.—This site yielded 168 molluscan species (table 28), the largest number from any site. Also the largest amount of deposit was screened here, 1,791 cu. ft. Examination of the table, however, reveals only 3 species limited to the lower levels, hence the large amount of material screened does not alone account for the large number of species. Apparently mollusks were readily available at this coastal site, though this was not true of fishes or decapods, to judge by their scarcity in the middens (see tables 13 and 18).

Site 50.—This site, on the curving sheltered shore of Tiouandé Bay, yielded an early radiocarbon date, 73 A.D., and 156 molluscan species (see table 29). Its situation at the mouth of the Tiouandé River may have been partly responsible for the abundance of species, 54 of which were bivalves.

Site 52.—A single day's dig at this site yielded 54 molluscan species, 17 of which are bivalves (see table 30). The deposit was shallow and the concentration of shell species was in the upper 12 in. There was no species peculiar to this site.

Site 51.—This inland site, situated like site 44 on a stream bank, was also like it in having a molluscan inventory composed almost entirely of marine species (see table 31).

ECHINODERMS

Echinoderm fragments, mostly spines, were rare and came from only three sites: 20 and 26 on the west coast and 6 on the east coast. All were kindly identified by Professor J. Wyatt Durham.

Site 6 yielded only Phyllacanthus imperialis, from levels ranging from surface to 90 in. From the west coast we obtained this species only at 42-48 in. in site 26.

Site 26 did yield, however, a few spines of Heterocentrotus mammillatus, from surface down to the 24-in. depth. From site 20 we obtained spines of this species from the 0-6 in. and 6-12 in. levels.

From site 20, depth 54-60 in., comes our only example of Laganum depressum.

Possibly some sea urchin spines were used as tools, but we have no proof of this. The rounded distal ends of some spines could have been used to press into soft clay to make the nubbins on some relief-decorated pottery. There is also the possibility of the use of sea urchin spines as files; for instance, in working Conus literatus shell.

CORALS

We list the species of corals which our explorations yielded, although these probably have little or no cultural significance. They have been kindly identified by Professors John W. Wells and J. Wyatt Durham. For most of the specimens only the genus could be determined. All, except one specimen of Fungia from the surface at site 47, were excavated specimens. We did not save coral specimens systematically, so the list for any one site is probably incomplete.

For the most part, the presence of coral in the middens at beaches can doubtless be attributed to beach debris. Anciently, calcined coral may have been used for bleaching the hair as was done in Fiji, Tonga, and Samoa; the practice is recorded by Sarasin for New Caledonia (Sarasin, 1916-1922, pp. 43-44; 1929, pp. 160-161).

From site 26 a considerable number of pieces of the calcareous axis of the alcyonarian coral Melitodes ochracea (Linnaeus) was obtained at various levels from the 0-6 in. block to the 30-36 in. block. Professor John W. Wells wrote on February 21, 1953:

> These are the axis joints, covered by the fleshy part in life and forming large branching colonies in shallow water. Alive, the colony is a brilliant yellow-vermilion-iron red color, and these axial pieces mostly retain their coral-red color. The species is known as the Red King Coral. Did it have some ceremonial or decorative value in this instance?

This species was collected at one other site: site 20, 0-6 in.

Other corals occur as follows:

Site 19: 0-6 in., Cyphastrea, Galaxea.

Site 20: 0-6 in., Poirtes; 6-12 inches, Porites; 12-18 inches, Goniostrea, Porites; 18-24 in., Acropora, Porites; 24-30 in., Porites; 54-60 in., Montipora.

Site 13: 0-6 in., Acropora, Goniastrea, Monipora; 6-12 in., Acropora, Montipora; 12-18 in., Montipora; 18-24 in., Acropora, Fungia, Montipora; 24-30 in., Acropora, Fungia, Montipora, Pavona; 30-36 in., Acropora, Fungia, Montipora; 36-42 in., Acropora, Montipora; 42-48 in., Acropora, Montipora.

Site 14: 24-30 in., Fungia, Pocillopora.

Site 26: 0-6 in., Acropora, coralline algae, Porites, Seriatopora; 6-12 in., Porites; 12-18 in., Montipora, Porites; 18-24 in., Goniastrea, Montipora, Porites; 24-30 in., Acropora, Montipora; 30-36 in., Acropora.

Site 44: 0-6 in., Acropora, Montipora, Platygyra stricta (?), Porites; 6-12 in., Montipora, Porites.

Site 6: 0-6 in., Acropora, Astreopora (?), Favia (?), Pachyseris, Platygyra stricta (?), Polyastra, Porites, Stylophora; 6-12 in., agaricid (?) coral, Caulastrea, Cladangia, Montipora, Platygyra, Porites; 12-18 in., Acropora, Montipora, Pachyseris, Pocillopora, Porites, Stylophora; 18-24 in., Acropora, Montipora, Platygyra; 24-30 in., Acropora, Montipora; 30-36 in., Acropora, Caulastrea, Favia, Montipora (?), Pocillopora (?); 36-42 in., Acropora, Caulastrea, coralline algae, Fungia, Montipora, Pachyseris, Platygyra, Stylophora, Symphyllia; 42-48 in., Caulastrea, Favia, Fungia, Millepora, Montipora, Pocillopora, Porites, Stylophora; 48-54 in., Caulastrea; 54-60 in., Acropora, Fungia, Pachyseris, Pocillopora; 72-78 in., Acropora; 84-90 in., Acropora; 90-96 in., Pocillopora.

Site 50: 0-6 in., Symplastrea; 6-12 in., Acropora; 18-24 in., Fungia; 30-36 in., Pachyseris, Porites; 36-42 in., Stylophora.

The possibility of pieces of coral being used as files should be noted, although none such was identified. It is conceivable that pieces could be so used in the manufacture of shell artifacts, for instance, rings of Conus literatus shell.

BOTANICAL SPECIMENS

Among the botanical material recovered from excavation was a series of fragments of shells of the candlenut,

Aleurites moluccana (L.) Willd.; the same species was excavated in Fiji (Gifford, 1951, p. 219). These were kindly identified by Miss Annetta M. Carter, Herbarium, University of California. Candlenut fragments were recovered from eight of the eleven sites sampled by excavation: sites 20, 13, 26, 44, 6, 50, 51, and 52. They were lacking at sites 19, 48, and 14.

Other botanical specimens are chiefly wood fragments, some being parts of house posts, principally from site 26, location B.

During the course of our excavations we recovered some thirty fragments of wood and bark which we hoped were of sufficient size to make the identification of genera and species possible. Most of these specimens are from site 26, locations B and C, and range in depth from 6 to 30 in.

Several wood specimens have obviously been altered by man; one end of the piece has been sharpened, probably with a stone axe, in order to drive it into the ground. In all probability some of these sharpened stakes or poles were used in some way as house posts. Others may possibly have been used as yam stakes, upon which to train the vines (Leenhardt, 1930, pl. 15, figs. 1 and 4). We observed this practice at several places on the island, including Oundjo, the present occupied village at site 26. Plate 3, d, illustrates one of these sharpened wood fragments from site 26, A1-2 B1-2, 24-30 in.

Professor Robert A. Cockrell, of the Department of Forestry, University of California, very kindly undertook the identification of the wood and bark specimens but the lack of comparative material and the poor condition of most of the wood (some of the specimens were recovered from below the ground-water level at site 26, location B), made identification impossible. However, the presence of both hard and soft wood among the specimens could be ascertained. According to Professor Cockrell, some of the soft wood specimens may be Araucaria, i.e., pine, of which there are several species on the island.

Candlenut fragments were excavated in 8 sites: site 20 (0-6 in.); site 13 (6-12 in., 18-24 in.); site 26 (0-42 in.); site 44 (0-6 in.); site 6 (0-12 in., 24-30 in.); site 50 (6-18 in.); site 52 (0-6 in.); site 51 (0-12 in.).

TABLES 13-31

TABLE 13

Distribution of Fish Bones

(Weight in gm.)

Depth (in.)*	Site										
	19	20	48	13	14	26	44	6	50	52	51
6	14.95	106.82	4.94	14.30		1259.59	12.83		62.91	5.46	15.21
12	0.79	284.59	0.75	1.40	0.50	1339.84	5.59		57.75	3.25	8.40
18	2.19	230.29	0.74	1.86	15.89	1146.44	0.50		7.80	0.95	
24	0.10	102.14	0.21	4.50	31.05	398.96					2.79
30		70.54			82.37	156.10		1.93			
36		39.69		0.61	14.52	102.66					
42		8.79			1.58	14.56					
48		1.46	0.72		0.75						
54		6.83			1.62						
60					0.80						
66											
72											
78											
84											
90											
96											
Total	18.03	851.15	7.36	22.67	149.08	4418.15	18.92	1.93	128.46	9.66	26.40

*Crossbar indicates lowest depth dug.

TABLE 14

Occurrence of Fish Species

Species	Depth (in.)							
	6	12	18	24	30	36	42	54
Site 26								
Aëtobatus narinari (Euphrasen)	x							
Balistes	x		x					
Calotomus coeruleo-punctatus (Rueppel)	x	x						
Calotomus spinidens (Quoy & Gaimard)		x						
Cheilinus fasciatus (Bloch)				x				
Dasyatis						x		
Diodon hystrix Linnaeus	x	x	x		x	x		
Epinephelus	x	x	x	x	x			
Galaxias neo-caledonicus Weber & Beaufort		x						
Galeolamna melanoptera (Quoy & Gaimard)			x					
Hemigymnus fasciatus (Bloch)	x		x	x				
Hemigymnus melapterus (Bloch)		x						
Hemipteronotus	x	x		x				
Labridae	x			x				
Lethrinus	x	x	x	x	x	x		
Naso	x	x	x	x	x			
Novaculichthys macrolepidotus (Bloch)	x	x	x	x		x		
Percoid	x	x	x	x				
Scarus	x	x	x	x	x	x		
Scomber japonicus Houttuyn	x							
Semicossyphus reticulatus (Valenciennes)	x	x						
Sparus	x	x	x	x				
Terapon puta Cuvier	x		x					
Site 20								
Balistes	x							
Diodon hystrix Linnaeus	x	x	x	x				
Epinephelus	x	x	x	x				
Galeolamna melanoptera (Quoy & Gaimard)								x
Halichoeres ?			x			x		

TABLE 14
(continued)

Species	Depth (in.)							
	6	12	18	24	30	36	42	54
Site 20 (continued)								
Hemigymnus melapterus (Bloch)				x				
Hemipteronotus	x							
Hologymnosus semidiscus (Lacepède)	x	x	x	x				
Iniistius ?	x		x	x		x		
Labridae		x		x				
Lethrinus	x	x	x	x		x		
Percoid				x				
Scarus	x	x	x	x	x		x	
Semicossyphus reticulatus (Valenciennes)	x							
Sparus		x						
Taeniura lymma (Forskael)?				x				
Terapon					x			
Site 19								
Semicossyphus reticulatus (Valenciennes)	x							
Site 14								
Lethrinus					x			
Naso						x		
Percoid				x				
Site 44								
Aëtobatus narinari (Euphrasen)	x		x					
Scarus	x	x						
Sparus	x	x						
Terapon puta Cuvier		x						
Site 6								
Hemipteronotus					x			
Site 50								
Lethrinus	x							
Sparus	x		x					
Site 51								
Scarus		x						

TABLE 15

Distribution of Bones of Other Vertebrates

(Weight in gm.; x, less than 1/2 gm.)

Depth (in.)*	Site									
	19	20	48	13	26	44	6	50	52	51
6	112.06	219.96	1.10	8.20	432.06	284.16	11.20	364.66	37.90	91.52
12	0.82	86.56	1.50	2.00	504.86	54.16	x	56.22	0.80	9.52
18	5.44	24.37		3.70	327.50	136.70		25.65		0.30
24		29.09		6.30	562.86			3.30		
30		25.65	199.71	5.04	395.14		126.00	1.70		
36		7.31	0.21	3.50	63.49					
42		0.31			18.44			7.00		
48			2.30							
54		55.35								
60										
66										
72										
78										
84										
90										
96										
Total	118.32	448.60	204.82	28.74	2304.35	475.02	137.20	458.53	38.70	101.34

*Crossbar indicates lowest depth dug.

TABLE 16

Distribution of Bones of Other Vertebrates

Vertebrates	Depth (in.)							
	6	12	18	24	30	36	42	48
Site 19								
Turtle	x							
Bird	x	x	x					
Man	x							
Rattus exulans	x							
Site 20								
Turtle	x	x	x	x				
Bird	x	x	x	x	x	x	x	
Man	x							
Rattus exulans	x	x	x	x	x	x		
Pteropus ornatus	x							
Site 48								
Dugong	x							
Turtle	x	x						x
Man						x		
Site 13								
Turtle	x			x	x	x		
Site 26								
Dugong	x		x	x	x			
Turtle	x	x	x	x	x	x	x	
Bird	x	x	x			x		
Man	x	x	x	x	x	x		
Rattus exulans	x	x	x	x	x			
Pteropus ornatus	x							
Site 44								
Turtle	x	x						
Bird	x	x						
Site 6								
Man				x				
Site 50								
Turtle	x	x	x	x			x	
Bird	x	x						
Man							x	
Seal	x							
Site 52								
Turtle	x							
Bird		x						
Man	x							
Site 51								
Turtle	x	x						
Bird	x	x	x					
Man	x							

TABLE 17

Distribution of Bones of Introduced Mammals

Mammals	Depth (in.)								
	6	12	18	24	30	36	42	48	54
Site 19									
Deer	x								
Cattle	x								
Rattus norvegicus	x								
Site 20									
Pig	x								
Deer	x	x			x				x
Site 48									
Rattus norvegicus					x				
Site 26									
Pig	x	x	x	x	x				
Deer	x			x					
Cattle	x								
Cat	x								
Rattus norvegicus		x							
Site 44									
Pig	x	x							
Cattle	x	x	x						
Goat		x							
Rattus norvegicus	x								
Site 50									
Pig	x								
Deer	x	x							
Cattle	x	x							
Goat	x								
Rattus norvegicus	x								
Site 52									
Goat	x								
Site 51									
Deer	x								

TABLE 18

Occurrence of Decapod Shell

(Weight in gm.)

Depth (in.)*	Site								
	19	20	48	14	26	44	6	50	51
6	8.45	5.76	5.30		1900.20	8.79	1.80	0.25	1.67
12	9.45	43.61			2062.88	0.48	0.69	0.20	
18	4.05	23.35	4.27		1585.55	1.47	0.34		
24	—	11.04	1.50		474.12				
30		23.48			291.50		7.30		
36		9.71		0.50	49.90				
42		4.07	0.51		2.36	—			—
48		1.03	0.85	0.55	1.10				
54		1.25							
60		—							
66									
72									
78				—					
84									
90								—	
96									
Total	21.95	123.30	12.43	1.05	6368.61	10.74	10.13	0.45	1.67

*Crossbar indicates lowest depth dug.

TABLE 19

Distribution of Molluscan Species

Species	Site										
	19	20	48	13	14	26	44	6	50	52	51
Bivalves											
Anodontia edentula Linné									x	x	
Antigona reticulata Linné								x			
Arca aceraea Melvill and Standen	x							x	x		
Arca cruciata Philippi		x			x		x	x	x		
Arca decussata Sowerby		x		x	x			x	x		
Arca imbricata Bruguière	x						x	x	x		
Arca navicularis Bruguière	x	x		x	x			x	x		
Arca nivea Chemnitz		x		x	x		x	x	x		x
Arca passa Iredale						x	x	x	x	x	x
Arca pilula saccula Iredale									x		
Arca protrita Iredale								x			
Arca scapha Meuschen	x	x	x	x	x	x	x	x	x	x	x
Arca tuamotana Maury									x		
Arca velata Sowerby								x			
Asaphis dichotoma Anton	x			x	x	x		x			
Asaphis violascens Forskal							x	x			
Brachidontes subramosus Hanley		x	x			x					
Cardita variegata Bruguière	x							x	x		
Cardium dupuchense Reeve	x	x		x	x	x	x		x	x	
Cardium enode Sowerby		x		x	x	x			x		
Cardium setosum Redfield				x					x		
Cardium whitleyi Iredale									x		
Chama brassica Reeve		x									
Chama imbricata Broderip		x		x	x	x	x	x	x		
Chama lazarus Linné	x	x		x	x			x			
Chama nivalis Reeve	x	x		x	x			x	x	x	
Chama producta Broderip		x			x			x			
Chama spinosa Broderip				x	x		x	x	x	x	
Circe scripta Linné				x	x	x	x				
Codakia tigerina Linné	x	x		x	x	x	x	x	x		
Corbis fimbriata Linné	x	x									
Cyrena caledonica Reeve			x	x		x	x	x	x	x	x
Donax cuneatus Linné									x	x	x
Donax tinctus Gould		x		x				x	x	x	
Gafrarium pectinatum Linné	x	x		x	x	x	x	x	x		x
Gafrarium tumidum Röding	x	x	x	x	x	x	x	x	x	x	x
Gari rossiteri Crosse		x									
Hippopus hippopus Linné				x			x	x	x		x
Isognomon isognomum Linné				x	x	x		x	x		
Lucina argentea Reeve									x		
Lucina edentula Linné		x				x		x	x		
Mactra maculata Chemnitz		x									
Mactra symmetrica Deshayes									x		
Mesodesma glabratum Gmelin	x	x		x	x	x	x	x	x		x
Modiolus agripeta Iredale								x	x		
Modiolus auriculatus Krauss	x	x			x	x		x	x		
Ostrea commercialis Iredale and Roughley			x	x	x	x	x	x	x	x	x
Ostrea gradiva Iredale	x		x	x	x	x					
Ostrea scyphophilla Péron and Lesueur				x			x				
Pecten ellochena Iredale				x							
Pecten janus Montrouzier	x	x			x						
Pecten lividus Lamarck		x			x						
Pecten madreporarum acroporicola Iredale				x							
Pecten pallium Linné						x		x	x		
Pecten radula Linné	x	x		x	x	x	x				
Pecten senatorius Gmelin	x	x		x	x	x		x	x		
Pecten vexillum Reeve		x		x	x						
Periglypta puerpera Linné	x	x		x	x	x	x	x	x	x	x
Pholas australasiae Sowerby									x		

TABLE 19
(continued)

Species	Site										
	19	20	48	13	14	26	44	6	50	52	51
Bivalves (continued)											
Pinctada vulgaris Schumacher	x	x		x	x	x			x		
Pitar ustulatus Reeve		x		x				x	x		
Semele crenulata Sowerby								x			
Septifer bilocularis Linné		x		x	x	x					
Soletellina elongata Lamarck		x			x			x	x		
Soletellina nymphalis Reeve					x				x		
Spondylus ducalis Bolten	x	x		x	x	x		x	x	x	
Tapes caledonica Bernardi				x		x	x		x		x
Tapes literata Linné		x									
Tapes striata Chemnitz						x	x				
Tapes variegata Sowerby		x		x	x		x	x	x	x	x
Tellina discus Hanley		x				x		x	x		
Tellina palatam Martyn		x		x	x	x		x			
Tellina remies Linné					x			x			
Tellina scobinata Linné								x	x		
Tellina virgata Linné	x	x						x	x		
Trapezium angulatum Lamarck		x						x	x	x	x
Tridacna crocea Lamarck								x	x	x	x
Tridacna maxima Bolten	x			x	x	x		x	x	x	x
Tridacna noae Bolten	x	x	x	x	x	x	x	x	x		x
Tridacna squamosa Lamarck	x	x			x	x	x	x	x		x
Venus imbricata Sowerby									x		
Univalves											
Amplustrum amplustre Linné								x			
Architectonica oxytropis A. Adams		x									
Astraea rhodostomus Lamarck	x	x				x	x	x	x	x	
Astraea semicostatum Kiener								x	x	x	x
Astraea stellaris Gmelin	x	x				x	x	x	x	x	x
Atys cylindrica Helbling	x	x				x	x				
Auricula semisculpta A. Adams						x					
Bulla ampulla Linné		x		x	x			x	x		
Bursa bufonia Gmelin								x			
Bursa granifera Lamarck		x						x			
Cantharus undosus Linné							x	x	x	x	x
Cassidula nucleus Martyn			x			x					
Cassis vibex Linné								x			
Cerithium aluco Linné	x	x				x			x		
Cerithium columna Sowerby		x	x	x				x	x		
Cerithium corallinum Sowerby				x		x	x		x		
Cerithium lemniscatum Quoy						x	x	x	x	x	x
Cerithium moniliferum Dufresne	x	x	x	x	x	x	x	x	x		
Cerithium nodulosum Bruguière	x	x			x	x	x	x	x		x
Cerithium obeliscus Bruguière		x						x	x		
Cerithium petrosum Wood								x	x	x	x
Cerithium tuberculatum Linné				x				x	x	x	x
Charonia tritonis Linné		x									
Clanculus maculatus Menke								x			
Clava fasciata Bruguière	x	x				x					
Colubraria maculosa Gmelin								x			
Conus aulicus Linné		x				x					
Conus catus Hwass								x	x		
Conus coronatus Gmelin		x						x			
Conus ebraeus Linné								x	x		
Conus eburneus Hwass				x	x	x			x		
Conus figulinus Linné									x	x	
Conus generalis Linné								x			
Conus gladiator Linné								x	x		
Conus imperialis viridulus Lamarck								x			
Conus literatus Linné		x		x	x	x	x	x	x		

TABLE 19
(continued)

Species	Site										
	19	20	48	13	14	26	44	6	50	52	51
Univalves (continued)											
Conus marmoreus Linné	x				x	x		x			x
Conus miles Linné								x	x		
Conus miliarus Hwass								x			
Conus punctatus Chemnitz								x	x		
Conus quercinus Hwass								x			
Conus striatus Linné									x		
Conus textile Linné								x	x		
Coralliophila cantrainei Montrouzier						x		x			
Cymatium chlorostoma Lamarck		x				x	x	x	x	x	
Cymatium pileare Linné		x				x	x	x	x	x	
Cymatium tuberosum Lamarck		x						x	x	x	
Cypraea annulus Linné	x	x		x	x	x	x	x	x		x
Cypraea arabica Linné								x	x		x
Cypraea argus Linné								x			
Cypraea caput-serpentis Linné								x	x		
Cypraea carneola Linné							x	x	x		
Cypraea caurica Linné						x		x			
Cypraea clandestina Linné	x			x					x		
Cypraea cylindrica Born	x			x	x	x		x			
Cypraea erosa Linné		x			x			x	x		
Cypraea errones Linné	x							x			
Cypraea histrio Meuschen								x			
Cypraea icterina Lamarck	x	x									
Cypraea isabella Linné								x	x		
Cypraea lynx Linné						x		x			
Cypraea moneta Linné	x	x				x		x			
Cypraea nucleus Linné								x			
Cypraea stolida Linné									x		
Cypraea teres Gmelin								x			
Cypraea tigris Linné	x	x		x	x	x		x	x		
Cypraea vitellus Linné		x				x		x			
Dolium cumingii Reeve					x			x	x	x	
Dolium pomum Linné						x		x	x		
Eulota similaris Férrusac	x										
Eunaticina lamarckiana Recluz									x		
Fasciolaria filamentosa Lamarck	x	x		x		x		x			
Fusus nicobaricus Lamarck		x				x		x			
Harpa conoidalis Lamarck									x	x	
Helcioniscus testudinaria Linné							x				
Heliacus dorsuosus Hinds	x										
Hipponix antiquatus Linné	x	x						x	x		
Hipponix australis Quoy and Gaimard	x	x				x	x	x			
Hipponix conicus Schumacher	x					x	x		x		
Iopas sertum Bruguière							x	x	x		
Janthina fragilis Lamarck		x									
Latirus polygonus Reeve								x			
Littorina scabra Linné			x	x	x	x	x	x	x		
Mamilla opaca Recluz		x						x	x		
Melampus fragilis Goss	x										
Melampus trifasciatus Küster						x		x			
Melania gouldiana Reeve		x				x				x	x
Mitra ambigua Swainson		x									
Mitra amphorella Lamarck		x						x			
Mitra carnicolor Reeve									x		
Mitra chrysalis Reeve									x		
Mitra dactyla Linné								x			
Mitra tornata Reeve									x		
Modulus tectum Gmelin									x		
Monodonta canaliferus Lamarck									x		
Murex adustus Lamarck	x	x		x		x	x				

TABLE 19
(continued)

Species	Site										
	19	20	48	13	14	26	44	6	50	52	51
Univalves (continued)											
Murex maurus Broderip									x		
Murex microphyllus Lamarck							x	x	x	x	
Murex ramosus Linné	x	x		x						x	
Murex ternispina Lamarck		x		x	x		x		x	x	
Nassarius albescens Dunker								x	x		
Nassarius pictus Dunker								x	x		
Nassarius suturalis Lamarck		x				x			x		
Nassarius taenius Gmelin						x			x	x	x
Natica chinensis Lamarck						x		x	x		
Natica flemingiana Recluz	x	x			x	x		x	x		
Natica galactites Philippi	x	x					x	x	x	x	x
Natica mamilla Linné	x	x				x	x	x	x	x	
Nautilus macromphalus Sowerby	x					x	x	x			
Nerita albicilla Linné	x	x	x	x	x	x	x	x	x	x	x
Nerita georgina Recluz			x					x			
Nerita planospira Anton						x					
Nerita plicata Linné	x	x	x	x	x	x	x	x	x		
Nerita polita Linné	x	x	x	x	x	x	x	x	x	x	x
Neritina roissyana Recluz									x		x
Neritopsis radula Linné									x		
Oliva elegans Lamarck									x	x	
Oliva erythrostoma Lamarck					x						
Oliva ispidula Linné						x			x		
Parahytida dictyodes Pfeiffer											x
Patella stellaeformis Reeve					x	x		x			
Peristernia incarnata Deshayes								x	x		
Phasianella variegata Lamarck		x									
Placostylus caledonicus Petit								x			
Placostylus duplex nyapagionis Pilsbry						x		x			
Placostylus guestieri Gassies	x	x				x	x	x			
Placostylus porphyrostomus Pfeiffer	x	x	x	x		x		x			
Planaxis sulcatus Born	x	x	x	x	x	x	x	x	x		
Potamides semitrisulcatus Bolten	x		x	x	x	x	x	x	x		x
Pterocera lambis Lamarck	x	x		x	x	x	x	x	x	x	x
Purpura echinata Blainville							x				
Pustularia cicercula Linné								x	x		
Pyramidella maculosa Lamarck	x	x									
Pyrene flava Bruguière		x									
Pyrene versicolor Linné	x	x		x	x			x	x		
Pythia scarabeus Linné							x	x			
Ricinula digitata Lamarck									x		
Ricinula hystrix reeveana Crosse								x			
Sinum incisum Reeve									x		
Siphonaria atra Quoy and Gaimard	x	x						x	x		
Siphonaria depressa Pease	x	x		x	x			x	x		
Sistrum albavoria Küster	x	x			x			x			
Sistrum chaidea Duclos				x			x	x	x	x	
Sistrum margariticola Broderip		x	x			x		x			
Sistrum spectrum Reeve								x	x		
Solidula nitidula Lamarck		x									
Spirula spirula Linné		x				x					
Strombus canarium Linné	x		x	x	x	x	x		x	x	
Strombus epidromus Linné	x	x				x		x	x		x
Strombus floridus Lamarck								x	x	x	x
Strombus gibberulus Linné		x				x		x	x		
Strombus lentigenosus Linné								x	x		
Strombus luhuanus Linné	x	x	x	x	x	x	x	x	x	x	x
Strombus rugosus Sowerby		x				x		x	x		
Strombus succinctus Linné									x		
Terebellum subulatum Lamarck		x									

TABLE 19
(continued)

Species	Site										
	19	20	48	13	14	26	44	6	50	52	51
Univalves (continued)											
Terebra dimidiata Linné		x								x	
Terebra subulata Linné		x								x	
Thais mancinella Linné								x			x
Thais pica Blainville	x	x					x	x	x	x	x
Trochus fenestratus Gmelin	x	x		x		x	x	x	x		x
Trochus maculatus creniferus Kiener								x	x		
Trochus niloticus Linné	x	x	x	x	x	x	x	x	x	x	x
Trochus obeliscus Gmelin	x	x		x	x	x	x	x	x	x	x
Trochus pyramis Born									x		
Turbo chrysostomus Linné		x				x	x	x	x	x	x
Turbo cinerea Born	x	x		x	x		x	x	x	x	
Turbo intercostalis Menke		x				x	x	x	x		x
Turbo petholatus Linné								x	x		x
Turbo setosus Gmelin	x	x		x	x	x	x	x	x	x	x
Turbo ticaonicus Reeve		x		x			x		x		
Urosalpinx paivae Crosse	x				x	x		x			
Vanikoro cancellata Lamarck								x			
Vasum turbinellum Linné	x	x				x	x	x	x	x	

TABLE 20

Molluscan Species in Site 19

Species	Depth (in.)			
	6	12	18	24
Bivalves				
Arca aceraea Melvill and Standen	x	x	x	
Arca imbricata avellana Lamarck	x			
Arca navicularis Bruguière			x	
Arca scapha Meuschen	x	x	x	x
Asaphis dichotoma Anton	x	x	x	x
Cardita variegata Bruguière			x	
Cardium dupuchense Reeve			x	x
Chama lazarus Linné			x	
Chama nivalis Reeve	x	x	x	
Codakia tigerina Linné	x	x		x
Corbis fimbriata Linné		x	x	
Gafrarium pectinatum Linné	x	x	x	
Gafrarium tumidum Röding	x	x	x	x
Mesodesma glabratum Gmelin	x	x	x	x
Modiolus auriculatus Krauss	x	x		
Ostrea gradiva Iredale	x			
Pecten janus Montrouzier	x	x		
Pecten radula Linné	x	x	x	
Pecten senatorius crassicostatus Sowerby		x		
Periglypta puerpera Linné		x	x	
Pinctada vulgaris Schumacher	x	x	x	x
Spondylus ducalis Bolten		x	x	x
Tellina virgata Linné			x	
Tridacna maxima Bolten			x	
Tridacna noae Bolten	x	x		
Tridacna squamosa Lamarck	x	x	x	
Univalves				
Astraea rhodostomus Lamarck	x	x	x	x
Astraea stellaris Gmelin	x	x	x	

TABLE 20

(continued)

Species	Depth (in.)			
	6	12	18	24
Univalves (continued)				
Atys cylindrica Helbling		x	x	
Cerithium aluco Linné	x			
Cerithium moniliferum Dufresne	x	x	x	
Cerithium nodulosum Bruguière			x	
Clava fasciata Bruguière	x			
Conus marmoreus Linné	x		x	
Cypraea annulus Linné	x	x	x	x
Cypraea clandestina Linné	x			
Cypraea cylindrica Born	x			
Cypraea errones Linné	x			
Cypraea icterina Lamarck	x			
Cypraea moneta Linné		x		
Cypraea tigris Linné	x	x	x	
Eulota similaris Férrusac	x	x	x	
Fasciolaria filamentosa Lamarck		x		
Heliacus dorsuosus Hinds		x		
Hipponix antiquatus Linné		x		
Hipponix australis Quoy and Gaimard	x	x	x	
Hipponix conicus Schumacher	x		x	
Melampus fragilis Goss			x	
Murex adustus Lamarck	x	x		x
Murex ramosus Linné	x			
Natica flemingiana Recluz	x	x		
Natica galactites Philippi	x			
Natica mamilla Linné	x	x	x	
Nautilus macromphalus Sowerby				x
Nerita albicilla Linné	x	x	x	x
Nerita plicata Linné	x	x	x	x
Nerita polita Linné	x	x	x	x
Placostylus guestieri Gassies	x		x	x
Placostylus porphyrostomus Pfeiffer	x	x	x	x
Planaxis sulcatus Born	x	x	x	x
Potamides semitrisulcatus Bolten	x	x	x	x
Pterocera lambis Lamarck	x	x	x	
Pyramidella maculosa Lamarck	x			
Pyrene versicolor Linné	x		x	
Siphonaria atra Quoy and Gaimard			x	
Siphonaria depressa Pease	x	x	x	
Sistrum albavoria Küster	x			
Strombus canarium Linné		x		
Strombus epidromus Linné	x	x	x	
Strombus luhuanus Linné	x	x	x	x
Thais pica Blainville		x		
Trochus fenestratus Gmelin		x	x	
Trochus niloticus Linné	x			
Trochus obeliscus Gmelin	x	x	x	x
Turbo cinerea Born	x	x	x	x
Turbo setosus Gmelin	x	x	x	x
Urosalpinx paivae Crosse			x	
Vasum turbinellum Linné	x		x	

TABLE 21

Molluscan Species in Site 20

Species	Depth (in.)									
	6	12	18	24	30	36	42	48	54	60
Bivalves										
Arca cruciata renuta Iredale								x		
Arca decussata Sowerby				x						
Arca navicularis Bruguière	x		x	x			x			x
Arca nivea Chemnitz	x									
Arca scapha Meuschen	x	x	x	x	x	x	x	x	x	
Brachidontes subramosus Hanley		x	x	x	x	x	x	x	x	
Cardium dupuchense Reeve		x	x	x				x	x	x
Cardium enode Sowerby	x	x	x	x	x	x	x	x	x	
Chama brassica Reeve	x			x						
Chama imbricata Broderip		x					x	x		
Chama lazarus Linné				x	x	x	x			x
Chama nivalis Reeve	x		x	x	x	x	x	x	x	
Chama producta Broderip				x						
Codakia tigerina Linné			x	x		x				
Corbis fimbriata Linné		x		x		x				
Donax tinctus Gould			x	x			x	x		
Gafrarium pectinatum Linné	x	x	x	x	x	x	x	x	x	
Gafrarium tumidum Röding	x	x	x	x	x	x	x	x	x	
Gari rossiteri Crosse	x									
Lucina edentula ovum Reeve						x	x	x		
Mactra maculata Chemnitz				x	x	x	x		x	
Mesodesma glabratum Gmelin	x	x	x	x	x	x	x		x	
Modiolus auriculatus Krauss			x			x				
Pecten janus Montrouzier	x	x	x	x	x	x	x	x	x	x
Pecten lividus Lamarck							x			
Pecten radula Linné	x	x	x	x	x	x	x	x	x	x
Pecten senatorius crassicostatus Sowerby	x	x	x	x	x	x		x	x	
Pecten vexillum Reeve			x							
Periglypta puerpera Linné	x	x	x	x	x	x	x	x	x	
Pinctada vulgaris Schumacher	x	x	x		x					
Pitar ustulatus Reeve			x		x	x	x	x	x	
Septifer bilocularis Linné		x	x							
Soletellina elongata Lamarck				x	x	x		x		x
Spondylus ducalis Bolten	x	x	x	x	x	x	x	x	x	
Tapes literata Linné		x			x					
Tapes variegata punicea Deshayes					x					
Tellina discus Hanley				x						
Tellina palatam Martyn				x	x	x	x	x	x	
Tellina virgata Linné				x			x	x		
Trapezium angulatum Lamarck								x		
Tridacna noae Bolten			x	x	x		x	x		
Tridacna squamosa Lamarck			x		x					
Univalves										
Architectonica oxytropis A. Adams								x		
Astraea rhodostomus Lamarck		x		x	x	x	x	x		
Astraea stellaris Gmelin			x	x						
Atys cylindrica Helbling				x				x		
Bulla ampulla Linné		x	x	x	x	x	x		x	x
Bursa granifera Lamarck		x								
Cerithium aluco Linné	x	x	x	x		x				
Cerithium columna Sowerby					x					
Cerithium moniliferum Dufresne		x	x	x	x				x	
Cerithium nodulosum Bruguière	x	x				x				
Cerithium obeliscus Bruguière			x		x					
Charonia tritonis Linné			x							
Clava fasciata Bruguière				x	x					
Conus aulicus Linné		x								
Conus coronatus Gmelin		x								
Conus literatus Linné	x	x		x	x	x				

TABLE 21
(continued)

Species	Depth (in.)									
	6	12	18	24	30	36	42	48	54	60
Univalves (continued)										
Cymatium chlorostoma Lamarck		x								
Cymatium pileare Linné		x				x				
Cymatium tuberosum Lamarck		x								x
Cypraea annulus Linné		x	x			x		x	x	
Cypraea cylindrica Born	x		x				x	x	x	
Cypraea erosa Linné							x			
Cypraea icterina Lamarck							x			
Cypraea moneta Linné			x			x	x			
Cypraea tigris Linné						x				
Cypraea vitellus Linné	x		x			x				
Fasciolaria filamentosa Lamarck	x		x		x		x			x
Fusus nicobaricus Lamarck		x			x					
Hipponix antiquatus Linné			x	x						
Hipponix australis Quoy and Gaimard								x		
Janthina fragilis Lamarck				x						
Mamilla opaca Recluz			x			x				x
Melania gouldiana Reeve							x			
Mitra ambigua Swainson		x								
Mitra amphorella Lamarck		x								
Murex adustus Lamarck	x	x	x	x		x	x			
Murex ramosus Linné		x	x							
Murex ternispina Lamarck										x
Nassarius suturalis Lamarck		x		x						
Natica flemingiana Recluz	x	x	x	x		x	x			x
Natica galactites Philippi	x		x	x		x	x		x	x
Natica mamilla Linné	x	x	x	x	x	x	x	x		
Nerita albicilla Linné	x	x	x	x	x	x	x	x	x	x
Nerita plicata Linné	x	x	x	x			x			
Nerita polita Linné	x	x	x	x			x			x
Phasianella variegata Lamarck				x			x		x	
Placostylus guestieri Gassies	x		x							
Placostylus porphyrostomus Pfeiffer	x	x	x	x	x	x	x	x	x	x
Planaxis sulcatus Born	x		x	x					x	
Pterocera lambis Lamarck	x	x	x	x	x	x	x	x	x	x
Pyramidella maculosa Lamarck							x			
Pyrene flava Bruguière							x			
Pyrene versicolor Linné		x	x	x	x	x	x			
Siphonaria atra Quoy and Gaimard			x							
Siphonaria depressa Pease		x	x	x	x	x	x	x	x	
Sistrum albavoria Küster			x							
Sistrum margariticola Broderip			x				x			
Solidula nitidula Lamarck				x						
Spirula spirula Linné		x	x		x					
Strombus epidromus Linné	x	x	x	x	x	x	x	x	x	x
Strombus gibberulus Linné		x	x			x		x		
Strombus luhuanus Linné	x	x	x	x	x	x	x	x	x	x
Strombus rugosus Sowerby		x								
Terebellum subulatum Lamarck		x								
Terebra dimidiata Linné	x									
Terebra subulata Linné	x									
Thais pica Blainville			x							
Trochus fenestratus Gmelin	x		x	x	x	x	x	x	x	x
Trochus niloticus Linné	x	x	x	x	x	x	x		x	x
Trochus obeliscus Gmelin	x	x	x	x	x	x	x	x	x	x
Turbo chrysostomus Linné					x					
Turbo cinerea Born	x	x	x	x	x		x			
Turbo intercostalis Menke							x			
Turbo setosus Gmelin	x	x	x	x	x	x	x	x	x	x
Turbo ticaonicus Reeve						x				
Vasum turbinellum Linné	x		x	x						

TABLE 22

Molluscan Species in Site 48

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Bivalves								
Arca scapha Meuschen	x	x	x	x	x	x	x	x
Brachidontes subramosus Hanley	x	x	x	x	x			
Cyrena caledonica Reeve	x	x			x			
Gafrarium tumidum Röding	x	x		x	x	x	x	x
Ostrea commercialis Iredale and Roughley	x	x	x	x	x	x	x	x
Ostrea gradiva Iredale	x	x	x	x	x	x	x	x
Tridacna noae Bolten								x
Univalves								
Cassidula nucleus Martyn	x	x		x				
Cerithium columna Sowerby						x		x
Cerithium moniliferum Dufresne	x		x		x			
Littorina scabra Linné	x		x		x			
Nerita albicilla Linné	x			x	x			
Nerita georgina Recluz		x						
Nerita plicata Linné		x	x	x	x	x		
Nerita polita Linné			x			x		
Placostylus porphyrostomus Pfeiffer	x	x	x	x	x	x	x	x
Planaxis sulcatus Born			x					
Potamides semitrisulcatus Bolten	x	x	x	x	x	x	x	
Sistrum margariticola Broderip				x				x
Strombus canarium Linné				x		x	x	
Strombus luhuanus Linné		x						
Trochus niloticus Linné	x							

TABLE 23

Molluscan Species in Site 13

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Bivalves								
Arca decussata Sowerby	x	x	x	x	x	x	x	x
Arca navicularis Bruguière	x		x	x	x		x	x
Arca nivea Chemnitz	x		x	x	x			
Arca scapha Meuschen	x	x	x	x	x	x	x	x
Asaphis dichotoma Anton	x	x		x	x	x	x	x
Cardium dupuchense Reeve				x	x	x		
Cardium enode Sowerby	x				x			
Cardium setosum Redfield					x			
Chama imbricata Broderip	x		x					
Chama lazarus Linné				x	x	x	x	
Chama nivalis Reeve	x		x	x	x	x	x	x
Chama spinosa Broderip	x	x		x	x	x		x
Circe scripta Linné	x	x	x	x	x			
Codakia tigerina Linné				x				
Cyrena caledonica Reeve	x		x	x				
Donax tinctus Gould			x		x	x	x	x
Gafrarium pectinatum Linné	x			x	x	x	x	x
Gafrarium tumidum Röding	x	x	x	x	x	x	x	x
Hippopus hippopus Linné	x							
Isognomon isognomum Linné		x		x	x		x	
Mesodesma glabratum Gmelin	x	x	x	x	x	x	x	x
Ostrea commercialis Iredale and Roughley	x	x	x	x	x	x	x	
Ostrea gradiva Iredale	x	x	x	x	x	x	x	x
Ostrea scyphophilla Péron and Lesueur	x							

TABLE 23
(continued)

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Bivalves (continued)								
Pecten ellochena Iredale					x			
Pecten madreporarum acroporicola Iredale								x
Pecten radula Linné	x	x	x					
Pecten senatorius crassicostatus Sowerby	x	x	x	x	x	x	x	x
Pecten vexillum Reeve					x			
Periglypta puerpera Linné	x				x			
Pinctada vulgaris Schumacher	x	x	x	x	x	x	x	
Pitar ustulatus Reeve						x		
Septifer bilocularis Linné	x	x		x	x	x	x	x
Spondylus ducalis Bolten	x	x		x	x	x	x	
Tapes caledonica Bernardi						x		
Tapes striata Chemnitz			x					
Tapes variegata Sowerby					x		x	
Tellina palatam Martyn			x					
Tridacna maxima Bolten	x	x		x	x			
Tridacna noae Bolten	x	x	x					
Univalves								
Bulla ampulla Linné			x	x	x	x		x
Cerithium columna Sowerby				x				
Cerithium corallinum Sowerby			x					
Cerithium moniliferum Dufresne	x	x	x	x	x	x	x	x
Cerithium tuberculatum Linné			x	x	x	x	x	
Conus eburneus Hwass		x						
Conus literatus Linné	x	x	x	x	x	x		
Cypraea annulus Linné	x					x		
Cypraea clandestina Linné	x	x		x				
Cypraea cylindrica Born	x		x	x	x			
Cypraea tigris Linné	x				x			
Fasciolaria filamentosa Lamarck	x							
Littornia scabra Linné				x				
Murex adustus Lamarck	x							
Murex ramosus Linné	x	x	x					
Murex ternispina Lamarck	x							
Nerita albicilla Linné	x	x	x	x	x	x	x	x
Nerita plicata Linné	x	x	x		x	x	x	
Nerita polita Linné	x	x	x	x	x	x	x	
Placostylus porphyrostomus Pfeiffer	x	x	x	x	x			
Planaxis sulcatus Born	x	x	x	x	x	x	x	
Potamides semitrisulcatus Bolten	x	x	x	x	x	x	x	x
Pterocera lambis Lamarck	x	x	x	x	x		x	
Pyrene versicolor Linné		x						
Siphonaria depressa Pease			x	x	x		x	x
Sistrum chaidea Duclos				x				
Strombus canarium Linné	x	x	x	x	x		x	x
Strombus luhuanus Linné	x	x	x	x	x			x
Trochus fenestratus Gmelin				x				
Trochus niloticus Linné	x	x	x	x	x			
Trochus obeliscus Gmelin	x	x	x	x				
Turbo cinerea Born	x	x	x	x	x			
Turbo setosus Gmelin	x	x	x					
Turbo ticaonicus Reeve	x		x					

TABLE 24

Distribution of Molluscan Species in Site 13, Rectangle C1-2 D1-2

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Bivalves								
Arca decussata Sowerby				3	15	7		11
Arca navicularis Bruguière				4				2
Arca nivea Chemnitz					2			
Arca scapha Meuschen		17	55	311	200	53	31	14
Asaphis dichotoma Anton				3	18	14	2	3
Cardium dupuchense Reeve						1		
Chama sp.							1	
Chama nivalis Reeve			1	8	10	10	13	14
Chama spinosa Broderip					11	4		1
Circe scripta Linné		1	2	1	2			
Codakia tigerina Linné				3				
Donax tinctus Gould			5	1	17	14	14	28
Gafrarium pectinatum Linné	1				4	2	2	10
Gafrarium tumidum Röding	1	17	38	253	276	61	15	4
Isognomon isognomum Linné				2	2			
Mesodesma glabratum Gmelin	1	1	9	24	67	20	17	18
Ostrea sp.								2
Ostrea commercialis Iredale and Roughley			9	6	70	2		
Ostrea gradiva Iredale		8	4	67	2	18	4	15
Pecten sp.						1		
Pecten madreporarum acroporicola Iredale								1
Pecten senatorius crassicostatus Sowerby				2	1	1	1	1
Periglypta puerpera Linné					1			
Pinctada vulgaris Schumacher				22	19	7	2	
Plicatula sp.								1
Septifer bilocularis Linné					3	3	3	1
Spondylus ducalis Bolten					4	1		
Tapes caledonica Bernardi						1		
Tapes variegata Sowerby					5	2	1	
Tonna sp.					1			
Tridacna maxima Bolten				9	1			
Tridacna noae Bolten			3					
Totals	3	44	126	710	731	222	106	126
Univalves								
Bulla ampulla Linné				1	6	1		1
Cerithium columna Sowerby				1				
Cerithium corallinum Sowerby			1					
Cerithium moniliferum Dufresne	3	11	8	16	30	3	2	1
Cerithium tuberculatum Linné			4	14	5	2	2	
Conus literatus Linné			2	8	2			
Cypraea annulus Linné							1	
Cypraea cylindrica Born				1	3			
Cypraea tigris Linné					2			
Littorina scabra Linné				1				
Murex ramosus Linné			1					
Nerita albicilla Linné				2	7		1	
Nerita plicata Linné					5	2	1	
Nerita polita Linné					2	1	2	
Placostylus sp.							2	
Placostylus porphyrostomus Pfeiffer			1					
Planaxis sulcatus Born		4	5	12	22	2	1	
Potamides semitrisulcatus Bolten	2	21	13	83	52	17	2	1
Pterocera lambis Lamarck			1	1	2			
Pyrene versicolor Linné		1						
Siphonaria depressa Pease							2	8
Sistrum chaidea Duclos				2				
Strombus canarium Linné				1				1

TABLE 24
(continued)

	Depth (in.)							
	6	12	18	24	30	36	42	48
Univalves (continued)								
Strombus luhuanus Linné				4	3			
Trochus niloticus Linné			2	1	3			
Turbo cinerea Born				1	1			
Totals	5	37	38	149	145	28	16	13

TABLE 25

Molluscan Species in Site 14

Species	Depth (in.)												
	6	12	18	24	30	36	42	48	54	60	66	72	78
Bivalves													
Arca cruciata renuta Iredale								x					
Arca decussata Sowerby				x			x	x		x		x	x
Arca navicularis Bruguière								x					
Arca nivea Chemnitz		x	x	x	x	x	x	x		x			
Arca scapha Meuschen	x	x	x	x	x	x	x	x	x	x	x	x	x
Asaphis dichotoma Anton					x								
Cardium dupuchense Reeve			x		x	x	x	x		x			
Cardium enode Sowerby					x	x				x		x	
Chama imbricata Broderip							x						
Chama lazarus Linné			x		x	x							
Chama nivalis Reeve											x		
Chama producta Broderip					x								
Chama spinosa Broderip					x								
Circe scripta Linné					x	x	x					x	
Codakia tigerina Linné						x							
Gafrarium pectinatum Linné		x			x			x	x		x	x	x
Gafrarium tumidum Röding	x	x	x	x	x	x	x	x	x	x	x	x	x
Isognomon isognomum Linné				x	x	x							x
Mesodesma glabratum Gmelin	x	x	x	x		x	x	x		x	x	x	x
Modiolus auriculatus Krauss							x						
Ostrea commercialis Iredale and Roughley	x	x	x	x	x	x	x	x	x	x	x		
Ostrea gradiva Iredale												x	
Pecten janus Montrouzier						x	x	x					
Pecten lividus Lamarck				x	x								
Pecten radula Linné	x	x	x	x	x	x	x	x	x		x		
Pecten senatorius Gmelin	x		x	x	x		x			x			
Pecten vexillum Reeve											x		
Periglypta puerpera Linné		x	x	x	x	x	x	x	x		x	x	
Pinctada vulgaris Schumacher				x									
Septifer bilocularis Linné			x	x	x	x	x	x	x				
Soletellina elongata Lamarck			x										
Soletellina nymphalis Reeve				x									
Spondylus ducalis Bolten	x		x	x	x	x	x	x	x	x	x	x	x
Tapes variegata Sowerby					x		x					x	
Tellina palatam Martyn				x	x		x			x	x		x
Tellina remies Linné													x
Tridacna maxima Bolten		x											
Tridacna noae Bolten			x		x		x	x	x	x	x	x	x
Tridacna squamosa Lamarck		x			x				x	x	x	x	
Univalves													
Bulla ampulla Linné					x	x	x						
Cerithium moniliferum Dufresne		x	x	x	x			x	x	x		x	x

TABLE 25

(continued)

Species	Depth (in.)												
	6	12	18	24	30	36	42	48	54	60	66	72	78
Univalves (continued)													
Cerithium nodulosum Bruguière....				x									
Conus eburneus Hwass		x	x	x	x	x	x	x	x				
Conus literatus Linné	x			x	x		x		x	x	x		
Conus marmoreus Linné		x	x	x		x	x	x		x			
Cypraea annulus Linné													x
Cypraea cylindrica Born			x			x			x				
Cypraea erosa Linné.....			x							x			
Cypraea tigris Linné.....			x	x	x								
Dolium cumingii Reeve.....			x										
Littorina scabra Linné					x								
Murex ternispina Lamarck		x											
Natica flemingiana Recluz				x									
Nerita albicilla Linné	x	x	x	x	x	x	x	x				x	
Nerita plicata Linné.....	x	x	x	x	x	x			x			x	
Nerita polita Linné.....								x				x	
Oliva erythrostoma Lamarck.....								x					
Patella stellaeformis Reeve							x						
Planaxis sulcatus Born.....		x		x	x	x	x	x	x				x
Potamides semitrisulcatus Bolten ..	x	x		x									
Pterocera lambis Lamarck	x	x	x	x	x	x	x	x	x	x	x		
Pyrene versicolor Linné							x	x					
Siphonaria depressa Reeve							x		x	x			x
Sistrum albavoria Küster.....									x				
Strombus canarium Linné.....	x	x	x	x	x	x	x	x	x	x			
Strombus luhuanus Linné	x	x	x	x	x	x	x	x	x	x	x	x	x
Trochus niloticus Linné	x	x	x		x	x	x	x	x	x	x		x
Trochus obeliscus Gmelin			x	x	x	x	x	x	x	x			
Turbo cinerea Born.....					x			x	x				
Turbo setosus Gmelin.....		x		x	x	x	x	x	x	x			x
Urosalpinx paivas Crosse													x

TABLE 26

Molluscan Species in Site 26

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Bivalves								
Arca passa Iredale.....			x	x	x	x		
Arca scapha Meuschen	x	x	x	x	x	x	x	x
Asaphis dichotoma Anton				x				
Brachidontes subramosus Hanley	x	x			x			
Cardium dupuchense Reeve	x	x	x	x	x	x		
Cardium enode Sowerby			x		x			
Chama imbricata Broderip.....			x	x				
Circe scripta Linné			x					
Codakia tigerina Linné	x	x		x				
Cyrena caledonica Reeve	x		x	x	x	x		
Gafrarium pectinatum Linné....	x	x	x	x	x	x	x	x
Gafrarium tumidum Röding.....	x	x	x	x	x	x	x	
Isognomon isognomum Linné ...				x				
Lucina edentula ovum Reeve....					x			
Mesodesma glabratum Gmelin..	x	x	x					
Modiolus auriculatus Krauss ...	x	x						

TABLE 26
(continued)

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Bivalves (continued)								
Ostrea commercialis Iredale and Roughley	x	x	x	x	x	x	x	
Ostrea gradiva Iredale	x		x			x		
Pecten pallium Linné			x					
Pecten radula Linné	x	x	x	x	x	x	x	
Pecten senatorius Gmelin		x			x			
Periglypta puerpera Linné	x	x	x	x	x	x	x	
Pinctada vulgaris Schumacher	x	x	x	x	x	x	x	
Septifer bilocularis Linné			x		x			
Spondylus ducalis Bolten		x						
Tapes caledonica Bernardi	x	x						
Tapes striata Chemnitz		x	x	x				
Tellina discus Hanley	x			x				
Tellina palatum Martyn	x			x	x	x	x	x
Tridacna maxima Bolten	x	x	x	x	x			
Tridacna noae Bolten	x	x	x	x	x	x		
Tridacna squamosa Lamarck	x	x	x	x	x	x	x	x
Univalves								
Astraea rhodostomus Lamarck							x	
Astraea stellaris Gmelin		x	x	x				
Atys cylindrica Helbling					x			
Auricula semisculpta A. Adams	x	x	x	x	x	x		
Cassidula nucleus Martyn	x	x	x	x			x	
Cerithium aluco Linné	x	x	x	x	x	x		
Cerithium corallinum Sowerby	x							
Cerithium lemniscatum Quoy		x						
Cerithium moniliferum Dufresne	x	x	x	x	x	x		
Cerithium nodulosum Bruguière		x						
Clava fasciata Bruguière	x	x						
Conus aulicus Linné			x					
Conus eburneus Hwass	x	x	x	x	x	x	x	
Conus literatus Linné	x	x	x	x	x	x		
Conus marmoreus Linné	x	x	x	x	x	x		
Coralliophila cantrainei Montrouzier						x		
Cymatium chlorostoma Lamarck		x				x		
Cymatium pileare Linné				x				
Cypraea annulus Linné	x	x						
Cypraea caurica Linné		x	x					
Cypraea cylindrica Born	x							
Cypraea lynx Linné					x			
Cypraea moneta Linné	x	x	x	x	x			
Cypraea tigris Linné	x	x	x	x	x	x	x	
Cypraea vitellus Linné	x	x	x		x			
Dolium pomum Linné	x							
Fasciolaria filamentosa Lamarck	x			x	x		x	
Fusus nicobaricus Lamarck		x						
Hipponix australis Quoy and Gaimard	x			x				
Hipponix conicus Schumacher	x	x	x	x				
Littorina scabra Linné	x	x	x		x	x		
Melampus trifasciatus Küster	x	x	x	x	x	x		
Melania gouldiana Reeve	x	x	x	x				
Murex adustus Lamarck			x					
Nassarius suturalis Lamarck		x						
Nassarius taenius Gmelin	x			x				
Natica chinensis Lamarck		x						
Natica flemingiana Recluz						x		
Natica mamilla Linné	x	x	x					

TABLE 26
(continued)

Species	Depth (in.)							
	6	12	18	24	30	36	42	48
Univalves (continued)								
Nautilus macromphalus Sowerby		x	x	x				
Nerita albicilla Linné		x	x	x	x		x	
Nerita planospira Anton				x				
Nerita plicata Linné	x	x	x	x	x	x	x	
Nerita polita Linné				x				
Oliva ispidula Linné	x							
Patella stellaeformis Reeve	x	x	x	x				
Placostylus duplex nyapagionis Pilsbry	x							
Placostylus guestieri Gassies			x					
Placostylus porphyrostomus Pfeiffer	x	x	x					
Planaxis sulcatus Born	x	x	x	x	x			
Potamides semitrisulcatus Bolten	x	x	x	x	x	x	x	
Pterocera lambis Lamarck	x	x	x	x	x	x	x	
Sistrum margariticola Broderip				x		x		
Spirula spirula Linné				x				
Strombus canarium Linné	x	x	x		x			
Strombus epidromus Linné					x			
Strombus gibberulus Linné				x				
Strombus luhuanus Linné	x	x	x	x	x	x	x	
Strombus rugosus Sowerby				x				
Trochus fenestratus Gmelin	x	x	x	x	x	x		
Trochus niloticus Linné	x	x	x	x	x	x	x	x
Trochus obeliscus Gmelin	x	x	x	x	x	x		x
Turbo chrysostomus Linné	x	x						
Turbo intercostalis Menke	x	x	x	x	x	x		
Turbo setosus Gmelin	x	x	x	x	x	x	x	
Urosalpinx paivae Crosse		x		x				
Vasum turbinellum Linné		x						

TABLE 27

Molluscan Species in Site 44

Species	Depth (in.)						
	6	12	18	24	30	36	42
Bivalves							
Arca cruciata renuta Iredale		x					
Arca imbricata Bruguière	x						
Arca nivea Chemnitz	x						
Arca passa Iredale	x	x	x	x			
Arca scapha Meuschen	x	x	x	x		x	
Asaphis violascens Forskal	x	x					
Chama imbricata Broderip	x						
Chama spinosa Broderip	x	x		x			
Circe scripta Linné	x						
Codakia tigerina Linné		x					
Cyrena caledonica Reeve	x	x	x				
Gafrarium pectinatum Linné	x	x	x	x			
Gafrarium tumidum Röding	x	x	x	x	x	x	x
Hippopus hippopus Linné	x						
Mesodesma glabratum Gmelin		x	x	x			
Ostrea commercialis Iredale and Roughley	x	x	x	x	x		
Ostrea scyphophilla Péron and Lesueur	x	x			x	x	
Pecten radula Linné		x					
Periglypta puerpera Linné	x	x					
Tapes caledonica Bernardi	x	x	x				
Tapes striata Chemnitz			x				

TABLE 27
(continued)

	Depth (in.)						
	6	12	18	24	30	36	42
Bivalves (continued)							
Tapes variegata Sowerby				x			
Tridacna noae Bolten	x						
Tridacna squamosa Lamarck	x						
Univalves							
Astraea rhodostomus Lamarck			x				
Astraea stellaris Gmelin	x	x	x	x			
Atys cylindrica Helbling	x						
Cantharus undosus Linné	x						
Cerithium corallinum Sowerby	x						
Cerithium lemniscatum Quoy		x					
Cerithium moniliferum Dufresne	x						
Cerithium nodulosum Bruguière	x	x					
Conus literatus Linné	x	x					
Cymatium chlorostoma Lamarck	x						
Cymatium pileare Linné	x						
Cypraea annulus Linné	x						
Cypraea carneola Linné	x						
Helcioniscus testudinaria Linné		x	x				
Hipponix australis Quoy and Gaimard			x				
Hipponix conicus Schumacher		x	x			x	
Iopas sertum Bruguière		x					
Littorina scabra Linné		x					
Murex adustus Lamarck	x						
Murex microphyllus Lamarck		x					
Murex ternispina Lamarck	x	x					
Natica galactites Philippi		x					
Natica mamilla Linné	x	x	x				
Nautilus macromphalus Sowerby	x						
Nerita albicilla Linné	x	x	x	x			
Nerita plicata Linné		x		x	x		
Nerita polita Linné	x	x	x	x	x		
Placostylus guestieri Gassies	x	x					
Planaxis sulcatus Born	x	x	x	x			
Potamides semitrisulcatus Bolten	x	x					
Pterocera lambis Lamarck	x	x					
Purpura echinata Blainville		x					
Pythia scarabeus Linné	x		x				
Sistrum chaidea Duclos	x	x					
Strombus canarium Linné	x	x	x				
Strombus luhuanus Linné	x	x	x	x	x		
Thais pica Blainville	x	x					
Trochus fenestratus Gmelin	x	x	x	x			
Trochus niloticus Linné	x	x	x		x		
Trochus obeliscus Gmelin	x	x					
Turbo chrysostomus Linné	x	x	x				
Turbo cinerea Born	x	x	x	x	x	x	
Turbo intercostalis Menke	x						
Turbo setosus Gmelin	x	x	x	x			
Turbo ticaonicus Reeve	x						
Vasum turbinellum Linné	x						

TABLE 28

Molluscan Species in Site 6

Species	Depth (in.)															
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96
Bivalves																
Antigona reticulata Linné	x	x	x	x	x	x	x		x		x		x			
Arca aceraea Melvill and Standen		x														
Arca cruciata Philippi	x	x		x	x	x	x	x	x	x	x			x	x	
Arca cruciata renuta Iredale							x									
Arca decussata Sowerby		x	x	x	x	x	x		x	x		x	x	x	x	
Arca imbricata Bruguière		x			x	x		x			x					
Arca navicularis Bruguière				x	x	x	x	x	x	x						
Arca nivea Chemnitz	x	x		x	x	x	x	x		x	x				x	
Arca passa Iredale		x	x													
Arca protrita Iredale		x					x									
Arca scapha Meuschen	x	x	x	x	x		x	x	x	x						
Arca velata Sowerby			x													
Asaphis dichotoma Anton	x	x	x	x	x	x	x	x	x	x	x	x	x		x	
Asaphis violascens Forskal	x	x	x	x	x	x	x	x	x	x						
Cardita variegata Bruguière	x	x	x	x	x	x	x	x	x	x	x		x		x	
Cardium dupuchense Reeve		x	x	x	x	x	x									
Chama imbricata Broderip	x	x	x	x	x	x										
Chama lazarus Linné		x														
Chama nivalis Reeve	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Chama producta Broderip	x															
Chama spinosa Broderip	x	x	x	x	x	x	x	x				x		x		
Codakia tigerina Linné	x	x	x	x	x	x				x	x			x		
Cyrena caledonica Reeve	x	x			x	x		x	x							
Donax tinctus Gould	x		x	x	x	x	x	x	x	x	x	x	x			
Gafrarium pectinatum Linné	x	x	x	x	x	x	x	x	x	x	x	x				
Gafrarium tumidum Röding	x	x	x	x	x	x	x	x	x	x	x	x	x			
Hippopus hippopus Linné		x	x	x	x	x	x			x	x					
Isognomon isognomum Linné					x	x	x									
Lucina edentula Linné			x	x	x	x	x	x	x	x	x	x	x	x		x
Mesodesma glabratum Gmelin	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Modiolus agripeta Iredale									x							
Modiolus auriculatus Krauss	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Ostrea commercialis Iredale and Roughley		x	x	x		x	x	x								
Pecten pallium Linné		x														
Pecten senatorius Gmelin			x													
Periglypta puerpera Linné	x	x	x	x	x	x	x	x	x	x		x	x	x		x
Pitar ustulatus Reeve			x	x	x	x	x	x	x				x		x	
Semele crenulata Sowerby						x										
Soletellina elongata Lamarck		x	x	x	x	x	x	x	x	x	x	x	x			x
Spondylus ducalis Bolten	x	x	x	x	x	x	x	x	x	x	x	x		x	x	
Tapes variegata Sowerby			x	x	x	x	x	x	x	x	x	x	x		x	x
Tellina discus Hanley	x		x						x							
Tellina palatam Martyn	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Tellina remies Linné	x	x	x	x	x	x				x		x				
Tellina scobinata Linné	x	x	x	x	x		x									
Tellina virgata Linné			x	x	x		x	x	x			x				
Trapezium angulatum Lamarck	x	x	x	x	x	x	x	x	x	x	x			x		
Tridacna crocea Lamarck	x															
Tridacna maxima Bolten	x	x	x	x												
Tridacna noae Bolten	x	x		x		x										
Tridacna squamosa Lamarck	x	x	x	x	x				x		x			x		
Univalves																
Amplustrum amplustre Linné				x												
Astraea rhodostomus Lamarck	x			x	x				x							
Astraea semicostatum Kiener					x											
Astraea stellaris Gmelin	x	x	x	x	x	x	x	x			x		x	x		
Bulla ampulla Linné		x					x									
Bursa bufonia Gmelin			x													

TABLE 28
(continued)

Species	Depth (in.)															
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96
Univalves (continued)																
Bursa granifera Lamarck	x	x		x			x									
Cantharus undosus Linné	x	x	x					x								
Cassis vibex Linné					x											
Cerithium columna Sowerby	x	x	x													
Cerithium lemniscatum Quoy	x	x	x	x						x						
Cerithium moniliferum Dufresne	x	x	x	x	x	x	x								x	
Cerithium nodulosum Bruguière	x				x											
Cerithium obeliscus Bruguière	x	x	x	x						x						
Cerithium petrosum Wood	x	x	x													
Cerithium tuberculatum Linné	x	x		x	x									x		
Clanculus maculatus Menke				x												
Colubraria maculosa Gmelin							x									
Conus catus Hwass		x	x			x										
Conus coronatus Gmelin		x														
Conus ebraeus Linné	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Conus generalis Linné							x		x							
Conus gladiator Linné	x															
Conus imperialis viridulus Lamarck	x															
Conus literatus Linné	x	x				x		x								
Conus marmoreus Linné	x	x		x			x	x	x							
Conus miles Linné	x	x	x			x										
Conus miliarus Hwass	x						x	x	x					x		
Conus miliarus abbreviatus Nuttall	x															
Conus punctatus Chemnitz					x			x								
Conus quercinus Hwass						x		x			x					
Conus textile Linné		x	x	x	x	x	x			x			x			
Coralliophila cantrainei Mountrouzier	x															
Cymatium chlorostoma Lamarck	x	x	x	x	x	x	x			x				x		
Cymatium pileare Linné										x						
Cymatium tuberosum Lamarck	x	x	x	x			x									
Cypraea annulus Linné	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cypraea arabica Linné	x	x	x	x	x	x	x	x		x	x	x	x			
Cypraea argus Linné							x		x						x	
Cypraea caput-serpentis Linné		x		x	x	x	x	x	x	x	x		x			
Cypraea carneola Linné		x	x		x	x	x	x	x	x	x					
Cypraea caurica Linné										x						
Cypraea cylindrica Born	x	x		x			x				x			x		
Cypraea erosa Linné				x		x				x					x	
Cypraea errones Linné		x				x			x			x				
Cypraea histrio Meuschen		x														
Cypraea isabella Linné	x	x	x	x		x	x	x	x					x	x	
Cypraea lynx Linné						x		x		x						
Cypraea moneta Linné	x	x			x	x	x	x		x		x		x		
Cypraea nucleus Linné	x															
Cypraea teres Gmelin											x					
Cypraea tigris Linné	x	x	x		x		x	x								
Cypraea vitellus Linné		x		x		x										
Dolium cumingii Reeve				x	x											
Dolium pomum Linné					x											
Fasciolaria filamentosa Lamarck	x	x	x	x		x										
Fusus nicobaricus Lamarck		x														
Hipponix antiquatus Linné														x		
Hipponix australis Quoy and Gaimard	x															
Iopas sertum Bruguière	x															
Latirus polygonus Reeve		x														
Littorina scabra Linné	x	x	x		x											
Mamilla opaca Recluz	x	x	x	x	x	x	x	x	x	x	x	x	x		x	
Melampus trifasciatus Küster			x													
Mitra amphorella Lamarck	x	x	x						x							
Mitra dactyla Linné	x						x									
Murex microphyllus Lamarck				x												

TABLE 28
(continued)

Species	Depth (in.)															
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96
Univalves (continued)																
Nassarius albescens Dunker		x					x									
Nassarius pictus kieneri Anton		x				x										
Natica chinensis Lamarck	x	x		x		x	x	x	x		x			x		
Natica flemingiana Recluz	x	x	x		x		x			x						
Natica galactites Philippi		x	x			x										
Natica mamilla Linné	x	x				x	x									
Nautilus macromphalus Sowerby		x			x	x		x						x		
Nerita albicilla Linné	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Nerita georgina Recluz		x														
Nerita plicata Linné	x	x	x	x	x	x	x	x	x	x	x	x	x			
Nerita polita Linné	x	x	x	x	x		x	x	x	x						
Patella stellaeformis Reeve	x	x	x	x	x	x	x									
Peristernia incarnata Deshayes	x															
Placostylus caledonicus Petit						x										
Placostylus duplex nyapagionis Pilsbry			x													
Placostylus guestieri Gassies	x	x	x	x		x	x	x	x	x						
Placostylus porphyrostomus Pfieffer	x	x	x	x			x	x								
Planaxis sulcatus Born	x	x	x	x	x			x			x					
Potamides semitrisulcatus Bolten		x	x													
Pterocera lambis Lamarck	x	x	x		x	x		x	x	x						
Pustularia cicercula Linné										x						
Pyrene versicolor Linné						x										
Pythia scarabeus Linné	x	x	x	x	x	x	x	x								
Ricinula hystrix reeveana Crosse			x			x										
Siphonaria atra Quoy and Gaimard			x				x				x					
Siphonaria depressa Pease					x		x	x								
Sistrum albavoria Küster	x															
Sistrum chaidea Duclos	x		x													
Sistrum margariticola Broderip																x
Sistrum spectrum Reeve	x	x														
Strombus epidromus Linné	x															
Strombus floridus Lamarck	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Strombus gibberulus Linné	x	x	x	x	x	x										
Strombus lentigenosus Linné		x														
Strombus luhuanus Linné	x	x	x	x	x	x	x	x	x	x						
Strombus rugosus Sowerby	x	x	x	x	x	x										
Thais mancinella Linné		x														
Thais pica Blainville	x	x	x	x	x	x	x	x	x	x				x		
Trochus fenestratus Gmelin	x	x	x	x		x	x		x	x	x	x				x
Trochus maculatus creniferus Kiener	x	x	x	x	x				x		x					
Trochus niloticus Linné	x	x	x	x	x	x	x	x	x	x	x		x			x
Trochus obeliscus Gmelin	x	x	x	x	x	x	x	x	x	x	x			x		
Turbo chrysostomus Linné	x	x	x			x										
Turbo cinerea Born	x	x	x	x		x	x	x		x						
Turbo intercostalis Menke	x	x		x		x		x								
Turbo petholatus Linné			x		x		x									
Turbo setosus Gmelin	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
Urosalpinx paivae Crosse		x														
Vanikoro cancellata Lamarck														x		
Vasum turbinellum Linné		x	x	x												

TABLE 29

Molluscan Species in Site 50

Species	Depth (in.)														
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
Bivalves															
Anodontia edentula Linné			x		x	x			x	x	x			x	
Arca aceraea Melvill and Standen		x													
Arca cruciata Philippi	x	x			x			x		x		x			
Arca decussata Sowerby	x	x													
Arca imbricata Bruguière	x	x						x	x						
Arca navicularis Bruguière														x	
Arca nivea Chemnitz	x		x	x		x		x							
Arca passa Iredale	x	x	x		x	x									
Arca pilula saccula Iredale	x		x	x	x	x	x	x	x	x	x	x		x	
Arca scapha Meuschen	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Arca tuamotana Maury						x									
Cardita variegata Bruguière			x	x			x		x	x			x		
Cardium dupuchense Reeve		x	x	x		x	x	x	x	x				x	
Cardium enode Sowerby										x					
Cardium setosum Redfield			x		x			x	x						
Cardium whitleyi Iredale			x												
Chama imbricata Broderip		x													
Chama nivalis Reeve		x	x	x	x	x	x	x	x	x		x	x	x	
Chama spinosa Broderip	x	x	x	x	x	x	x	x	x	x		x	x	x	
Codakia tigerina Linné			x												
Cyrena caledonica Reeve	x	x	x	x	x	x	x	x	x	x		x			
Donax cuneatus Linné	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Donax tinctus Gould	x	x	x			x	x	x	x	x		x			
Gafrarium pectinatum Linné	x				x		x	x	x						
Gafrarium tumidum Röding	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Hippopus hippopus Linné		x			x	x									
Isognomon isognomum Linné					x										
Lucina argentea Reeve	x	x	x		x	x	x			x		x	x	x	
Lucina edentula Linné					x										
Mactra symmetrica Deshayes						x		x			x				
Mesodesma glabratum Gmelin	x	x	x	x	x	x	x	x	x		x				
Modiolus agripeta Iredale		x	x	x		x			x	x					
Modiolus auriculatus Krauss	x		x			x									
Ostrea commercialis Iredale and Roughley	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Pecten pallium Linné										x					
Pecten senatorius crassicostatus Sowerby		x													
Periglypta puerpera Linné	x	x	x	x	x			x				x	x	x	
Pholas australasiae Sowerby												x			
Pinctada vulgaris Schumacher			x												
Pitar ustulatus Reeve				x								x			
Soletellina elongata Lamarck			x		x				x	x		x			
Soletellina nymphalis Reeve		x													
Spondylus ducalis Bolten		x	x	x	x	x	x			x		x			
Tapes caledonica Bernardi	x	x	x	x		x	x	x	x	x	x	x	x		
Tapes variegata Sowerby			x		x										
Tellina discus Hanley						x		x							
Tellina scobinata Linné		x	x	x					x						
Tellina virgata Linné										x					
Trapezium angulatum Lamarck	x	x	x	x						x					
Tridacna crocea Lamarck			x												
Tridacna maxima Bolten	x	x	x			x	x								
Tridacna noae Bolten		x										x			
Tridacna squamosa Lamarck			x			x	x		x				x	x	
Venus imbricata Sowerby			x				x								
Univalves															
Astraea rhodostomus Lamarck			x	x			x								
Astraea semicostatum Kiener		x	x												
Astraea stellaris Gmelin	x	x	x	x	x	x	x	x	x			x	x	x	

TABLE 29
(continued)

Species	Depth (in.)														
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
Univalves (continued)															
Bulla ampulla Linné	x	x	x	x		x	x	x	x	x		x	x	x	
Cantharus undosus Linné		x	x												
Cerithium aluco Linné		x													
Cerithium columna Sowerby			x												
Cerithium corallinum Sowerby	x	x	x			x	x			x	x				
Cerithium lemniscatum Quoy		x	x	x	x	x		x		x	x	x	x	x	
Cerithium moniliferum Dufresne		x	x				x								
Cerithium nodulosum Bruguière					x		x								
Cerithium obeliscus Bruguière		x	x		x	x	x		x					x	
Cerithium petrosum Wood			x												
Cerithium tuberculatum Linné	x	x	x	x	x	x	x					x			x
Conus catus Hwass	x	x						x	x						
Conus ebraeus Linné				x							x	x	x		
Conus eburneus Hwass									x		x				
Conus figulinus Linné					x							x	x		
Conus gladiator Linné	x		x												
Conus literatus Linné				x											
Conus miles Linné			x				x								
Conus punctatus Chemnitz								x							
Conus striatus Linné			x												
Conus textile Linné		x	x		x							x			
Cymatium chlorostoma Lamarck		x	x					x							
Cymatium pileare Linné					x		x	x							
Cymatium tuberosum Lamarck	x	x	x		x	x	x		x						
Cypraea annulus Linné	x	x	x		x	x			x				x		
Cypraea arabica Linné		x	x	x	x	x			x						
Cypraea caput-serpentis Linné		x		x		x						x			
Cypraea carneola Linné	x														
Cypraea clandestina Linné		x													
Cypraea erosa Linné						x		x			x	x		x	
Cypraea isabella Linné		x				x		x						x	
Cypraea stolida Linné											x				
Cypraea tigris Linné					x										
Dolium cumingii Reeve	x				x		x	x	x			x	x		
Dolium pomum Linné					x										
Eunaticina lamarckiana Recluz									x						
Harpa conoidalis Lamarck	x							x							
Hipponix antiquatus Linné	x														
Hipponix conicus Schumacher		x													
Iopas sertum Bruguière		x													
Littorina scabra Linné		x	x												
Mamilla opaca Recluz	x	x	x	x	x	x									
Mitra carnicolor Reeve												x			
Mitra chrysalis Reeve	x														
Mitra tornata Reeve	x														
Modulus tectum Gmelin		x		x											
Monodonta canaliferus Lamarck	x														
Murex maurus Broderip		x													
Murex microphyllus Lamarck		x	x				x				x				
Murex ternispina Lamarck	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Nassarius albescens Dunker		x													
Nassarius pictus Dunker					x										
Nassarius suturalis Lamarck		x													
Nassarius taenius Gmelin	x		x	x	x	x	x		x						
Natica chinensis Lamarck	x	x	x	x			x						x		
Natica flemingiana Recluz		x						x		x				x	
Natica galactites Philippi	x														
Natica mamilla Linné	x	x				x			x					x	
Nerita albicilla Linné	x	x	x	x	x	x	x	x	x	x	x	x		x	
Nerita plicata Linné	x	x		x											
Nerita polita Linné	x	x				x				x					

TABLE 29

(continued)

Species	Depth (in.)														
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
Univalves (continued)															
Neritina roissyana Recluz		x													
Neritopsis radula Linné									x						
Oliva elegans Lamarck	x			x											
Oliva elegans tricolor Lamarck	x	x	x	x	x		x			x	x	x	x	x	
Oliva ispidula Linné	x														
Peristernia incarnata Deshayes	x														
Planaxis sulcatus Born	x	x	x												
Potamides semitrisulcatus Bolten	x	x					x								
Pterocera lambis Lamarck	x	x	x	x	x	x	x	x		x		x			
Pustularia cicercula Linné		x													
Pyrene versicolor Linné	x														
Ricinula digitata Lamarck								x							
Sinum incisum Reeve										x					
Siphonaria atra Quoy and Gaimard		x						x	x					x	
Siphonaria depressa Pease												x			
Sistrum chaidea Duclos		x	x	x		x	x				x	x			
Sistrum spectrum Reeve		x													
Strombus canarium Linné	x	x	x		x	x	x	x				x		x	
Strombus epidromus Linné			x	x		x			x						
Strombus floridus Lamarck	x	x	x	x	x	x	x		x	x	x	x	x		
Strombus gibberulus Linné	x														
Strombus lentigenosus Linné		x													
Strombus luhuanus Linné	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Strombus rugosus Sowerby		x	x	x			x	x	x			x		x	
Strombus succinctus Linné						x									
Tnais pica Blainville		x	x												
Trochus fenestratus Gmelin		x	x	x		x	x	x	x						
Trochus maculatus creniferus Kiener		x													
Trochus niloticus Linné	x	x	x	x	x	x	x		x	x	x	x	x		
Trochus obeliscus Gmelin	x	x		x	x	x	x	x			x	x		x	
Trochus pyramis Born			x												
Turbo chrysostomus Linné	x	x	x	x		x			x			x			
Turbo cinerea Born	x	x	x												
Turbo intercostalis Menke		x	x												
Turbo petholatus Linné				x	x										
Turbo setosus Gmelin	x	x	x	x	x	x	x	x			x	x	x		
Turbo ticaonicus Reeve	x			x				x							
Vasum turbinellum Linné						x	x								

TABLE 30

Molluscan Species in Site 52

Species	Depth (in.)				
	6	12	18	24	30
Bivalves					
Anodontia edentula Linné	x				
Arca passa Iredale	x				
Arca scapha Meuschen	x	x			
Cardium dupuchense Reeve	x				
Chama nivalis Reeve	x				
Chama spinosa Broderip	x				
Cyrena caledonica Reeve	x	x	x	x	
Donax cuneatus Linné	x	x	x	x	x
Donax tinctus Gould	x	x			
Gafrarium tumidum Röding	x	x	x	x	
Ostrea commercialis Iredale and Roughley	x	x	x		

TABLE 30
(continued)

Species	Depth (in.)				
	6	12	18	24	30
Bivalves (continued)					
Periglypta puerpera Linné	x	x			
Spondylus ducalis Bolten	x				
Tapes variegata Sowerby	x	x			
Trapezium angulatum Lamarck			x		
Tridacna crocea Lamarck	x				
Tridacna maxima Bolten		x			
Univalves					
Astraea rhodostomus Lamarck		x			
Astraea semicostatum Kiener	x	x			
Astrea stellaris Gmelin	x				
Cantharus undosus Linné	x				
Cerithium lemniscatum Quoy	x	x	x		
Cerithium petrosum Wood		x			
Cerithium tuberculatum Linné	x	x	x		
Conus figulinus Linné		x			
Cymatium chlorostoma Lamarck	x				
Cymatium pileare Linné	x				
Cymatium tuberosum Lamarck		x			
Dolium cumingii Reeve	x		x		
Harpa conoidalis Lamarck		x			
Melania gouldiana Reeve		x			
Murex microphyllus Lamarck	x				
Murex ramosus Linné		x			
Murex ternispina Lamarck		x			
Nassarius taenius Gmelin				x	
Natica galactites Philippi		x			
Natica mamilla Linné		x			
Nerita albicilla Linné	x	x			
Nerita polita Linné	x	x			
Oliva elegans tricolor Lamarck	x				
Pterocera lambis Lamarck	x	x			
Sistrum chaidea Duclos	x	x	x		
Strombus canarium Linné			x		
Strombus floridus Lamarck	x	x	x	x	
Strombus luhuanus Linné	x	x	x		
Terebra cimidiata Linné	x				
Terebra subulata Linné		x			
Thais pica Blainville		x			
Trochus niloticus Linné	x	x	x		
Trochus obeliscus Gmelin	x	x			
Turbo chrysostomus Linné	x	x		x	
Turbo cinerea Born		x			
Turbo setosus Gmelin	x	x	x		
Vasum turbinellum Linné		x			

TABLE 31

Molluscan Species in Site 51

Species	Depth (in.)				
	6	12	18	24	30
Bivalves					
Arca nivea Chemnitz	x				
Arca passa Iredale		x			
Arca scapha Meuschen	x	x	x		x
Cyrena caledonica Reeve	x	x	x		
Donax cuneatus Linné	x				
Gafrarium pectinatum Linné		x	x		
Gafrarium tumidum Röding	x	x	x		
Hippopus hippopus Linné		x			
Mesodesma glabratum Gmelin	x				
Ostrea commercialis Iredale and Roughley	x	x	x		x
Periglypta puerpera Linné	x	x			
Tapes caledonica Bernardi		x			
Tapes variegata Sowerby	x				
Trapezium angulatum Lamarck	x	x			
Tridacna crocea Lamarck	x	x			
Tridacna maxima Bolten	x	x			
Tridacna noae Bolten	x	x			
Tridacna squamosa Lamarck	x	x			
Univalves					
Astraea semicostatum Kiener	x	x			
Astraea stellaris Gmelin	x				
Cantharus undosus Linné	x				
Cerithium lemniscatum Quoy	x	x			
Cerithium nodulosum Bruguière	x				
Cerithium petrosum Wood	x				
Cerithium tuberculatum Linné			x		
Conus marmoreus Linné	x				
Cypraea annulus Linné	x				
Cypraea arabica Linné	x				
Melania gouldiana Reeve	x				
Nassarius taenius Gmelin	x				
Natica galactites Philippi	x	x			
Nerita albicilla Linné	x	x			
Nerita polita Linné		x			
Neritina roissyana Recluz	x				
Parahytida dictyodes Pfeiffer	x	x			
Potamides semitrisulcatus Bolten	x	x		x	x
Pterocera lambis Lamarck	x	x			
Strombus epidromus Linné	x	x			
Strombus floridus Lamarck	x	x	x		
Strombus luhuanus Linné	x	x			
Thais mancinella Linné	x				
Thais pica Blainville	x				
Trochus fenestratus Gmelin	x	x			
Trochus niloticus Linné	x	x	x		
Trochus obeliscus Gmelin	x	x			
Turbo chrysostomus Linné	x	x	x		
Turbo intercostalis Menke	x	x			
Turbo petholatus Linné	x				
Turbo setosus Gmelin	x	x	x		

ARTIFACTS

BONE ARTIFACT

The dearth of bone artifacts is one of the striking features of New Caledonian archaeology. In all of our digging only one tiny fragment of bone, worked to a point, was recovered. It came from site 26, at a depth of 12-18 in., and may be the distal end of a dagger. Sarasin pictures a bone dagger from New Caledonia (Sarasin, 1929, pl. 63, fig. 9).

SHELL ARTIFACTS

New Caledonian sites were more productive of shell artifacts than the two sites excavated in Viti Levu by Gifford in 1947 (Gifford, 1951, p. 220). The New Caledonian sites yielded shell net sinkers, shell fishhooks, shell bracelets and rings, spire-lopped univalve shells, cowry (Cypraea) shell caps for octopus lures, shell paring knives, and other implements.

Net sinkers.—Bivalve shells, mostly Arca, with a hole in the curved part of the shell near the umbo are in modern use for casting-net sinkers (pl. 3, a). The hole was made, almost invariably, not by abrasion but by punching or knocking out a piece of shell, as is shown by the irregular edge of the hole. Sarasin figures an archaeological example (Sarasin, 1929, pl. 2, fig. 14), and calls it a "Hobelmuschel," which seems unlikely because of the rough edge of its opening. He also pictures a casting-net (Sarasin, 1929, pl. 5, fig. 1) weighted with unbored stones. Leenhardt's picture of an Arca shell attached to a magic bundle (Leenhardt, 1930, pl. 3) suggests that some of the Arca specimens we excavated may not have been net sinkers. In plate 7, g, h, we show two archaeological specimens that we regard as sinkers.

All Arca sinkers collected came from excavated sites, except two from site 45 A (Patana), where they were found on the surface.

On the west coast, Arca scapha was the species most used; on the east coast there were both Arca scapha and Arca passa. On the west coast a few Arca passa sinkers were found at site 26, at a depth of 12-30 in.

At site 13 all of the sinkers were Arca scapha except for one Spondylus ducalis in the 0-6 in. level. At sites 20 and 14, single Cardium dupuchense sinkers were recovered at 54-60 in., also one from site 50 at 30-36 in.; Sarasin (1929, p. 77) cites Giglioli as recording a Cardium. Two Arca nivea sinkers were obtained at 30-36 in. at site 14.

Table 32 presents the distribution of 976 shell net sinkers from our excavations. Sites 26 and 14 were the centers of abundance. These two sites yielded approximately 1 sinker per 2 cu. ft. of deposit.

In the Fijian collection there are specimens of Arca scapha, each with a hole in the umbo, which perhaps could have served as net sinkers: 5097, site 5, surface; 5362, site 32, surface; 5551, site 17, location B, 102-108 in.; 5552, site 17, location A, 24-30 in.; 5554, site 17, location A, 18-24 in.; 5686, site 17, location B, 78-84 in.

Fishhooks.—From the Loyalty Islands and from Ile des Pins Sarasin figures a simple shell fishhook made from the stout lip of an adult land shell of the genus Placostylus (Sarasin, 1917, figs. 9, 147; 1929, pl. 6, figs. 5, 7). We found ten examples of the same type in excavated sites in New Caledonia, as follows: 6 specimens from site 19, 0-18 in.; 1 from site 20, 0-6 in.; 1 from site 26, 0-6 in.; 1 from site 6, 18-24 in.

Money shells.—At site 26, the inhabited village of Oundjo, we excavated 587 specimens of Conus eburneus which had been ground in preparation for making shell-bead money from the central, or nuclear, whorl of the shell. The shells were ground by abrasion to remove the slightly elevated center of the spire; plate 6 shows an abraded shell (i) and an unmodified one (j). A single bead was made from the central, or nuclear, whorl of each abraded shell. Manufacture and use have been described (Lambert, 1900, p. 168; Leenhardt, 1930, pp. 47-55; 1939, pp. 5-7; Sarasin, 1929, pp. 177-184, pl. 51). Unfortunately these accounts do not specify a center of manufacture of shell money. The absence of abraded shells of Conus eburneus in ten of the eleven sites we excavated indicates an extreme localization of this industry at site 26. At site 13, at a depth of 6-12 in., we found the slightly abraded upper part of a shell, which really forms a sort of cap (19940), but we doubt that this was a money shell. It seems rather to be a disk, like 20795, also from site 13 (18-24 in.), shown in plate 8, i.

The count of money shells, by excavated levels, was as follows: 0-6 in., 202; 6-12 in., 130; 12-18 in., 125; 18-24 in., 86; 24-30 in., 31; 30-36 in., 11; 36-42 in., 2. The art of making Conus shell money obviously reached its peak in late times, perhaps after the arrival of the French.

Specimen 22278 from site 26 (0-6 in.) may be an ornament (pl. 20, c) for a money-holder. It is a flat straight fragment of Meleagrina, 6 mm. wide, 28 mm. long, and about 1.5 mm. thick, with four shallow pits drilled in one face. A money-holder with Meleagrina ornaments and Conus eburneus beads is pictured in plate 20, d.

Bracelets and rings.—Three species of univalves with sturdy shells were used for the manufacture of bracelets and rings: Trochus niloticus, Conus literatus, and Conus marmoreus.

Trochus bracelets were of large circumference, but narrow, being cut from the curved base of the main whorl of the adult shell. These bracelets were pleasingly mottled by the red blotches on the shell's exterior. Specimen 24504 (pl. 8, r) appears to have been about 74 mm. in inside diameter. Two other figured specimens are 22859 (pl. 8, s) and 24052 (pl. 8, t). The chipped edges of 24052 show how the bracelet was chipped out before grinding. Three other fragments, two of them in process of manufacture, were obtained. All six specimens are from site 26: 22859 (2 specimens, 1 figured), from a depth of 12-18 in.; 23064, 12-18 in.; 24052, 24-30 in.; 24504, 0-6 in.; 24874, 12-18 in.

Sarasin figures two Conus literatus millepunctatus rings from Canala and Hienghéne respectively (Sarasin,

1929, pl. 50, figs. 4, 5); the specimen shown in figure 4 is ethnological, the one in figure 5 comes from an ossuary. (Sarasin, 1917, fig. 32, is apparently the same specimen as fig. 4.)

Broad rings of Conus shell are widely distributed in Micronesia and Melanesia, and constitute one of the items of the kula exchange described by Malinowski for the Trobriands and adjoining groups in western Melanesia (Malinowski, 1922, pls. 16, 17). Like the Trobriand examples, the New Caledonian rings are made from Conus literatus millepunctatus as well as from Conus literatus; the latter has fewer markings than the subspecies millepunctatus, the number of markings being a variable trait. We have not attempted to discriminate between these intergrading forms, but have called them all Conus literatus.

Our only complete New Caledonian ring (25962) came from the fibula of a skeleton in the ossuary at site 6. (See pl. 6, a.) It must have been put on the left humerus at the time of the secondary disposal of the remains, since it is altogether too small (inside diam., 43 mm.) to have been slipped over the hand of a living adult. A large ethnological bracelet (2851), the gift of Mr. and Mrs. John S. Hampel, who obtained it at Houailou, is shown in plate 6, b; its inside diameter is 72 mm.

Actually, our excavations yielded only eleven fragments of Conus rings or bracelets, five of which are quite narrow. Ten include the angle of the main, or body, whorl of the shell, so that one edge of the bracelet is thicker than the other. The specimen illustrated in plate 6, g, is an exception. Four specimens are from site 26, 2 from a depth of 0-6 in., 1 from 12-18 in., and 1 from 18-24 in.; 5 are from site 13, 0-18 in.; 1 from site 14, 36-42 in.; and 1 is from site 6, 66-72 in. Six of the specimens are figured in plate 6, c-h. A doubtful fragment is illustrated in plate 20, n. The top and bottom edges of two of the fragmentary specimens from site 13 are ground smooth, but the interior of the ring is unfinished. Two stone tools illustrated by Sarasin (1929, pl. 50, figs. 9, 10) were perhaps used for grinding out the interior of rings; Sarasin characterizes them as "zum Ausschleifen der Conus-Bracelets."

A considerable antiquity for Conus rings is indicated by the specimen 28227 from site 6, 66-72 in., since a charcoal sample from a depth of only 24-30 in. yielded a radiocarbon date of 1339 A. D.

Lambert mentions bracelets of both Conus millepunctatus and Conus marmoreus, and pictures three (Lambert, 1900, pp. 145-147, fig. 34).

We obtained a fair series of the lower parts of Conus shells from which rings had apparently been cut or, probably more accurately, filed and broken off. These are of two species, Conus literatus, which makes large as well as small rings, and Conus marmoreus, which makes only small rings, since it is a smaller species. The process of cutting the rings is indicated by two specimens shown in plate 6, k and m: k shows the first step, a groove filed or sawed around the circumference of the shell; m shows the second step, a bevel filed or ground below the groove, perhaps with a file of sea urchin spine or coral or possibly with an abrasive stone. Specimen 23640 (pl. 6, c) shows such filing also above the groove, but it is not clear whether this was always done; it does not appear on other fragments or finished bracelets. The smaller whorls inside the main whorl of the shell, together with the columella, had also to be removed in forming the ring.

Except for three filed Conus marmoreus shells from east coast site 6, all of the filed shells of both species came from four west coast sites (20, 13, 14, 26).

Table 33 shows the distribution of 75 filed Conus literatus shells, most of them from the 18-24 in. level. These are from four west coast sites, with the concentration in site 26 where 59 specimens were found. The balance of 16 were about evenly distributed among sites 20, 13, and 14.

Fifteen filed Conus marmoreus shells were obtained by excavation. Three come from a depth of 6-30 in. at site 6; 12 from site 26. Site 26 yielded the following specimens: 3 from 0-6 in.; 3 from 6-12 in.; 2 from 12-18 in.; 1 from 18-24 in.; 2 from 24-30 in.; 1 from 30-36 in. Thus, half the specimens came from the upper 12 in., half from below 12 in. One specimen is illustrated in plate 6, l.

The filed shells may be regarded as evidence of the manufacture of shell rings. Of the total number of Conus literatus and Conus marmoreus, 71 are from site 26 (Oundjo), which appears to have been a manufacturing center for Conus shell rings as well as for Conus eburneus money beads.

Besides the filed shells mentioned above, 70 broken Conus literatus shells were recovered at various depths from sites 26, 13, 14, and 50. Four broken Conus marmoreus shells were obtained from site 26. Whether these are by-products of shell-ring manufacture is an open question, but they may well be, even though they show no signs of filing.

Six more or less fragmentary Conus literatus shells, all showing grinding of the top periphery of the main whorl but without a girdling cut (as in pl. 6, k) or filing of the side wall (as in pl. 6, m) may also have been worked for the purpose of making shell rings. In these the grinding of the top edge obviously preceded the cutting off of the lower part of the shell, which is not so in the specimen shown in plate 6, k. In these six specimens the spire has been removed almost entirely, exposing the inner surface of the main whorl. These specimens (22252, 22767, 23404, 23847, 24550, 24679) are all from site 26, the range of depths being from 0-6 in. down to 30-36 in.

A seventh fragment (21190), from a depth of 24-30 in. in site 14 (pl. 20, n), has a ground periphery like the six above, but has also, about 5 mm. below the ground edge, a broad shallow groove, which gives the impression of ornament rather than an attempt to cut through the shell. We have no comparable specimen from elsewhere.

What may well be an example of secondary use of a part of a shell ring is illustrated by our square pendant 20611 from site 13 (12-18 in.), shown in plate 8, e. This piece has two biconically drilled holes to hang it by. The deeper and larger drillings were made on the concave surface; then, presumably, smaller holes were drilled on the convex face to meet the first ones.

Spire-lopped univalves.—Spire-lopped univalves are chiefly of the genera Conus and Oliva. We recovered 14 specimens of Conus and 24 of Oliva. There is always the possibility that some of these specimens have been abraded on the beaches and then picked up by man. Others show definite evidence of having the spire ground off or knocked off by human agency.

The 14 Conus specimens are listed below; three are figured as indicated. Whether these were used on necklaces or other ornamental objects is not known.

Site 26: 6-12 in., Conus marmoreus, 24139 (pl. 7, c); 12-18 in., Conus sp.,. 23607; 18-24 in., Conus marmoreus, 24205; 30-36 in., Conus marmoreus, 23315.

Site 6: 24-30 in., Conus sp., 28901; 42-48 in., Conus miliarus, 28134; 60-66 in., Conus sp., 27882; 84-90 in., Conus ebraeus, 27934.

Site 50: 0-6 in., Conus sp., 30777; 6-12 in., Conus sp., 30290, 31131; 18-24 in., Conus ebraeus, 30661 (pl. 8, z); 42-48 in., Conus catus, 31001 (pl. 8, ab); 66-72 in., Conus ebraeus, 29684.

The 24 spire-lopped olive shells appear to belong to two species, 4 to small Oliva ispidula and 20 to large Oliva elegans with its variety tricolor.

The four Oliva ispidula are from sites 26 and 50 and from the upper 6 in. of the deposits: site 26, 23140, 23900 (pl. 8, d); site 50, 30059, 31075 (pl. 8, c). They may once have been strung as beads.

The twenty spire-lopped Oliva elegans and Oliva elegans tricolor are all from site 50, except one (31928) from site 52 at a depth of 0-6 in. At site 50 the depths at which the specimens were found range from 0-6 in. to 78-84 in., with the concentration at the 6-12 in. level. These shells may have been used in ancient times for necklaces like those Sarasin pictures from New Caledonia (Sarasin, 1929, pl. 47, fig. 6) or possibly for dance ornaments like the Solomon Islands specimen illustrated in our plate 20, a.

Site 50: 0-6 in., 29507, 30274; 6-12 in., 30304 (2 specs.), 30465 (2 specs.), 31132 (3 specs.); 12-18 in., 30114, 30882; 24-30 in., 29577; 30-36 in., 31212; 36-42 in., 29870 (pl. 8, b); 36-42 in., 30694; 48-54 in., 29658 (pl. 8, a); 54-60 in., 31291; 66-72 in., 29988; 78-84 in., 30039.

A spire-lopped Cymatium pileare with a hole in its side (29633, site 50, 42-48 in.) may have been strung as a pendant.

A limpet, Patella stellaeformis, with the apex neatly removed so that the remaining shell forms a ring, may be a paring knife, although perhaps it is just an ornament (pl. 8, g). It comes from a depth of 30-36 in. at site 6.

Shell knives.—There are two types of shell knives, one a straight blade, the other made from a whole univalve shell with an oval side opening that gives the cutting or paring edge. The first type appears to be made of sharp longitudinal fragments of Conus literatus (Sarasin, 1929, pl. 2, fig. 18); the second of Strombus luhuanus or other univalve shells. This second type was probably used as a paring knife; Sarasin calls it "rabot" and "Hobelloch" (Sarasin, 1917, fig. 40; 1929, pl. 50, fig. 11).

We found it difficult to distinguish between true blades of the first type and mere pieces knocked off in the process of manufacturing shell rings. Both are very sharp. We have figured one only (pl. 8, v), although we have eight knives altogether from sites 20 and 26. These are listed as follows.

Site 20: 6-12 in., 17489 (pl. 8, v), 18830; 12-18 in., 19000.

Site 26: 0-6 in., 22278; 12-18 in., 23977, 24853; 18-24 in., 24015; 24-30 in., 24054.

Our second type, the paring knife or peeler (cf. Gifford, 1951, fig. 1, a) is represented by six specimens from our excavations: 5 of Strombus luhuanus, 1 of Sistrum albovaria. This last specimen is from site 20 at a depth of 12-18 in. and is shown in plate 8, h. The five Strombus luhuanus are from sites 20, 26, and 44, as follows.

Site 20: 0-6 in., 17458 (pl. 8, ad); 30-36 in., 18591.

Site 26: 24-30 in., 22969; 30-36 in., 22589 (pl. 8, ac).

Site 44: 6-12 in., 25211.

We also show (pl. 7, m) a paring knife found on the surface of site 4. The shell was identified by Dr. Emerson as a young Lambis chiragra Linné. It suggests a modern Fijian breadfruit peeler (Gifford, 1951, fig. 1, a) whose cutting edge has been formed by abrading the wall of the shell.

Two small shells, Conus catus and Cypraea annulus, from sites 50 and 26 respectively, are shown in plate 8, aa and f. These have abraded side openings but are perhaps too small for use as parers. The Cypraea annulus is comparable to an abraded Ovula tortilis from Lifou, Loyalty Islands, pictured by Sarasin (1929, pl. 50, fig. 8). In figure 7 of the same plate he also shows a leg band of string from Canala, with a small Ovula shell attached to it.

Side-drilled univalves.—Nine side-drilled univalve shells of several species were collected, mostly from east coast sites.

Site 26: 0-6 in., Turbo setosus, 24806 (pl. 7, a).

Site 43: 0-6 in., Charonia lampas Linné, 16696 (pl. 7, f).

Site 44: surface, fragment of Cassis, 25004 (pl. 7, e); 0-6 in., Potamides semitrisulcatus, 25476.

Site 6: 12-18 in., 3 perforated Nerita albicilla, 26074; 24-30 in., Nerita albicilla, 26116.

Site 52: 0-6 in., Terebra dimidiata, 31774 (pl. 8, p).

The Charonia lampas shell from site 43, near Nakéty, may have been used in fishing as a marker on top of a stick. We saw one so used at Oundjo, and Lambert illustrates a similar specimen (Lambert, 1900, p. 37, fig. 8). Or it may have been part of a gable ornament like those from Nakéty illustrated by Sarasin (1929, pl. 43, fig. 1). The smaller drilled shells listed above may have served as ornaments, but the use of the large heavy fragment of Cassis is uncertain.

"Pot scribes."—Four specimens were recovered that may be "scribes" for making incised decorations on pottery. All appear to be of Cardium shell and one is a complete valve of Cardium enode, with the ends of the serrate tips on each side of the center knocked off, leaving the center tip to serve as a marker or scorer (see pl. 7, d). This specimen is from a depth of 24-30 in., site 20. The other three specimens are small segments of the edge of Cardium valves, probably Cardium enode. One, from a depth of 6-12 in. at site 19, very much resembles an object from Viti Levu (Gifford, 1951, fig. 1, g); it is shown in plate 8, j. Two similar small pieces, 16813 from site 19, 0-6 in., and 23801 from site 26, 18-24 in., are not figured.

Scrapers of bivalve shell.—The edges of a Gafrarium tumidum valve and of fourteen Pecten valves suggest their use as scrapers. The Gafrarium valve, from site 26, 6-12 in., is shown in plate 20, b. Sarasin pictures a similar scraper of Arca shell (Sarasin, 1929, pl. 2, fig. 17). The fourteen Pecten valves show wear on the

distal edge of the shell opposite the hinge. These were perhaps used as scrapers, like the ethnological specimens pictured by Sarasin (1917, fig. 41; 1929, pl. 10, figs. 1-3). None of ours is perforated near the hinge, as is one of Sarasin's. All fourteen are from west coast sites.

Site 19: 6-12 in., Pecten radula, 16893; 6-12 in., Pecten senatorius, 17285.
Site 20: 0-6 in., Pecten janus, 18377 (pl. 8, ag); 0-6 in., Pecten janus, 18851; 12-18 in., Pecten senatorius, 17504 (2 specs.); 18-24 in., Pecten janus, 18580.
Site 13: 0-6 in., Pecten senatorius, 19883; 0-6 in., Pecten radula, 20519; 0-6 in., Pecten senatorius, 20700; 6-12 in., Pecten senatorius, 19929.
Site 14: 6-12 in., Pecten radula, 21524 (pl. 8, ah); 12-18 in., Pecten radula, 21819; 18-24 in., Pecten radula, 21170.

Perforated bivalves.—Certain perforated bivalve shells, probably not used as net sinkers, may have been worked by man or by nature. Thus, some externally drilled valves may have been operated on by predatory mollusks rather than by man, but have been collected and used by man. Some openings were apparently made by punching rather than drilling. The following is the list of 41 specimens of perforated bivalves.

Site 13: 18-24 in., Chama nivalis, 19616 (pl. 8, n); 18-24 in., Chama sp., 19988; 18-24 in., Chama spinosa, 20466; 18-24 in., Chama spinosa, 20473; 24-30 in., Chama nivalis, 19650 (6 specs.); 24-30 in., Chama spinosa, 19679 (2 specs.); 24-30 in., Ostrea commercialis, 19679 (3 specs.); 24-30 in., Chama spinosa, 20481 (2 specs.); 24-30 in., Chama spinosa, 20487; 24-30 in., Chama spinosa, 21103 (8 specs.); 30-36 in., Chama nivalis, 19705 (2 specs.); 30-36 in., Chama spinosa, 19710; 30-36 in., Spondylus ducalis, 20829.
Site 14: 60-66 in., Periglypta puerpera, 21744.
Site 26: 6-12 in., modern mother-of-pearl button with 2 holes, 22919 (pl. 8, l); 6-12 in., perforated fragment of mother-of-pearl shell, 22484 (pl. 8, x); 12-18 in., drilled fragment of mother-of-pearl shell (Meleagrina), 22702 (pl. 8, w); 18-24 in., perforated fragment, 24729.
Site 6: 24-30 in., Lucina edentula, 26117; 24-30 in., Tellina palatam, 26724 (pl. 8, o); 36-42 in., Arca cruciata, 29101 (pl. 8, k); 54-60 in., Arca sp., 27641.
Site 50: 6-12 in., Pecten senatorius, 30832; 66-72 in., Arca sp., 29989 (pl. 8, m).

The perforated Meleagrina fragment shown in plate 8, x, is apparently part of a pendant like those shown by Lambert and Sarasin (Lambert, 1900, p. 311; Sarasin, 1929, pl. 10).

Abraded bivalves.—Two Chama shells with abraded holes from site 50 look as though they had been ground by man. Both are illustrated: 29660, from a depth of 48-54 in. (pl. 8, q); 29675, 54-60 in. (pl. 8, u). In other Chama and Ostrea shells, the irregular openings may have been the result of attachment to other shells during growth, the holes being formed when the shells were separated.

Cut shell.—Five pieces of definitely sawed or cut shell with a straight edge along the cut are here listed, although we have no idea of their purpose.

Site 13: surface, Meleagrina sp., 19458 (pl. 7, b).
Site 26: 18-24 in., Trochus niloticus, 22945 (pl. 8, y); 36-42 in., Tridacna fragment, 22619 (pl. 20, i).
Site 50: 12-18 in., Pinctada vulgaris, 30323; 18-24 in., clam shell, 29570 (pl. 8, ae).

Specimen 22619 is of special interest, not only because it is cut, but because its flat surfaces show scratches that indicate abrasion.

Octopus lures.—Octopus lures made of a piece of Cypraea main whorl, a stone, sticks, and string are reported from Mare, Loyalty Islands, by Sarasin: "Il faut encore mentionner le piège à poulpes, que nous n'avons jamais rencontré en Calédonie et qui est un instrument de pêche d'origine polynésienne" (Sarasin, 1917, p. 251, figs. 148, 149). In his later work Sarasin states: "Die Tintenfischangel, ein polynesisches Gerät, fehlt Neu-Caledonien völlig" (Sarasin, 1929, p. 81, pl. 6, figs. 9-11).

Our excavations in five sites (19, 13, 14, 26, and 6) yielded 27 pieces of Cypraea main whorls which look like caps of octopus lures but no stones were found. The following shell species were identified: Cypraea lynx, Cypraea tigris, Cypraea vitellus. The species of a number of the caps could not be identified. Table 34 gives the distribution of the 27 specimens; 21 of them are from site 26. Two caps are shown in plate 7, j (Cypraea tigris) and l (Cypraea vitellus).

A series of 97 Cypraea fragments also suggests the presence of the octopus lure in New Caledonia. These are apparently remnants left after the cap had been cut from the main whorl of the shell. Eighty are from site 26, 17 from sites 19, 20, 14, 6, and 50. Two are shown in plate 7, i (Cypraea tigris) and k (Cypraea vitellus). Other identified species are Cypraea arabica, from sites 6 and 50 only, and Cypraea lynx, from site 26 only; Cypraea tigris is by far the most common. The species of many of the fragments cannot be identified.

Table 35 presents the distribution of these fragments. Cypraea specimens, either caps or remnants, were found in seven of the eleven excavated sites: site 19, 20, 13, 14, 26, 6, and 50.

CHIPPED STONE ARTIFACTS

The scarcity of stone artifacts in the New Caledonian sites prompted us to retain all likely chipped stone fragments for more detailed examination. Such fragments were found at all sites except site 48, but when the specimens were thoroughly examined, most of them were found not to be artifacts. The ones considered artifacts have been classified in two groups and are described below. Typologically (though not chronologically) all are probably Lower Palaeolithic or Eolithic and strongly suggest the nondescript assemblage so characteristic of Australia; however, none shows evidence of the gum-hafting applied to some Australian ethnological pieces. Perhaps, therefore, the comparison should be with the totally unhafted Tasmanian stone tools.

The New Caledonian chipped stone artifacts are generally nondescript implements; apparently there was no preference for a particular shape. All were altered only enough to render them usable as tools. Sarasin (1929, pl. 2) pictures a number of chipped stone tools to which he assigns various uses.

Our chipped stone specimens have been examined by two experts, T. D. McCown and A. E. Treganza. Neither

could discern indubitable evidence of retouching by pressure flaking, so it is likely that the specimens were retouched by percussion. Specimens which possibly have been pressure-flaked are illustrated in plate 11, a, c, and i.

Group 1 types.—Group 1 (183 specimens) shows definite, though slight, modification for use; the edges of most of them, except hammerstones, have been modified, apparently only by percussion flaking or by use. (See table 36 and table 37.) Of the total of 183 pieces, 118 are flakes, 65 cores. Sixty-nine, or about 40 per cent, show a portion of the original stone surface; a minimum of effort had been expended in making the fragments usable as tools.

Scraper-hammerstones (A): This classification is represented by two dual-purpose tools of chalcedony, one flake, and one core, with a portion of the original surface visible on both specimens. A scraping edge is formed on one side by primary percussion flaking and the working edge shows retouching. Pitted areas indicate use as a hammerstone. (Pl. 11, ad.)

End and side scrapers (B): There are 30 end and side scrapers (26 flakes and 4 cores), with portions of the original surface visible on 10 specimens. One end and a side of each implement is a scraping edge formed by primary percussion flaking, and the working edge shows retouching. Five are quartz, 25 chalcedony. (Pl. 11, c-e.)

Side scrapers, one side worked (C): There are 36 of these (33 flakes and 3 cores), with portions of the original surface visible on 9. One side of each implement is a scraping edge formed by primary percussion flaking and the working edge shows retouching. One is quartz, 2 silicified rhyolite (lava), 33 chalcedony. (Pl. 11, f-g.)

Side scrapers, two sides worked (D): Seven of these 35 specimens (32 flakes and 3 cores) show portions of the original surface. Two sides of each implement are scraping edges formed by primary percussion flaking, with retouched working edges. Eight are quartz, 27 chalcedony. (Pl. 11, h-i.)

End scrapers (E): There are 13 end scrapers (11 flakes and 2 cores); one implement shows a portion of the original surface. One end of each tool is a scraping edge formed by primary percussion flaking with the working edge retouched. Two are quartz, 11 chalcedony. (Pl. 11, a-b.)

Gravers (F): Gravers are represented by 4 miscellaneous chalcedony flakes, with no original surface visible. Each specimen has a peaklike projection, apparently fortuitous. Two show definite use; the other two are adapted for use as gravers. (Pl. 11, m-o.)

Choppers (G): Most of the choppers are medium-large cores. There are 18 of these, plus 4 flakes, a total of 22 specimens. The original surface is visible on 16 tools of this classification. The bifacial chopping edge of some was formed by primary percussion flaking, and some of them show retouching. The chopping edge of the others is a convenient, fortuitous edge of the original surface, showing no primary percussion or secondary flaking. Three are quartz, 19 chalcedony. (Pl. 11, x-y.)

Scraper-choppers (H): Scraper-choppers are represented by 10 specimens (9 medium-large cores and one flake). A portion of the original surface is visible on the 9 cores. This type is a dual-purpose tool, with the scraping edges formed by primary percussion flaking, the working edges retouched. The bifacial chopping edge was formed by the same percussion technique, or a convenient, fortuitous edge of the nodule was used. Two are quartz, 8 chalcedony. (Pl. 11, v-w.)

Hammerstones and pecking stones (I): There are 28 of these (25 cores and 3 flakes), with 15 specimens retaining a portion of the original surface. This type is divided into four general forms: (1) medium to large globular stones (pl. 11, ab); (2) medium-sized semiglobular stones (pl. 11, aa); (3) roughly cylindrical stones (pl. 11, z); (4) small rounded quartz pebbles used as pecking stones (pl. 11, ac). These implements do not seem to have been intentionally shaped; the working edges were not specially prepared. Sixteen are quartz, 2 serpentine, 3 basalt, and 7 chalcedony.

Shaft scraper (J): The one specimen in this class is an irregularly shaped basalt flake, with a fortuitous, unretouched scraping edge which could be used for working down club handles, etc. (Pl. 11, k).

Flake knife (K): A small flake of serpentine, with fortuitous edges that show use, is possibly a knife (pl. 11, j). A small, irregularly shaped flake with sharp edges, the only fragment of obsidian recovered, would have made a good knife (pl. 11, l). This piece is significant because there is no known source of obsidian on New Caledonia.

At site 44 we recovered numerous silicified (?) rhyolite (lava) flakes. They came from 24 blocks (6-42 in.) at location B and from one 0-6 in. block at location C. Only one of these flakes is an artifact, a side scraper with one retouched working edge (type C).

The presence of these fragments only at site 44 suggests a local source of the material. Location B is largely alluvial below the 1-ft. level and the flakes show no evidence of being waterworn; hence it is unlikely that they were brought down by the river near by. It would seem probable that axes and adzes were once made in the region and that there must have been close by a source of the material used.

Table 36 presents the distribution of chipped stone tools of Group 1 found at our excavated sites, but to a depth of 42 in. only. Since, at every site, Neolithic potsherds were found at greater depths than chipped stone, it seems clear that these chipped stone fragments do not represent a Palaeolithic culture. It is interesting that these crude objects were contemporaneous with pottery. Apparently, however, they were only a minor product of the New Caledonians, whose genius was expressed in more finely made artifacts and in more skillful techniques. Even simple flint tranchets, like those described from the Solomon Islands (H. S. Harrison, 1931, pp. 425-434), were not found.

A few chipped stone tools were found, on the surface of unexcavated sites: Type B, site 32, 2 specimens; type D, site 28, 1 specimen; type E, site 30, 1 specimen; type I, sites 9, 36, and 38, 1 specimen each. From a test pit in site 5, a single example of type E was found between 12 and 18 in.

Group 2 types.—Group 2 (361 specimens) comprises unclassified flakes and cores, some of which show modification but no retouching; they may or may not be flaked by use. (See table 38 for stratigraphic occurrence.) Plate 11 shows utilizable, but unused, flakes (p-r) and those which show flaking from use (s-u). The probable uses of some specimens are aptly described by Sarasin (1929,

p. 127): "Sprenglinge, von einem Quarzblock abgeschlagen, dienen heute noch ohne weitere Zubereitung zum Polieren und Schärfen der Lanzen, zum Haarschneiden, Rasieren, Skarifizieren usw."

SINKERS AND ANCHOR STONES

A heavy turtle-net sinker of unworked white coral limestone, with a sinnet binding at the top, was given us by Ramon, one of our workmen at Oundjo. It is pictured in plate 9, b. Its length is 23 cm., its weight 6 lbs.

A perforated sinker or anchor stone of fine-grained basalt, 2 lbs. in weight and smoother and more symmetrical than two figured by Sarasin (1929, pl. 8, figs. 5, 6), was presented to us by Chief Bome of Oundjo. It seems to be a natural cobble except for the biconical hole apparently pecked from opposite sides in an original natural depression or small hole. The profile view of this specimen (fig. 1, a) shows it turned to the left.

A cobble with an oval hole completely through it, excavated at site 20 (depth, 6-12 in.), was at first thought to be a club head. However, examination by Dr. Arnould, geologist at the Institut Francais d'Oceanie, proved that the hole had been made by a belemnite, a cephalopod of the Cretaceous. The rock is sedimentary and includes some volcanic tuff. The cobble could have been used as a sinker. The tracery left by the animal within the opening indicates that the object was probably never hafted (pl. 10, aa).

GRINDSTONES AND SMOOTHERS

Thirteen grindstone fragments were recovered from four of the sites (sites 19, 26, 44, 6); nine of them came from site 26. All are irregular in shape and none is intentionally shaped. All have been ground smooth in places by abrasion. The material ranges from fine-grained basalt to decomposed serpentine. Table 39 gives the dimensions.

At site 26 there seems to be a correlation between the presence of these grindstones and of large numbers of abraded Conus eburneus shells, which are used in the manufacture of bead money. These grindstones may also have been used to produce other shell and stone artifacts, which would account for their presence at sites 19, 44, and 6, where we found no evidence of money manufacture.

Files, that is, stones used to smooth or abrade by rubbing or filing, total six.

Site 19: surface, 16728, a barrel-shaped piece of coral, both ends almost flat, probably used as abrading surfaces, length 25 mm., diam. 25 mm. (pl. 10, g).

Site 51: 0-6 in., 31503, ovoid, length 82 mm., width 39 mm., thickness 28 mm.

Site 26: 0-6 in., 22411, small, flat, round, with one side showing use; 12-18 in., 24551, irregularly shaped, length 54 mm., width 33 mm.; 24-30 in., 23402, stone fragment with one flat surface showing evidence of use as a smoother, length 129 mm., width 75 mm., thickness 46 mm. (pl. 10, u).

Site 35: surface, 16662, small, round abrading stone.

GROUND STONE ARTIFACTS

Ground stone tools were much scarcer than the crude chipped stone tools. Adze, axe, mace (monstrance axe), and chisel were the most conspicuous and attractive forms, with shaped slingstones the most common after these. Besides these five types (most of the specimens being gifts from French and aboriginal friends), only an occasional ground stone fragment was found. As elsewhere the fine finish of the ground stone implements made these prizes for finders. This was probably true in antiquity as it is today and may partly account for their scarcity in the excavations.

Adze, chisel, and axe.—A few specimens, fragmentary for the most part, were recovered from the upper levels at certain sites. Ground stone artifacts are extremely rare on the surface of New Caledonian archaeological sites, and almost as rare underground. This is true also in Fiji, as Gifford found (Gifford, 1951, p. 221). Perhaps these tools were handed down as heirlooms or were deposited in the ossuaries with the remains of their owners, since the great amount of work involved in their manufacture no doubt made them valued objects. The specimens found by excavation were chiefly discarded fragments.

Sarasin shows examples of adzes, axes, and chisels (Sarasin, 1929, pls. 22-27). His plate 22 illustrates the range of shapes; plates 23-27 show ethnological hafted specimens.

Our excellent drawings of adzes and axes are the work of Dr. J. F. Goins. The upper edge of the cross section represents the front of the specimen, the lower edge the back. Our full view shows the back, the profile the depicted surface turned to the right, except in figures 1, c, f and 3, i, which show the surface turned to the left. The terms "front" and "back" are those used by Buck and his colleagues in their "Terminology for Ground Stone Cutting-Implements in Polynesia" (1930, p. 176).

We are indebted to Professor Howel Williams, of the Department of Geological Sciences, for mineralogical identifications. Unless otherwise stated, a combination of nephrite serpentine and other minerals was the material used. Of the seventeen specimens which could be recognized as adzes or possibly chisels (two specimens), thirteen were gifts of local collectors.

Our adzes are classified in four groups on the basis of their transverse cross sections.

Group I: This has a lenticular (sharp-edged) transverse cross section, corresponding with one of Beyer's Early Neolithic types from the Philippines (Beyer, 1948, fig. 8, no. 4). Our group comprises nine specimens: 16646, 24967 (fig. 2, e), 24970 (fig. 1, f), 24971 (fig. 1, b), 24973 (fig. 2, h), 24975 (fig. 1, d), 25000 (fig. 2, a), 29495 (fig. 2, d), and 24999 (fig. 2, g). Eight of these were gifts. A tenth adze, already in the University's collection, is illustrated in Gifford's Fijian paper (1951, fig. 3, k).

Specimen 16646, from the surface of site 30, has the shape and beveled edge of an adze but shows no signs of having been ground and polished. The material is quartzite, not the serpentine and nephrite of all the other axes and adzes, and this may be just a stone shaped by nature. It is also possible that because of its convenient shape the stone may have been used as an adze. Two of the adzes in Group I have straight cutting edges; the rest are curved or rounded. All have a blunt or rounded butt.

Group II: This type has an ellipsoidal or wide oval transverse cross section and corresponds with another Philippine Neolithic type (Beyer, 1948, fig. 8, no. 3). Our group comprises five specimens: 17438, 22478 (fig. 3, f), 24972 (fig. 2, b), 24976 (fig. 2, f), and 24988 (fig. 2, c), all of which except 22478 were gifts. Specimen 17438 is the cutting edge portion (about one-third of the original implement) of a very battered adze blade. The five adzes in this group have curved or rounded cutting edges. Three specimens have blunt or round butts, one a pointed butt (fig. 2, b), and the battered specimen is of course indeterminate (fig. 3, f).

Group III: Of two adzes or chisels in this group, one, 19459 (fig. 1, c) from site 13, surface or talus, is the cutting edge portion of a fragment with an oval transverse section (cf. Beyer, 1948, fig. 8, no. 2). The cutting edge is so battered that the shape cannot be determined, and the butt end is missing. It could have been a chisel, as suggested by its thickness. In the same group is specimen 21151 (not illustrated), from site 14, 12-18 in., which is a midsection fragment with parallel sides, used secondarily as a hammerstone.

Group IV: There is only one specimen in this group, 17029 (fig. 1, e), which is the thinnest and smallest of all the adzes, being only 41 mm. long. The implement is completely finished, with a slightly trapezoidal transverse cross section, and has a slightly rounded cutting edge and a blunt butt. It comes from site 19, our southernmost site on the west coast.

Five of tne six axes in our collection are complete specimens; these were all gifts. The only excavated one is 23150, a fragment from the cutting edge portion of a large axe, recovered from a depth of 0-6 in. at site 26.

The transverse cross sections of the axes are all of the lenticular (sharp-edged) type figured by Beyer (1948, fig. 8, no. 4). The cutting edges are all curved.

Three of the five whole specimens (24966, 24978, and 24974) have blunt or rounded butts; the other two (24969 and 31338) have pointed butts. All the specimens are completely finished, well ground and polished (fig. 3, b, e, g-i).

Specimen 24977 (fig. 3, d), the butt fragment of a nephrite mace or monstrance axe, like the one pictured by Sarasin (1929, pl. 27, figs. 1 and 2), has two biconically drilled holes to facilitate hafting. A hafted ethnological specimen in the Museum is pictured in plate 9, a.

Eleven other ground stone fragments were recovered by excavation or received as gifts. These specimens range from three-quarters of the original implement to mere flakes. They are all clearly portions of tools, but it is not possible to determine whether they are axes or adzes. Like the axes and adzes listed in the groups above the material used is various combinations of nephrite serpentine.

Specimen 24968 (fig. 3, a), the gift of Chief Bome of Oundjo, is the very large proximal portion of an axe or adze. It is lenticular (sharp-edged) in transverse cross section and has a rounded butt. No. 16621 is the central fragment of a heavy (445 gm.) ground stone tool with a lenticular (sharp-edged) transverse cross section. It comes from the surface of site 17, and is made of serpentine with a talc admixture. Nos. 19890a (site 13, 0-6 in.) and 16665 (site 37, surface) are fragments with ellipsoidal or wide-oval transverse cross sections, the first from the median portion, the second from the tapering butt, of a tool. Specimen 16665 has a pointed butt. Nos. 19890b (site 13, 0-6 in.) and 18680 (site 20, 0-6 in.) are small fragments of tools with ellipsoidal or wide-oval transverse cross sections. These pieces have also had their lateral edges ground so as to be straight-sided, i.e., perpendicular to the front and back of the implement. No. 24987, gift of a native of Oundjo (site 26), is apparently a small fragment of a ceremonial mace or monstrance axe. It has one biconically drilled hole and the general appearance of this type of implement. No. 21151 (site 14, 12-18 in.) is the parallel-sided midsection of an axe, adze, or chisel and is oval in transverse cross section (cf. 19459, fig. 1, c). The interesting feature of this fragment is that both broken ends have been used as hammerstones.

Four small flakes, nos. 19808 (site 13, talus slope), 20708 (site 13, 0-6 in.), 24957 (site 20, 24-30 in.), and 25098 (site 44, 0-6 in.), were recovered from our excavations. These are pieces of the faces of ground stone implements, but no other information can be gleaned from them.

Because of the small number of our series of axes and adzes and the fragmentary condition of almost all the specimens recovered by excavation, it is impossible to draw conclusions based upon stratigraphy or stylistic differences. We can only say that the pieces which can be recognized as adzes, chisels, or axes are all from upper levels (0-18 in.).

Slingstones.—We acquired twelve stone objects which, according to our native informants, are slingstones. These are bipointed objects of serpentine or fine-grained basalt, most of them highly polished. (Cf. Sarasin, 1929, pl. 58, figs. 1 and 2). Only two specimens were recovered from our excavations, and these were fragments obtained at a depth of 6-12 in. in sites 26 and 52. The other ten, perfect specimens, were gifts. Six of these are pictured in plate 10, m-o, q-s, with provenience stated in the explanation of the plate. The four unfigured gift specimens are from Canala (1), Tiaoué (3). Specimen 25001 (dimensions 38 x 27 mm.), from the surface of site 44, may be a slingstone, to judge by its oval shape. Weights of the ten complete gift specimens range from 25.8 gm. to 71.6 gm. Professor Howel Williams identified the material of which specimen 24982 is made as talc or steatite and the material of 24986 (from Tiaoué) as containing "serpentinized dunite; relic olivine granules in serpentine matrix, a little chromite and pyroxene."

Beads.—Sixteen beads of serpentine and steatite, and one of jade, were excavated. Thirteen of these are finished, that is, shaped, with biconically drilled holes; three are incomplete, that is, shaped but not drilled. All but two are from site 26; one of these is from site 20, the other, a large jade bead (fig. 3, c) from site 49.

The shape of the beads ranges from oval and flat to round and cylindrical. See plate 10, a-e, and h-l, for the range in size and shape.

A seventeenth specimen, 25012 (site 44, 0-6 in.), a tiny object of amorphous shape but biconically drilled, is probably best classified as a bead.

Lambert (1900, pp. 128, 181) illustrates a large jade bead shaped like our jade bead (fig. 3, c) and a pump-drill for making the holes in jade beads. Sarasin (1929, pl. 48, figs. 1-3, 7) pictures typical stone beads as they are strung.

Pendants and various objects.—No. 22679; steatite pendant with biconically drilled hole, recovered from a depth of 6-12 in. at site 26; 31 mm. long, 26 mm. wide, and 17 mm. thick at the thickest point. (Pl. 10, f.)

No. 27287 (site 26, 6-12 in.); a cylindrical stone with two encircling grooves near the middle; 76 mm. long, 26 mm. maximum diameter; diameter in grooves 21 mm. (Pl. 10, p.)

No. 31683 (site 51, 0-6 in.); a portion of a spatulate stone pendant with biconically drilled hole in the narrow end; 132 mm. long, 66 mm. wide, 10 mm. thick. (Pl. 10, y.)

No. 22477 (site 26, 6-12 in.); like 31683 in shape but no drilled hole; one side smoothed by abrasion; 210 mm. long, 70 mm. wide, 14 mm. thick. (Pl. 10, z.)

No. 24177 (site 26, 12-18 in.); fragment of steatite with three radiating grooves on one surface; 48 x 47 mm., 16 mm. thick. (Pl. 10, t.)

No. 24432 (site 26, 6-12 in.); fragment of steatite with a peaklike point, apparently shaped by man; would be useful for incising pottery before firing.

A number of oval, globular, and oblong stones caught by the screens were retained for future examination. These show no evidence of modification of any sort, and we must therefore assume that they are natural stones. It is of interest, however, that they resemble the "magical" stones shown by Sarasin (1929, pl. 71, figs. 1 and 2).

Specimens 25524 (site 44, 6-12 in.) and 24932 (site 26, 24-30 in.) are small, pointed stones that show no intentional shaping but may nevertheless have been used.

POTTERY

The unpainted pottery of Oceania is unattractive, as compared with the painted wares of the aboriginal New World. In New Caledonia vessels were shaped by coiling with paddle and anvil (Gifford, 1928; Avias, 1950a, p. 117) and by coiling or hand molding without paddle and anvil (Sarasin, 1929, pp. 107-112). Coiling must have been used rather widely to build a vessel wall (pl. 17, u, v), although this technique can be recognized only rarely in archaeological potsherds. The wall was then compacted and thinned with paddle and anvil, obliterating the coils. The concavities on the inner surfaces of large potsherds seem to indicate the use of paddle and anvil in their manufacture, a process described by Leenhardt for New Caledonia and by Kingsley Roth for Fiji (Leenhardt, 1930, p. 32; K. Roth, 1935).

In New Caledonia the pottery was fired in an inadequately controlled atmosphere and, accordingly, at a relatively low temperature (Leenhardt, 1930, p. 33). This resulted in a rather poor grade of pottery with considerable variation in the surface color, ranging from red to black, and likewise in the core. Carbon streaks, due to incomplete firing, occur infrequently. Firing clouds were not noted. Hardness, rated by University of Michigan standards, ranged from 2 to 6. At site 13, the range was from 2 to 2.5.

The temper was apparently indiscriminately selected. In few of the potsherds examined had the temper been carefully chosen and prepared for use. Occasionally a hard, sharp-fracturing, fine-textured pottery was found. In general the temper was beach or river sand (metamorphic rocks, quartzite, arkose, graywacke, slate, serpentine), and occasionally calcite (shell). One sherd, 24689 (pl. 17, t), shows the use of ground potsherds as tempering material. Microscopic examination by Professor G. H. Curtis (App. II) of twenty-five New Caledonian potsherds shows that clay ranges from 51 to 73 per cent, with the tempering material making up the balance. The pottery is usually coarse-textured and crumbles or shatters readily. In two sherds, 22009 (2 specs.), from site 26 fibrous material may possibly have been used as temper, or the fiber may have been extraneous material that was burned out. See plate 17, r, s.

Most potsherds are too small to show the vessel form, but bowls and jars are inferred. Only two vessels that were nearly whole were found. They came from the surface at site 47, the inhabited village of Sekodé near Nakéty, on the east side of the island (see pl. 19).

Exterior surfaces were generally smoothed, occasionally with great care, but wiping marks were often apparent. Some pieces have a polished appearance, perhaps because of an intentional slip. Interiors of vessels were generally wiped or scraped and were poorly smoothed, if at all. Some potsherds are so worn by wave action that their original surface condition cannot be discerned.

Thickness of vessel walls ranges from 3 mm. to 26 mm. The coarse texture of the core produced correspondingly weak vessel walls. There is a wide range in size (cf. Glaumont, 1895, p. 40), from the small ceremonial bowl (Avias, 1950a, p. 120) to the large jar containing perhaps as much as five gallons. Pottery handles recovered from our excavations had probably been attached to large jars.

Most pottery in New Caledonia was undecorated, as was also true in Fiji. A few sherds that may have been painted were found at site 26 (see pl. 14, ad). Glaumont (1895, p. 40), Leenhardt (1930, p. 33), and Avias (1950a, p. 117) mention the use of kauri resin as a postfiring glaze on New Caledonian pottery. This was also used extensively in Fiji in the same manner (K. Roth, 1935; Gifford, 1951, p. 224). We have one archaeological sherd from New Caledonia (pl. 13, i) that may show evidence of this practice. Most of the decoration was surface incision and relief rather than paint.

The decoration varies widely in the degree of refinement and in the means of application. The designs vary from crude incisions, gashes, and gouges, often hard to recognize, to rich and intricate design elements of incising, gashing, gouging, relief (various forms), roulette marking, and combinations of these. The intricate patterns are best illustrated by the pottery found at site 13 (see pls. 16, 22, 23), which is very similar to that found on the Ile des Pins (Lenormand, 1948, pp. 54-58).

From the appearance of the designs and the method of application, we may infer the use of a number of different implements: twigs and straws (Avias, 1950a, p. 115), edges of various shells, carved paddles, etc.

Distribution of potsherd types.—The fifty-three sites we visited all had potsherds on the surface. Indeed, except for the two nearly complete pots mentioned above, only sherds were found either on the surface or by excavation.

Potsherds from the eleven excavated sites weighed 17,226 oz. and were obtained both from the surface and by screening 7,641 cu. ft. of excavated material. The yield was much less than from the two sites in Viti Levu excavated by Gifford, for which the corresponding figures are 36,687 oz. and 2,880 cu. ft. (Gifford, 1951, pp. 189, 223). Table 40 gives the weight of potsherds for each 6-in. level in each of the eleven sites at which excavations were made.

The character of the excavated sites may help to explain the weight statistics. Thus at site 26 the cultural deposit lay on bedrock, which put a definite limit to our digging. Similarly, at site 44 locations A and C were shallow deposits on bedrock. Location B, however, was

alluvium, which offered no impediment to digging, and site 51 was also an alluvial deposit. Site 48 was on bedrock, but our one-day excavation there gave us too little time to reach it except in one small test pit. All other sites (19, 20, 13, 14, 6, 50, and 52) fronted on the sea and were laid down on beach sand, which was relatively easy to dig. Consequently in these we carried excavations down to levels with few or no potsherds or other cultural material. The result of this is to reduce the average number of ounces of potsherds per cubic foot of excavated material. The average yield in ounces per cubic foot was as follows: site 19, 0.82; site 20, 2.84; site 48, 1.08; site 13, 2.97; site 14, 1.18; site 26, 6.44; site 44, 1.32; site 6, 0.45; site 50, 0.94; site 52, 2.12; site 51, 3.14.

Our potsherds, excluding a few that may have been painted, are classified on the same basis as those from Fiji (Gifford, 1951, pp. 222 ff.), namely, plain surface, incised decoration, and relief decoration. The distinction between the types is purely arbitrary and ignores the probability that some plain and decorated potsherds are actually from the same vessel.

The following tabulation gives the percentages by weight of the three types of potsherds in each site. The symbol x means half of one per cent or less.

Site	Plain	Incised	Relief
19	94	6	x
20	95	3	1
48	97	1	2
13	63	34	3
14	94	2	4
26	96	4	x
44	97	2	1
6	95	4	1
50	96	4	x
52	95	5	x
51	94	4	2

The eleven sites show a considerable degree of uniformity in the relative proportions of the three types of potsherds found, except for site 13, which differs markedly from all the others. Here the percentage of decorated ware is 37 per cent of the total as compared with a range of 3 to 6 per cent in the other sites.

No significant differences in the relative quantities of the three types according to depth in any one site were discernible except perhaps at site 14, in which relief sherds increase in the lower levels; however, the total samples at these levels are small. In Fiji, the upper levels yielded more incised, the lower levels more relief-decorated sherds, but no such depth difference was evident in New Caledonia.

The accompanying tabulation gives the total weight of potsherds collected on the surface at sites 19, 20, 48, and 52, and the percentages of plain, incised, and relief. At these sites potsherds were collected from the surface before excavation and without any attempt to select the decorated ones. Sites 13 and 14 are omitted from the tabulation because at these sites the sherds came partly from the talus slope, where they had weathered out at various levels and therefore do not represent the sherd occurrence on the true or last-occupied surface. At site 26 there were so many sherds on the surface that we collected mostly decorated pieces and can thus give no valid data on the relative abundance of decorated and plain types, and this was also true at site 6. At sites 44, 50, and 51 the surface sherds were included in the count of those found in the first six inches of excavation.

Potsherds Found on Surface

Site	Total weight (oz.)	Percentage of total weight		
		Plain	Incised	Relief
19	280	99	2	0
20	60	93	5	2
48	130	97	1	2
52	166	99	1	0

Rim and lip types.—The rim is the upper portion of a vessel wall, ending in the lip. There are three types of rims: straight, outcurved, and incurved. The rim thickness varies: it may thin noticeably as it approaches the lip; it may thicken noticeably; or it may remain the same as the body. Rims are illustrated in figure 4 (exterior of the rim is always shown at the right).

The typology of the lips is based on the form or shape of the junction between inner and outer walls at the mouth of the vessel. C. F. Miller (1950, p. 280) defines three main criteria: rounded, flattened, and beveled.

> A rounded lip is one which is gently curved. A flattened lip is one which is noticeably flattened, with square or sharp edges. A beveled lip is one with the lip sloping either towards the interior or exterior of the vessel.

We have amplified Miller's classification and use six types in our typology: rounded; grooved; flat; inside bevel; outside bevel; double-bevel, i.e., sloping both to the inside and outside of the vessel.

Table 42 gives the distribution of the rim and lip types in percentages of the total found at each site. In most sites the straight rim and the rounded lip are the predominant forms; in seven of the eleven sites 50 per cent or more of the rims are straight. The exceptional site is site 13, where straight rims fall to 32 per cent, outcurved rims rise to 61 per cent, and round lips fall to 29 per cent.

Below thirty inches the number of sherds collected was insufficient to provide data on the relative abundance of the respective types at the different levels. Down to that level the percentages at different depths do not depart far from the averages given in table 42.

Potsherds with suspension holes.—In the north-central part of the island on both west and east coasts we collected 177 potsherds with holes near the rim for inserting cords. The holes were evidently made by perforating the pot with a pointed stick before firing and are either single or arranged in pairs. Both plain and decorated (incised and relief) sherds show such perforations (pl. 17, w-z), which were used to suspend the vessel by cords from the roof beams of the house (Glaumont, 1895, pp. 43, 45, figs. 1, 3; Leenhardt, 1909).

MacLachlan (1940, p. 264, fig. 50) illustrates an incised sherd from Fiji with what may be a hole for suspension. He gives no precise provenience for it.

Potsherds with holes for suspension were collected both on the surface and from the excavations, as follows: from the surface at sites 16, 17, 32, 45B, and 49 (all west coast except 49) and from excavations at sites 44, 6, 50, 52, 51, and 26 (all east coast except 26). None was found below 42 in. Of the 177 excavated specimens, 86 are plain, 89 are incised, and 2 from site 26 have relief decoration.

The southern part of the island provided no potsherds with holes for suspension. Site 44, the southernmost of

the sites excavated on the east coast, yielded only one, while the heaviest concentration (124 specimens) was at site 26, the northernmost site excavated on the west coast.

In the six excavated sites the number of perforated sherds decreased with depth: 0-6 in., 63; 6-12 in., 48; 12-18 in., 27; 18-24 in., 16; 24-30 in., 13; 30-36 in., 9; 36-42 in., 1. Distribution is as follows:

Site 26, 0-42 in., 124 specimens; site 44, 0-6 in., 1 specimen; site 6, 0-18 in., 13 specimens; site 50, 0-18 in., 3 specimens; site 52, 0-12 in., 24-30 in., 13 specimens; site 51, 0-12 in., 18-24 in., 23 specimens. It is obvious from our finds that this device for suspending pots, recorded by the ethnologists Glaumont and Leenhardt, has a fair antiquity.

Pottery handles.—Eighty-six pottery handles or fragments of handles were collected; 67 of these were excavated. These are classified, according to differences in diameter of their two transverse cross sections, as circular, oval, or flat. If the difference in diameters is less than 2 mm., the handle is classed as circular; if it is more than 2 mm., the handle is oval; and if there are extreme differences in width and thickness, the handle is called flat. All measurements were taken at a median point, since the handle usually spreads and is thickest at the point of attachment to the vessel. The range of diameters for the circular handles is 18-44 mm.; for oval, 15-41 mm. Flat handles range in thickness of the flattened part from 11 to 23 mm.

Nineteen handles come from the surface of five unexcavated sites: sites 21 (1 spec.), 37 (2 specs.), 40 (3 specs.), 41 (11 specs.), and site X (2 specs.). The specimens from sites 41 and X were gifts: eleven from site 41 were presented to us by Mr. Eugene Dijou; and Mr. Ernest E. Féré gave us two from site X, on the road between Canala and Kouaoua, not visited by us.

Handles were found at eight of the eleven sites excavated, the exceptions being sites 50, 52, and 51, situated in the Tiouandé region on the north-central part of the east coast. It may be that handles were not used in this area or farther north.

Two circular handles in the collection are decorated: 17392, site 19 (6-12 in.) has part of a deeply incised pattern near the junction with the wall of the vessel (pl. 18, d); 26792, site 6 (30-36 in.) has a punctate design and the smallest diameter, 18 mm., in the circular group (pl. 18, c).

One oval handle (24991) from site 26 (18-in. level) has a deep longitudinal groove on its convex face (pl. 18, a). It resembles one illustrated by Avias (1950a, pl. II, fig. 3, p. 126).

Apparently most of the handles were attached to the pots horizontally. An oval handle from site X (24993) is an exception; its shape suggests vertical attachment (pl. 18, g). All the other handles that are complete enough for us to judge suggest horizontal attachment.

The oval handle 16649a was made by successive applications of clay to the core (pl. 18, h). Avias illustrates a similar one (Avias, 1950a, pl. II, fig. 2, p. 126).

The oval type is the most common, occurring at all of the eight sites except 48 and 14. Next in frequency is the circular type, present at all eight sites except 14 and 26. The flat type is found at only three sites (19, 20, and 14). Avias (1949a) mentions a flat handle from Teremba, across the estuary from our site 48. We collected no flat handles at the east coast sites, but Avias (1949a) speaks of one from Bogota, in the same general region as our site 44. No handles at all were found north of site 6 on the east coast. All three types were present at sites 19 and 20; only one type at each of the excavated sites 48 (circular), 14 (flat), and 26 (oval). Nowhere did handles occur below 42 in.

Thus it appears that pottery handles were most common on the west coast of New Caledonia with the greatest variety occurring in the southwestern part of the island, that is, at sites 19 and 20. A comparison of the distribution of handles and of sherds perforated for suspension cords suggests that the two forms are to a considerable degree mutually exclusive. Perhaps both served the same function.

Avias (1949a, p. 1; 1950a, pp. 135, 136) regards pottery handles as prehistoric in New Caledonia, since no ethnologist reports the use of pots with handles. Our depth distributions are inconclusive, since mere finding on the surface of a site is not necessarily proof of recency. Our site and depth distributions for handles are as follows: site 19, 0-12 in., 19 specimens; site 20, 0-6 in., 12-42 in., 21 specimens; site 48, 24-36 in., 2 specimens; site 13, 0-18 in., 7 specimens; site 14, 18-24 in., 1 specimen; site 26, 12-18 in., 1 specimen; site 44, 0-18 in., 10 specimens; site 6, 24-36 in., 6 specimens. Two peaks of depth distribution appear: 30 specimens from a depth of 0-6 in. and 13 from 24-30 in. These two peaks are not correlated with different types of handles. Flat handles were found at depths of 0-6 in., 18-24 in., and 36-42 in.; oval handles from depths from 0-6 in. to 30-36 in.; and circular handles at depths from 0-6 in. to 12-18 in. and 24-36 in.

Gambreled shoulders and flat bottoms.—Gambreled shoulders, possibly low on the vessel like the Gila shoulder of the Hohokam area of Arizona, were very common at site 13 (0-42 in.), but scarce elsewhere: site 19 (6-18 in.); site 48 (0-6 in.); site 14 (60-66 in.); and site 51 (6-30 in.).

In looking for gambreled shoulders we found 23 sherds that belonged to flat-bottomed vessels and were not true shoulder sherds. These are all from site 13, from depths between the surface and 24 in. The base of these potsherds is flat and undecorated and all appear rubbed or worn by use. Five are illustrated in plate 17, h-l, arranged with the base toward the top of the plate. These suggest the flat-bottomed sherd from Viti Levu pictured by Gifford (1951, pl. 19, c).

Modified potsherds.—Four potsherds recovered have small, biconically drilled holes, apparently for mending. Three of these pieces, with the holes just below the lip, are rim sherds from site 13, the fourth a body sherd from site 26. The four specimens are illustrated in plate 17, a-d; note the two holes in b.

Three potsherds abraded to disk shape with beveled edges were found at site 13 (0-24 in.). The beveled edge suggests that they may have been used as lids for small-necked jars. They are illustrated in plate 17, e-g.

"Yam charm."—Specimen 24992 is an elongate object of baked clay with a core of coral. It was found at site X on the road from Canala to Kouaoua, and given to us by Mr. Ernest E. Féré. It is said to represent a yam and to be a magical charm placed in a yam field to ensure a good crop. It is shown in figure 1, g.

Decorated sherds: relief.—There are five types of relief decoration: nubbins, ribs, gouges, crossed or checkerboard, and appliqué.

Nubbins: Nubbins are small protuberances on the exterior of a vessel, usually made by thrusting a stick into the soft clay on the inside before firing. Avias calls these "pustules" and has illustrated the method by a very clear drawing (Avias, 1950a, p. 114, fig. A, item 7). Excavated sherds in our collection with stick nubbins numbered 125. Two more were obtained from unexcavated sites: site 37, south of the lower Nera River; and site 41 on the ranch of Mr. Eugene Dijou near Moindou. We found no potsherds in New Caledonia with appliqué nubbins, like those in Viti Levu (Gifford, 1951, p. 226, pl. 18, d). However, we did find three in which the nubbins were pushed out with a finger instead of a stick.

Plate 12, a-c, i, j illustrates stick nubbins. Except for one sherd, 28878 from site 6 (0-6 in.), none has any other decoration. No nubbined sherds made by the stick method were found at sites 19, 13, 14, 26, 50, or 52, and none below 30 in. Eighty-two of the 125 sherds excavated come from the upper 6 in. The deepest occurrence was in the 24-30 in. level at site 48. The largest number comes from site 20, where the greatest concentration was in the upper 6 in. Only one of the nubbined specimens, a sherd from site 44 (0-6 in.), is a rim sherd. Another piece, from site 6 (12-18 in.), has nubbins on the shoulder below the neck. In all the others it is impossible to tell how close to the rim the nubbins were placed, but we assume they were on the upper half of the vessel.

The 125 stick-nubbined sherds were distributed as follows.

Site 20 (83 specs.): 0-6 in., 56; 6-12 in., 21; 12-18 in., 6
Site 48 (16 specs.): 0-6 in., 12; 6-12 in., 2; 12-18 in., 1; 24-30 in., 1
Site 44 (16 specs.): 0-6 in., 10; 6-12 in., 4; 12-18 in., 1; 18-24 in., 1
Site 6 (8 specs.): 0-6 in., 4; 6-12 in., 1; 12-18 in., 2; 18-24 in., 1
Site 51 (2 specs.): 12-18 in., 1; 18-24 in., 1

Three nubbined sherds, one from site 26 (0-6 in.), the other two from site 44 (0-6 in., 6-12 in.), differ from the 125 with stick nubbins. These three have a wide depression like a Fijian piece illustrated by Gifford (1951, pl. 19, j), and the nubbins look as though they had been made by the potter's pushing out the clay with her little finger instead of with a stick. Indeed, the sherd from site 26, no. 22265, has a thumb print on the outside where the vessel was supported while the pressure was applied on the inside. The two from site 44 are illustrated in plate 12, d, k.

Ribs: The most frequent type of relief decoration in New Caledonia is parallel ribbing of raised welts, probably made by pressure from a grooved paddle or tapa beater (pl. 12, n-x). Four of the excavated sites (20, 48, 50, and 52) lacked it. From unexcavated sites we obtained only one ribbed specimen, this from site 38 on Nepoui Peninsula.

We found 279 ribbed sherds by excavation. The largest number, 121, came from site 13, from the surface down to 42 in. At site 14, an air-line mile away, all but two of the 65 ribbed sherds were found at a depth between 36 and 66 in. This would suggest the possible contemporaneity of site 13 and the lower levels of site 14. Twenty of the ribbed sherds have gambreled shoulders: site 19 (6-18 in.) 2; site 13 (0-42 in.), 14; site 14 (60-66 in.), 1; site 51 (6-30 in.), 3. (See pl. 17, m-q.)

The range in the size and spacing of the ribs is much the same in our New Caledonian sherds as in those of the same type from Fiji (cf. Gifford, 1951, pl. 24, a, b, f, g, h, l, m). Varying effects in ribbed decoration were produced by applying the paddle to the pot at different angles. Thus 6 ribbed sherds from site 13 (0-24 in.) may be described as chevron-ribbed (pl. 12, t). Five from site 13 (0-24 in.) and 2 from site 14 (36-48 in.) have interrupted ribs. One from site 13 (18-24 in.) has both ribs and a line of incision of the roulette type. Two from site 13 (0-6 and 24-30 in.) have curved ribs (pl. 12, w), probably made with a specially carved paddle.

Distribution by site and depth is as follows.

Site 19: 0-6 in., 2; 6-12 in., 1; 12-18 in., 1
Site 13: 0-6 in., 77; 6-12 in., 24; 12-18 in., 2; 18-24 in., 9; 24-30 in., 3; 36-42 in., 6.
Site 14: 0-6 in., 1; 12-18 in., 1; 36-42 in., 5; 42-48 in., 25; 48-54 in., 17; 54-60 in., 13; 60-66 in., 3
Site 26: 0-6 in., 2; 6-12 in., 3; 12-18 in., 1; 18-24 in., 2; 30-36 in., 1
Site 44: 0-6 in., 2; 6-12 in., 2; 12-18 in., 1; 24-30 in., 1; 30-36 in., 1
Site 6: 0-6 in., 2; 6-12 in., 1
Site 51: 0-6 in., 2; 6-12 in., 10; 12-18 in., 33; 18-24 in., 4; 24-30 in., 14; 30-36 in., 7

Gouges: There are six sherds with gouged relief decoration: 1 from site 14 (24-30 in.); 2 from site 50 (6-12 in.); 3 from site 51 (0-6 in., 6-12 in., 24-30 in.) (pl. 12, e-h). Gouged relief was apparently accomplished by gouging the soft clay with a sharp instrument or stick, raising the clay above the normal surface. It is the crudest of the five types of relief decoration.

Cross or checkerboard: Sherds with cross-relief or checkerboard pattern were rare. The design was presumably made by striking or pressing with a cross-grooved stamp, paddle, or tapa beater. Ten sherds with cross-relief decoration were collected. Three were found in digging a small test pit, 18 in. deep, at site 10, inland on the east coast. The other seven came from four excavated sites: site 14, 36-42 in., 1; site 26, 0-6 in., 2; site 44, 0-6 in., 1; site 6, 6-12 in., 1; 12-18 in., 2. The appearance of these ten sherds is like certain of the Fijian sherds (Gifford, 1951, pl. 22). Plate 12, l, m, illustrates New Caledonian specimens.

Dr. G. H. Curtis reports (App. II) on the mineral constituents of four specimens from sites 14, 26, 44, and 6. These resemble other Caledonian sherds in composition and differ from similar Fijian sherds; it is thus unlikely that they were imported from Fiji.

Appliqué: This is the most ornate relief decoration. The sherds suggest that it was usually a ribbonlike narrow band encircling the vessel, applied after the vessel had been completely shaped. Appliqué decoration appears on 19 sherds, 8 of them from west coast site 14, 11 from east coast sites 44 (1 sherd), 6 (9 sherds), and 51 (1 sherd). Fourteen of these are illustrated in plate 12, y-al. The decoration on all 19 sherds suggests encirclement of the vessel; probably, to judge from the 9 rim sherds, not far below the rim or neck. The band of clay has apparently been applied to the complete vessel and then modified with a small tool to form various patterns: a series of elevations and depressions, a wavy design (as in the large piece found on the surface at site 14), or a series of four-pointed stars (as in pieces from site 6). None of the rim pieces has the appliqué on the actual

edge like the specimens found by Mr. Eugene Dijou at a depth of 6 m. near Moindou (Avias, 1950a, pl. 3, p. 137; fig. F, items 11 and 12, p. 124). One of the New Caledonian pieces (pl. 12, aj) has a close parallel in a Fijian specimen (cf. Gifford, 1951, pl. 24, r).

Distribution is as follows.

Site 14: 0-6 in., 1; 12-18 in., 4; 24-30 in., 1; 36-42 in., 2
Site 44: 0-6 in., 1
Site 6: 6-12 in., 1; 12-18 in., 6; 30-36 in., 1; 72-78 in., 1
Site 51: 12-18 in., 1

Decorated sherds: incised.—In ten of our excavated sites the weight of potsherds with incised decoration ranges from 1 to 6 per cent of the total weight of all sherds found; at site 13 the percentage rises to 34 (see tabulation, p. 71). Because of the distinctive character of the pottery found at site 13 we shall discuss separately the specimens found there. The following paragraphs deal with sherds found in other sites.

We have attempted to analyze the decoration of these incised pieces and have established on a purely arbitrary basis what we consider the basic design elements. In figure 5 we present 154 of these individual elements. Because of the smallness of the sample of decorated pottery we have attempted no study of the stratigraphic distribution of these design motives, especially since this has been done for the full designs (pls. 13-15).

For convenience the incised sherds have been divided into three groups: the first includes unique designs, only one of each being found; the second, designs found only at one site, although represented by more than one specimen at each site; the third, designs found at more than one site.

Group 1: Sherds with unique designs (see pl. 13) were found at nine excavated sites: site 19 (0-6 in.), 2; site 20 (0-30 in.), 9; site 14 (18-24 in., 48-54 in.), 2; site 26 (0-36 in.), 13; site 44 (6-18 in.), 2; site 6 (0-24 in., 36-42 in.), 8; site 50 (0-6 in.), 1; site 52 (0-6 in.), 1; site 51 (12-18 in.), 1. None was found at site 48. A sherd with two wide perpendicular lines (29992) was excavated at a depth of 66-72 in. at site 50, but was destroyed in the course of petrographic analysis and is not illustrated. Unique sherds were collected on the surface of unexcavated sites 15, 33, 40, and 49.

Group 2: Sherds with designs found only at one site, but with several specimens of each, come from seven excavated sites (see pl. 14): site 19 (0-18 in.), 3 designs, 9 sherds; site 20 (0-12 in., 24-30 in.), 6 designs, 18 sherds; site 14 (18-24 in., 36-48 in.), 2 designs, 9 sherds; site 26 (0-42 in.), 16 designs, 203 sherds; site 6 (0-18 in.), 3 designs, 14 sherds; site 50 (12-18 in.), 1 design, 6 sherds; site 51 (0-6 in.), 1 design, 4 sherds. Two designs from site 14, not represented in the plate, are gouged chevrons (24-30 in., 2 sherds), short parallelograms (0-30 in., 5 sherds).

Combining groups 1 and 2 we find the 74 designs limited to a single site as follows: site 19, 5 designs; site 20, 15 designs; site 14, 6 designs; site 26, 29 designs; site 44, 2 designs; site 6, 11 designs; site 50, 3 designs; site 52; 1 design; site 51, 2 designs.

Site 26 is the richest, with 29 designs; sites 20 and 6 yielded 15 and 11 designs respectively. At each of the other sites, 6 designs or less were found. This distribution is partly explained by the quantity of midden material screened (see p. 3), or it may be correlated with the total weight of potsherds excavated at each site (see table 40).

Whatever their relative abundance at the several sites, these sherds with designs limited to one site imply local manufacture and suggest a wider distribution of pottery-making than has previously been reported. Ethnologists have hitherto considered the island's northern half the pottery-making region, from which wares were transported to the south (Glaumont, 1895, p. 41; Leenhardt, 1930, p. 33), a misconception remarked by Avias (1949a): "Il signale l'erreur répandue, qui consiste à attribuer aux seuls indigènes du Nord de l'île la fabrication des poteries."

Group 3: As might be expected, sherds with designs found at more than one site constitute by far our largest group, the data on which are given below. The total number of sherds with each design is given in parentheses after the design description. All but five types are illustrated in plates 14 and 15.

Punctate (91): site 19 (6-12 in.); site 20 (6-12 in., 18-24 in.); site 14 (18-24 in.); site 26 (0-36 in.); site 44 (0-12 in.); site 6 (0-24 in.); site 50 (12-18 in.); site 52 (6-12 in.); site 51 (12-24 in.); site 15 (surface); site 49 (surface). Illustrated in pl. 15, z, aa, ae.

Multiple intersecting lines (138): site 19 (12-18 in.); site 20 (0-6 in., 12-18 in.); site 26 (0-36 in.); site 44 (0-6 in.); site 6 (0-6 in.); site 50 (0-6 in.); site 52 (0-6 in.); site 51 (0-12 in.); site 32 (surface); site 38 (surface). Illustrated in pl. 15, i, u.

Shell impressed (11): site 14 (0-6 in.); site 26 (0-12 in., 18-30 in.). Illustrated in pl. 15, p.

Leaf or tree design (11): site 19 (0-12 in.); site 20 (0-6 in., 12-18 in.); site 44 (0-6 in.). Illustrated in pl. 15, a, c, f.

Gashes and gouges on rim (12): site 26 (0-12 in., 18-24 in.); site 6 (6-12 in.); site 50 (6-12 in.); site 52 (0-6 in.). Illustrated in pl. 15, j, m, q.

Miscellaneous gashes (74): site 19 (0-6 in., 12-18 in.); site 20 (0-18 in.); site 26 (0-42 in.); site 44 (0-6 in.); site 6 (0-6 in.); site 50 (6-12 in., 66-72 in.); site 52 (0-6 in., 12-18 in.); site 51 (0-12 in., 18-24 in.); site 39 (surface); site 40 (surface). Illustrated in pl. 15, g, x.

Gashes in parallel lines (136): site 20 (0-24 in.); site 14 (12-24 in.); site 26 (0-36 in.); site 44 (0-6 in.); site 6 (0-12 in.); site 50 (0-18 in.); site 52 (0-6 in., 12-18 in., 24-30 in.); site 38 (surface). Illustrated in pl. 15, h, o, r.

Multiple fine lines (16): site 26 (0-12 in., 18-24 in.); site 52 (0-12 in.); site 51 (0-12 in.). Illustrated in pl. 15, aj.

Wavy lines on rim (42): site 26 (0-24 in., 30-36 in.); site 50 (0-12 in.); site 52 (0-12 in.); site 51 (0-6 in., 12-18 in.); site 49 (surface). Illustrated in pl. 15, k, w, ag.

Straight line below rim (16): site 26 (6-12 in., 18-24 in.); site 6 (6-12 in.); site 50 (0-6 in., 12-24 in., 54-60 in.); site 52 (6-12 in.); site 51 (0-18 in.); site 49 (surface). Illustrated in pl. 15, ac.

Parallel lines with oblique cross lines (3): site 26 (12-18 in.); site 51 (0-6 in.). Illustrated in pl. 15, s.

Deep gouges (3): site 26 (0-6 in.); site 50 (0-6 in.). Illustrated in pl. 15, af.

Perpendicular gashes below rim (2): site 19 (surface); site 39 (surface). Illustrated in pl. 15, b.

Pressed serrations (2): site 26 (0-6 in.); site 49 (surface). Illustrated in pl. 15, ad.

Diverging pairs of parallel lines (5): site 26 (0-6 in., 30-36 in.); site 50 (0-6 in.); site 52 (6-12 in.). Illustrated in pl. 15, ak.

Parallel zigzag lines (2): site 26 (0-6 in.); site 49 (surface). Illustrated in pl. 15, l.

Radiating lines from suspension holes (4): site 19 (0-6 in.); site 26 (12-18 in.); site 52 (6-12 in.); site 45 (surface). Illustrated in pl. 15, y.

Multiple continuous lines (8): site 26 (0-6 in., 12-24 in.); site 50 (0-6 in.); site 51 (0-12 in.). Illustrated in pl. 15, v, al.

Multiple chevrons (5): site 19 (0-6 in.); site 20 (0-6 in.); site 44 (0-6 in.). Illustrated in pl. 15, e.

Parallel and oblique lines (5): site 44 (0-6 in.); site 50 (0-6 in.); site 51 (6-12 in., 24-30 in.). Illustrated in pl. 14, ak.

Fine hatching (2): site 26 (6-12 in.); site 49 (surface). Illustrated in pl. 14, al.

Fine wavy lines (4): site 26 (6-12 in., 18-24 in.); site 51 (0-6 in.). Illustrated in pl. 14, ai.

Various incised lines below rim (10): site 14 (24-30 in.); site 26 (0-12 in.); site 44 (0-6 in.); site 6 (6-12 in.); site 50 (0-12 in.); site 52 (0-6 in.); site 51 (0-6 in.); site 49 (surface).

Zigzag or short converging lines (5): site 19 (6-12 in.); site 26 (0-6 in., 30-36 in.); site 50 (0-6 in., 48-54 in.); site 52 (0-6 in.).

Two parallel lines below rim (14): site 26 (12-24 in.); site 50 (0-12 in.); site 52 (0-6 in.); site 51 (0-12 in.); site 49 (surface).

Three or more parallel lines (21): site 19 (6-12 in.); site 20 (6-18 in.); site 48 (0-6 in.); site 26 (0-6 in., 18-24 in.); site 44 (0-6 in.); site 6 (0-6 in., 24-30 in.); site 50 (36-42 in.); site 52 (0-6 in.); site 51 (0-18 in.).

Nondescript incising on rim (3): site 19 (0-6 in.); site 26 (24-30 in.); site 50 (36-42 in.).

Site 13, incised sherds: As was stated in our introductory paragraph, site 13 yielded a distinctive type of pottery, of which 114 decorated sherds are shown in plates 16, 22, and 23. Here we found a whole series of sherds with complicated patterns of incised decorations, sometimes on both sides of a sherd, unlike those encountered at any of our other sites, except for 3 surface sherds found at sites 14, 18, and 50, respectively. The unique character of the site 13 pottery suggests a temporal difference between it and the other sites, an assumption corroborated by the radiocarbon dates for site 13, which, according to Professor Crane, are 481 B.C. and 846 B.C. There are no obvious differences in pottery designs found at different depths in site 13.

The pottery designs found at site 13 resemble those illustrated by Lenormand (1948) and Avias (1950a, pl. 3) from Ile des Pins. To be sure, the Reverend Auguste Wabealo asserted that the ancestors of the latest inhabitants of site 13 had moved there about two hundred years ago from Ile des Pins, where Lenormand found finely decorated sherds intermixed with the crude type so familiar in New Caledonia. It seems unlikely, however, that this elaborate type of pottery was made by the people of site 13, even if their former home was Ile des Pins. On this point Lenormand's comment (1948, p. 58) is pertinent: "Les marmites canaques des gens de l'Ile des Pins étaient fabriquées à l'île Ouen." (Ouen Island is at the southern end of New Caledonia.)

The incised decoration at site 13 consists of continuous or dotted (roulette) lines arranged in circles, semicircles, diamonds, squares, or parallel, and the various combinations make up a wide variety of designs. The diversity of motives and the skillful execution are vastly superior to anything found elsewhere on the New Caledonian mainland.

At site 13 we found three shapes which are rare or absent elsewhere: vessels with gambreled shoulder (pl. 17, q), which are also found elsewhere; vessels with flat bottom (pl. 17, h-l; pl. 23, ah); and vessels with a decorative flange below the rim. The last two are peculiar to site 13. The illustrated specimen of this last type (pl. 16, aj) comes from a depth of 24-30 in., and three others, less complete, are from depths respectively of 0-6 in. (no. 20540), 6-12 in. (no. 20767), and 12-18 in. (no. 19579).

In addition, we found two more types unique to site 13: a flat handle or lug for a vessel (pl. 22, ah); and part of the neck of a bottle-necked vessel (pl. 23, ai). To judge from the fragment, the neck of this last vessel was probably about 1-1/2 in. in diameter. This specimen resembles a sherd shown in Lenormand's second plate (third from the left). Some of the sherds illustrated in plate 22 (r, s, z-ae) show "eye" designs. A possible "eye" design is shown in plate 16, n, a design shown in larger context on an Ile des Pins sherd pictured by Avias (1950a, pl. 3, fig. 1). Many of the rim sherds are decorated on both exterior and interior.

The parallels with Ile des Pins sherds raise the question of the relationship of the two sites. Did the ancient people of site 13 settle at Ile des Pins first or vice versa, or were they both from a common origin? Radiocarbon dates from Ile des Pins may help to supply the answer.

The geologist Maurice Piroutet, describing (1917, pp. 260-262) what is probably our site 13, remarks on the occurrence of potsherds in the marine deposit as well as in the kitchen midden and comments on the varied and original pottery decoration. He discerned, among many other motifs, incised imbrications like those on certain Corinthian vases of the 7th century B.C. and another recalling the palmettes, "imprimées à la roulette, du buccheroo nero étrusque." M. Piroutet points out these analogies "sans prétendre en tirer la moindre conséquence, considérant ces poteries calédoniennes comme beaucoup plus récentes." Professor Crane's radiocarbon dates do, however, indicate that the site 13 material is contemporaneous with the Corinthian material mentioned by Piroutet.

EUROPEAN CLAY PIPES

A number of clay pipe fragments of European origin—mostly from Scotland, to judge from the names on the stems of two—were recovered from several sites: site 15, surface; site 48, 0-6 in.; site 26, 0-18 in.; site 44, 0-12 in.; site 6, 0-6 in.; site 51, 0-12 in.; site 52, 0-12 in. None was found at sites 19, 20, 13, 14, or 50.

Two types of bowls and two stem fragments are illustrated in plate 20, e-h. Plate 20, f shows a stem stamped with the word "Glasgow" on one side, "Murray" on the opposite side. Plate 20, g is similarly stamped "Glasgow" and "McDougall." These four pieces are from site 44.

GLASS BEADS

Nine colored glass trade beads, probably of European manufacture, were recovered from sites 26 and 44.

From site 26 (0-6 in. and 6-12 in.) we recovered two blue faceted beads with a hexagonal transverse cross section with a diameter of 6 mm. One is shown in plate 20, m. Also from site 26 (6-12 in.) came a green bead,

in the shape of a flattened sphere with a diameter of 9 mm., shown in plate 20, l.

From site 44 (0-6 in.) we recovered four blue beads, also flattened spheres, with a diameter of 8.5 mm. One is shown in plate 20, j. These four specimens are identical with no. 74, of C. W. Meighan's "Trade Bead Classification" (MS), recorded from Alaska, Canada, Oregon, and Northern California, as well as from New Caledonia.

From the 0-6 in. level of site 44 we recovered a green, keeled bead, shown in plate 20, k. It has a diameter of 8 mm.

In the 6-12 in. level of site 44, we found half of a green bead in the shape of a flattened sphere, similar to the one shown in plate 20, l.

TABLES 32-42

TABLE 32

Distribution of Shell Net Sinkers

Depth (in.)*	Sites											Total
	19	20	48	13	14	26	44	6	50	52	51	
6				7		82	80			5		174
12		1		5		92	11	1		1		111
18	1			1	3	94	8	2	3		1	113
24	—			7	9	138	1	1				156
30			2	2	76	88			9			177
36				1	75	29			12			117
42		1		1	37	7	—		16	—	—	62
48			1	2	10	1			16			30
54					4				10			14
60		1			3				6			10
66									1			1
72					2				2			4
78					1				1			2
84									5			5
90									—			
96								—				
Total	1	3	3	26	220	531	100	4	81	6	1	976

*Crossbar indicates lowest depth dug.

TABLE 33

Distribution of Filed Conus literatus Shells

Depth (in.)*	Sites											Total
	19	20	48	13	14	26	44	6	50	52	51	
6		2		3	1	8						14
12		1				8						9
18						13						13
24	—	1		2	2	13						18
30		1			1	10						12
36		1				7						8
42					1		—			—	—	1
48			—	—		—						
54												
60		—										
66												
72												
78					—							
84												
90									—			
96								—				
Total		6		5	5	59						75

*Crossbar indicates lowest depth dug.

TABLE 34

Cypraea Caps for Octopus Lures

Depth (in.)	Site				
	19	13	14	26	6
6	1			7	
12		1		4	2
18				3	1
24				3	
30			1	4	

TABLE 35

Cypraea Remnants

Depth (in.)	Site					
	19	20	14	26	6	50
6				13	1	1
12	1			18	2	
18	2			13		1
24			2	17		
30			1	11	2	
36		2		7		
42				1	1	1

TABLE 36

Distribution of Chipped Stone Tools: Group 1

Tools	Site									
	19	20	13	14	26	44	6	50	52	51
Scraper-hammerstone (A)										
6 in.			1							
24 in.					1					
End and side scraper (B)										
6 in.	2	2	5	2	4	4		1		
12 in.			1		2					
18 in.		1			1			1		
24 in.				1	1					
Side scraper, 1 side worked (C)										
6 in.	2	4	9	1	2	1				
12 in.	2	1	3		3					
18 in.		1	1	1	1					
24 in.					3					1
36 in.						1				
Side scraper, 2 sides worked (D)										
6 in.	3		7		1					
12 in.	1		1	2	3	1			1	1
18 in.					2					
24 in.				4	3					
30 in.										2
36 in.										1
End scraper (E)										
6 in.		1	5							
12 in.			1							
18 in.										1
36 in.					1					
Graver (F)										
6 in.			3		1					
Chopper (G)										
6 in.			5			3				
12 in.			1		2	1				
18 in.					1					
24 in.					2					
30 in.					3					
36 in.					3					
42 in.							1			
Scraper-chopper (H)										
6 in.	1		1	1	1					
12 in.					1			1		
24 in.					1					
30 in.					3					
36 in.					1					

TABLE 36
(continued)

Tools	Site									
	19	20	13	14	26	44	6	50	52	51
Hammerstone or pecking stone (I)										
6 in.						5			3	1
12 in.			1			4		1		1
18 in.					1		2			1
30 in.					2					
36 in.					2					
Shaft scraper (J)										
6 in.			1							
Flake knife (K)										
6 in.			1							
24 in.		1								

TABLE 37

Chipped Stone Artifacts: Group 1

Types	Dimensions (mm.)									Weight (gm.)			Number of Specimens
	Length			Width			Thickness						
	min.	max.	ave.	min.	max.	ave.	min.	max.	ave.	min.	max.	ave.	
Scraper-hammerstones (A)	47	48	47.5	21	38	29.5	14	35	24.5	16	74.5	45.3	2
End and side scrapers (B)	19	63	32.3	10	45	23.9	4	24	12.0	1	67.5	13.4	30
Side scrapers, one side worked (C)	15	59	35.6	11	45	23.9	4	24	11.9	0.8	35.4	12.0	36
Side scrapers, two sides worked (D)	17	76	34.9	11	49	22.4	5	38	14.0	1	96.2	15.9	35
End scrapers (E)	23	60	37.6	20	37	26.9	8	25	14.6	5.3	63.2	17.5	13
Gravers (F)	27	64	39.0	21	35	27.0	5	18	12.0	3.0	38.0	15.5	4
Choppers (G)	29	85	60.0	22	72	48.0	15	52	33.5	13.4	326.4	123.7	22
Scraper-choppers (H)	32	77	56.8	23	68	48.8	8	54	35.7	6.4	262.7	131.9	10
Hammerstones and pecking stones (I)	22	90	44.3	12	79	34.3	11	69	27.0	3.5	198.8	77.4	28
Shaft scraper (J)		93			50			10			42.2		1
Flake knife (K), serpentine		45			42			7			16.0		1
Flake knife (K), obsidian		31			14			4			1.3		1

TABLE 38

Unclassified Flakes and Cores: Group 2

Depth (in.)	Site									
	19	20	13	14	26	44	6	50	52	51
6	36	7	61	14	37	6	2		1	4
12	6	1	54		30	1	3	1	2	3
18		1	2	2	15	2				3
24	1				20					2
30		1	4		11					1
36			1	1	10	1				1
42			2			1				
48				2	2			1		
54				3						
60				1						
66				1						

TABLE 39

Grindstone Fragments

Specimen no.	Provenience		Dimensions (mm.)			Illustration
	Site	Depth (in.)	Length	Width	Thickness	
17071	19	0-6	79	74	25	
21943	26	surface	93	68	30	
22858	26	12-18	84	80	23	Pl. 10, v
22940	26	18-24	42	35	21	
23208	26	12-18	71	58	28	
23391	26	18-24	80	51	30	
23522	26	30-36	51	50	26	
23734	26	6-12	46	22	11	
24087	26	0-6	115	64	39	Pl. 10, x
24726	26	18-24	92	66	34	Pl. 10, w
25147	44	6-12	75	42	21	
25495	44	0-6	42	27	25	
25963	6	surface	50	35	10	

TABLE 40

Distribution of Potsherds

(Weight in oz.; x, 1/2 oz. or less)

Depth (in.)	Site										
	19	20	48	13	14	26	44	6	50	52	51
6	381	542	56	655	66	1,614	590	287	243	145	445
12	87	498	22	353	16	1,471	341	216	241	130	311
18	38	407	5	195	66	1,278	147	123	95	39	261
24	x	445	6	133	72	1,172	15	54	37	7	115
30		386	4	111	37	795	3	53	34	3	43
36		196	7	10	26	360	6	28	13		15
42		138	4	13	51	88	2	17	22		x
48		10	3	x	65	5		5	38		
54		6			56			4	16		
60		3			25			5	9		
66					6			3	25		
72					3			1	23		
78					1			1	18		
84								1	14		
90								1	x		
Total weight	506	2,631	107	1,470	490	6,783	1,104	799	828	324	1,190

TABLE 41

Distribution of Potsherd Types: Percentages of Weight

(x, 1/2 of 1 per cent or less)

Type	Depth (in.)														
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
Site 19															
Plain	94	90	95	100											
Incised	6	10	5	0											
Relief	0	x	x	0											
Site 20															
Plain	93	95	96	99	99	99	99	100	100	100					
Incised	5	4	4	1	1	1	1	0	0	0					
Relief	2	1	x	0	0	0	0	0	0	0					
Site 48															
Plain	96	95	100	100	100	100	100	100							
Incised	2	0	0	0	0	0	0	0							
Relief	2	5	x	0	x	0	0	0							

TABLE 41
(continued)

Type	Depth (in.)														
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
Site 13															
Plain	64	65	60	65	57	50	69	x							
Incised	32	32	37	34	42	50	15	x							
Relief	4	2	3	2	1	0	15	0							
Site 14															
Plain	98	94	95	99	95	100	94	92	89	80	83	100	100		
Incised	2	6	2	1	3	0	2	2	2	0	0	0	0		
Relief	x	0	3	x	3	0	4	6	9	20	17	0	0		
Site 26															
Plain	96	96	95	95	96	96	99	100							
Incised	4	4	5	4	4	4	1	0							
Relief	x	x	x	x	x	x	0	0							
Site 44															
Plain	96	99	98	100	100	100	100								
Incised	2	1	1	0	0	0	0								
Relief	2	x	1	x	0	0	0								
Site 6															
Plain	95	95	90	100	98	93	94	100	100	100	100	100	100	100	100
Incised	5	4	4	x	2	7	6	0	0	0	0	0	0	0	0
Relief	x	x	6	x	0	x	0	0	0	0	0	0	x	0	0
Site 50															
Plain	94	95	91	97	100	100	100	97	100	100	100	96	100	100	100
Incised	6	4	9	3	x	x	x	3	x	x	x	4	0	0	0
Relief	0	x	0	0	0	0	0	0	0	0	0	0	0	0	0
Site 52															
Plain	93	96	95	100	100										
Incised	7	4	5	0	x										
Relief	x	0	0	0	0										
Site 51															
Plain	95	95	93	95	88	93	0								
Incised	5	4	3	3	2	0	0								
Relief	x	1	3	3	9	7	100								

TABLE 42

Rim and Lip Types: Percentages

	Site											Total sherds
	19	20	48	13	14	26	44	6	50	52	51	
Rims												
Straight	56	70	70	32	44	50	73	63	49	48	53	1,013
Outcurved	30	20	8	61	46	49	27	34	47	48	45	849
Incurved	14	10	22	7	10	1	0	3	4	4	2	88
Lips												
Round	81	91	83	29	93	97	79	82	90	97	87	1,581
Grooved				1								4
Flat		5	11	47	4	1	10	4	2		4	201
Inside bevel	14	2	6	7	2	1	10	5	6		7	75
Outside bevel	5	2		14	1	1	1	7	2	3	2	78
Double bevel				2		x*		2				11

*Less than half of 1 per cent.

DISTRIBUTION OF ARTIFACT TYPES IN NEW CALEDONIA

This section deals with the distribution of artifact types in the eleven New Caledonian sites which we excavated. The types are classified in two categories: those limited to single sites, and those shared by two or more. The classification is of course subject to revision since some of the supposedly unique types may be obtained at other sites when further excavations are undertaken.

The artifacts limited to one site show the traits developed locally, whereas those found at two or more sites demonstrate the relationships of the eleven sites excavated.

UNIQUE TYPES

Twenty-five unique artifact types, each found at only one site, are listed below. (Designs on decorated pottery are excluded.) Each type is illustrated as indicated. The numbers per site are as follows: site 19, 1; site 20, 1; site 13, 9; site 14; 1; site 26, 9; site 6, 2; site 50, 2. None was found at sites 48, 44, 52, or 51. The list gives the range of depths at which the types were found; some of them have a considerable vertical distribution. In the deeper sites unique types were lacking at the lower depths. Thus, in site 20, dug to 60 in., the single unique type was found at 12 in.; in site 14, dug to 78 in., at 30 in. Sites 6 and 50, dug to 96 in. and 90 in. respectively, yielded two unique types each. At site 6, the lowest depth at which a unique type was found was 36 in.; at site 50, 60 in. It is not clear whether the absence of unique types at the greater depths is of cultural significance or is purely fortuitous.

It would seem that the unique types do indicate a degree of local specialization. Thus presently occupied site 26, with nine unique types, seems to have been a center of specialization throughout its history. Similarly site 13, with nine unique types, was also a center of specialization; it was presumably deserted in antiquity, as the radiocarbon dates given beyond indicate. This specialization at site 13 would seem to have chronological significance, especially when coupled with the large series of unique pottery decorative designs. No similar site was found in New Caledonia.

The twenty-five unique types are listed below. (See p. 3 of the Introduction for explanation of depth statistics.)

Bone dagger (pl. 8, af); site 26, 18 in.

Conus eburneus money shell (pl. 6, i); site 26, 6-42 in.

Conus eburneus cap (pl. 8, i); site 13, 12-24 in.

Meleagrina money ornament (pl. 20, c, d); site 26, 6 in.

Trochus niloticus bracelet (pl. 8, r, s, t); site 26, 6-30 in.

Conus literatus with ground periphery; site 26, 6-36 in.

Conus literatus with ground periphery and groove (pl. 20, n); site 14, 30 in.

Square Conus literatus pendant (pl. 8, e); site 13, 18 in.

Spire-lopped Cymatium pileare; site 50, 48 in.

Patella stellaeformis ring (pl. 8, g); site 6, 36 in.

Abraded bivalve shell (pl. 8, q, u); site 50, 54-60 in.

Sinker or anchor stone (pl. 10, aa); site 20, 12 in.

Chipped shaft scraper (pl. 11, k); site 13, 6 in.

Ground stone adze, oval cross section (fig. 3, f); site 26, 12 in.

Ground stone adze, slightly trapezoidal cross section (fig. 1, e); site 19, 12 in.

Ground lenticular axe; site 26, 6 in.

Steatite drilled pendant (pl. 10, f); site 26, 12 in.

Cylindrical stone with 2 encircling grooves (pl. 10, p); site 6, 12 in.

Incised steatite object (pl. 10, t); site 26, 18 in.

Potsherd with grooved lip (fig. 4, i-k); site 13, 6-30 in.

Potsherd made into disk (pl. 17, e-g); site 13, 6-24 in.

Potsherd from flat-bottomed vessel (pl. 17, h-l); site 13, 6-24 in.

Flanged potsherd (pl. 16, aj); site 13, 6-30 in.

Flat handle or lug for a pottery vessel (pl. 22, ah); site 13, 6-12 in.

Part of neck of bottle-necked vessel (pl. 23, ai); site 13, 24-30 in.

To these unique 25 artifact types should be added the 74 incised pottery designs (groups 1 and 2, p. 74, illustrated mostly in pls. 13 and 14), bringing the total of unique types to 99. This does not include the many incised pottery designs, probably at least 100, peculiar to site 13 (pls. 16, 22, and 23).

The distribution of the 99 unique types in the sites excavated is as follows: site 19, 6 types; site 20, 16; site 13, 9; site 14, 7; site 26, 38; site 44, 2; site 6, 13; site 50, 5; site 52, 1; site 51, 2. The figure for site 13 does not include incised pottery designs. No unique type was found at site 48.

That the frequency of unique types may be correlated with the amount of deposit screened seems unlikely, since site 6 (1,791 cu. ft. screened) yielded only 13 unique types and site 26 (1,053 cu. ft. screened) 38 unique types, whereas site 13 (495 cu. ft. screened) yielded more than 100.

It appears that sites 13 and 26 were true culture centers, 13 in ancient times, 26 more recently. For the other eight sites no particular significance seems to attach to the number of unique types and the amount of deposit screened. It is possible that site 20, with 16 unique types, may have been a cultural center for the southwestern coast of the island.

Site 19, 612 cu. ft. screened, 6 unique types
Site 20, 927 cu. ft. screened, 16 unique types
Site 48, 99 cu. ft. screened, no unique types
Site 14, 414 cu. ft. screened, 7 unique types
Site 44, 837 cu. ft. screened, 2 unique types
Site 50, 882 cu. ft. screened, 5 unique types
Site 52, 153 cu. ft. screened, 1 unique type
Site 51, 378 cu. ft. screened, 2 unique types

There is a marked contrast between the yield of unique types at the two currently inhabited sites, site 26, with 38 unique types, and 51, with only 2.

SHARED TYPES

Table 43 gives the distribution of the 57 types shared by two or more sites. In addition, 23 incised potsherd designs (group 3) shared by two or more of the excavated sites are given on pages 74-75, making a total of 80 shared aboriginal traits found at the various sites. In the table the notation for depth gives the highest and lowest 6-in. block in which the type occurred, but this does not necessarily imply continuous distribution throughout the range.

TABLE 43

Distribution of Shared Types by Depth (in.)

Artifact	Site										
	19	20	48	13	14	26	44	6	50	52	51
Bivalve shell net sinker (pls. 3a; 7 g, h)	18	12-60	30-48	6-48	18-78	6-48	6-24	6-24	18-84	6-12	18
Placostylus shell fishhook (Sarasin, 1917, figs. 9 and 147)	6-18	6				6		24			
Conus literatus bracelet or ring (pl. 6 a-h)				6-18	42	6-24		72			
Filed Conus literatus shell (pl. 6 m)		6-36		6-24	6-42	6-36					
Filed Conus marmoreus shell (pl. 6 l)						6-36		6-30			
Small spire-lopped Conus (pls. 7 c, 8 z, ab)						12-36		30-90	6-72		
Spire-lopped Oliva ispidula (pl. 8 c, d)						6			6		
Spire-lopped Oliva elegans (pl. 8 a, b)									6-84	6	
Conus literatus straight knife (pl. 8 v)		12-18				6-30					
Univalve whole-shell paring knife (pl. 8 h, ac, ad)		6-36				30-36	12				
Univalve whole shell with abraded opening (pl. 8 f, aa)						6			12		
Side-drilled univalve shell (pls. 7 a, e; 8 p)						6	6	18-30		6	
Shell "pot scribe" (pls. 7 d, 8 j)	6-12	30				24					
Scraper of bivalve shell (pls. 8 ag, ah; 20 b)	12	6-12		6-24	12-24	12					
Perforated bivalve shell, other than net sinker (pl. 8 k-o, w, x)				24-36	66	12-24		30-60	12-72		
Cut shell (pls. 7 b; 8 y, ae; 20 i)				6		24-42			18-24		
Octopus-lure Cypraea cap (pl. 7 j, l)	6			12	30	6-30		12-18			
Octopus-lure (?) Cypraea remnant (pl. 7 i, k)	12-18	36			24-30	6-42		6-42	6-42		
Grindstone (pl. 10 v, w, x)	6					6-36	6-12	6			
Stone file (pl. 10 g)	6					6-30					6
Chipped scraper-hammerstone (pl. 11 ad)				6		24					
Chipped end-and-side scraper (pl. 11 c-e)	6	6-18		6-12	6-24	6-24	6		6-18		
Chipped side-scraper, one side worked (pl. 11 f, g)	6-12	6-18		6-18	6-18	6-24	6-36				24
Chipped side-scraper, two sides worked (pl. 11 h, i)	12			6-12	12-24	6-24	12			12	12-36
Chipped end-scraper (pl. 11 a, b)		6		6-12		36					18
Chipped graver (pl. 11 m-o)				6		6					
Chipped chopper (pl. 11 x, y)				6-12		12-36	6-12	42			
Chipped scraper-chopper (pl. 11 v, w)	6			6	6	6-36			12		
Hammerstone or pecking stone (pl. 11 z, aa, ab, ac)				12		18-36	6-12	18	12	6	6-18
Stone-flake knife (pl. 11 j, l)		24		6							

TABLE 43
(continued)

Artifact	Site										
	19	20	48	13	14	26	44	6	50	52	51
Slingstone (pl. 10 m-o, q-s)						12	6			12	
Stone bead (fig. 3 c; pl. 10 a-e, h-l)		6				6-18	6				
Spatulate stone pendant (pl. 10, y, z)						12					6
Small pointed stone object (pottery marker?)						12-30	12				
Incised-decorated potsherd	6-18	6-42	6	6-48	6-54	6-42	6-18	6-42	6-72	6-30	6-30
Relief-decorated potsherd	12-18	6-18	6-30	6-42	6-66	6-36	6-24	6-78	12	6	6-42
Potsherd with straight rim (fig. 4 a, i, j, k, m-o)	6-18	6-42	6-18	6-30	6-60	6-48	6-24	6-42	6-78	6-12	6-36
Potsherd with outcurved rim (fig. 4 e-h, p-r)	6-18	6-36	6-48	6-42	6-60	6-48	6-42	6-42	6-54	6-30	6-36
Potsherd with incurved rim (fig. 4 b-d, l)	6-18	6-42	6-12	6-42	6-60	6-36		6-18	6-30	6	6
Potsherd with round lip (fig. 4 b-h)	6-18	6-42	6-48	6-42	6-60	6-48	6-42	6-42	6-78	6-30	6-36
Potsherd with flat lip (fig. 4 a)		6-24	6-18	6-42	30-48	6-36	6-18	6-12	24-78		6-36
Potsherd with lip with inside bevel (fig. 4 l-n)	6	6-24	6-12	6-30	18	6-24	6-18	6-30	6-72		6-18
Potsherd with lip with outside bevel (fig. 4 o, p)	6	6-18		6-30	54	6-24	6-18	6-36	12	6	12-24
Potsherd with lip with double bevel (fig. 4 q, r)				6-12		6-12		24-30			
Potsherd with suspension holes (pl. 17, w-z)						6-42	6	6-18	6-18	6-30	6-24
Pottery handle (pl. 18)	6-12	6-42	30-36	6-18	24	18	6-18	30-36			
Pottery handle, circular cross section (pl. 18 c-e)	6-12	30	30	6			6-18	30-36			
Pottery handle, oval cross section (pl. 18 a, g-i)	6	6-36		6-12		18	6	30-36			
Pottery handle, "flat" cross section (pl. 18 b, f)	6	42			24						
Relief-decorated potsherd, stick-nubbins (pl. 12 a-c, i, j)		6-18	6-30				6-24	6-24			18-24
Relief-decorated potsherd, finger-nubbins (pl. 12 d, k)						6	6-12				
Relief-decorated potsherd, gouged (pl. 12 e-h)					30				12		6-30
Relief-decorated potsherd, cross (pl. 12 l, m)					42	6	6	12-18			
Relief-decorated potsherd, ribbed (pl. 12, n-x)	6-18			6-42	6-66	6-36	6-36	6-12			6-36
Relief-decorated potsherd appliqué (pl. 12, y-al)					6-42		6	12-78			18
Potsherd with gambreled shoulder (pl. 17, m-q)	6-18		6	6-42	66						12-30
Potsherd drilled for mending (pl. 17, a-d)				6-12		12					

Table 44 presents a statistical analysis of the shared traits presented in table 43. The first column gives the total number of shared types for each site. The other vertical columns give, under the appropriate site headings, (C) the count of traits shared by that site with the site listed in the same row in the left-hand column (stub) of the table; and (P) the percentage of the total shared traits of the site which it shares with the site listed in the stub. Thus site 19, with a total of 35 shared traits, shares 25 with site 20, 12 with site 48, 20 with site 13, and so on. Also 71 per cent of site 19 shared traits are shared with site 20, 34 per cent with site 48, 57 per cent with site 13, and so on. These percentages are derived by dividing the number of traits shared by the two sites by the total number of shared traits of the site listed at the top of the vertical column; thus the figure 71 per cent in the site 19 column is the quotient of 25 (the site 19 traits shared with site 20) and 35 (the total number of site 19 shared traits). In similar fashion the figure 74 per cent in the site 20 column is the quotient of 25 (the number of site 20 shared traits shared with site 19) and 34 (the total number of site 20 shared traits). The percentages in the columns should be read down.

Table 45 presents for each of 55 pairs of sites a per-

TABLE 44

Counts and Percentages of Shared Traits

(C, count; P, per cent; read percentages down)

Site	Total shared traits	Site																					
		19		20		48		13		14		26		44		6		50		52		51	
		C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P
19	35			25	74	12	86	20	61	21	68	30	43	22	59	21	55	18	47	15	54	18	51
20	34	25	71			13	93	19	58	20	65	28	41	34	65	21	55	17	45	13	46	18	51
48	14	12	34	13	38			12	36	12	39	11	16	12	32	13	34	10	26	8	29	12	34
13	33	20	57	19	56	12	86			22	71	30	43	18	49	20	53	15	39	10	36	16	46
14	31	21	60	20	59	12	86	22	67			27	39	19	51	21	55	18	47	12	43	17	49
26	69	30	86	28	82	11	79	30	91	27	87			32	84	35	92	35	92	27	96	30	86
44	38	22	63	24	71	12	86	18	55	19	61	32	46			27	71	19	50	18	64	21	60
6	38	21	60	21	62	13	93	20	61	21	68	35	51	27	73			23	61	19	68	20	57
50	38	18	51	17	50	10	71	15	45	18	58	35	51	19	51	23	61			23	82	22	63
52	28	15	43	13	38	8	57	10	30	12	39	27	39	18	49	19	50	23	61			20	57
51	35	18	51	18	53	12	86	16	48	17	55	30	43	21	58	20	53	22	58	20	71		

TABLE 45

Percentage Indexes Showing Relationships of Sites on Basis of Shared Types

Sites	Site										
	19	20	48	13	14	26	44	6	50	52	51
19		72	60	59	64	64	61	57	49	48	51
20			65	57	62	61	68	58	47	42	52
48				61	63	47	59	63	48	43	60
13					69	67	52	57	42	33	47
14						63	56	61	52	41	52
26							65	71	71	67	64
44								72	50	56	59
6									61	59	55
50										71	60
52											64

centage index, derived by adding the percentages of traits shared by the pair and dividing the sum by 2. The purpose is, by using a single figure instead of two, to make the relationships of each pair more readily perceptible. Thus the percentage index 61 for sites 13 and 48 is half the sum of 36 (the percentage of site 13 traits shared with site 48) and 86 (the percentage of site 48 traits shared with site 13).

The following list (p. 88) ranks the 55 percentage indexes in order from lowest (33) to highest (72), an arrangement which reveals twenty-six degrees of relationship between sites, from the sites least closely related to those most closely related. In the third column we have indicated the location of the pairs of sites on the east or west coast: west-east, east-east, or west-west.

On the east coast the two sites with the most traits in common (index 72) are sites 44 and 6, with sites 50 and 52 in second place (index 71). Sites 50 and 52 are nearly adjacent, whereas 44 and 6 are separated by many miles. The closest relationship between any two west coast sites is between the two southernmost (sites 19 and 20), with an index of 72. West coast site 26 has a closer relationship (index 71) with two east coast sites (6 and 50) than with any west coast site, thus indicating a trans-island connection. On the west coast the closest affinity of site 26 is with site 13 (index 67), but this is not so close as that between west coast sites 13 and 14, which have an index of 69, are only a mile apart, and have the earliest radiocarbon dates of any sites on the west coast.

Turning to the least closely related sites, that is, those with low percentage indexes, we find seven sites (east coast, 50, 52, and 51; west coast, 20, 48, 13, and 14), with indexes ranging from 33 to 47. Of the west coast sites, the lowest index, 47, expresses the relationship between sites 48 and 26, which are respectively our least and most excavated sites on the west coast. Of the east coast sites, the lowest percentage index is 50, representing the relationship between sites 44 and 50.

The vertical distribution of the 80 traits shared by two or more New Caledonian sites (see table 43) presents problems as to the chronological equation of the same levels in various sites. Obviously, to equate them would be unwarranted in view of the radiocarbon dates from seven of the sites (20, 13, 14, 26, 6, 50, 51).

For the depth range of the 80 shared traits see page 85. It is noteworthy that only an occasional trait is limited to either upper or lower levels. When this is so, the

trait is usually one shared by only two sites and possibly indicates contemporaneity of the two. Those shared by three or more sites usually show a considerable range of depth, which in turn implies long existence of the types.

Combining unique and shared traits for all sites except site 13, we get the following totals of traits for each of ten sites. Site 13 is omitted because no exact count was made of the many unique incised pottery designs.

Site 19: Unique traits 6, shared traits 35, total traits 41
Site 20: Unique 16, shared 34, total 50
Site 48: Unique 0, shared 14, total 14
Site 14: Unique 7, shared 31, total 38
Site 26: Unique 38, shared 69, total 107
Site 44: Unique 2, shared 38, total 40
Site 6: Unique 13, shared 38, total 51
Site 50: Unique 5, shared 38, total 43
Site 52: Unique 1, shared 28, total 29
Site 51: Unique 2, shared 35, total 37

Site 13 and site 26 were apparently true culture centers. Site 13, with its more than 100 unique pottery designs, 9 other unique traits, and 33 shared traits, was probably the culture center of antiquity; site 26, with 38 unique traits and 69 shared traits, the center of culture of recent times. This view receives corroboration from the radiocarbon dates presented in the next section: 846 B.C. and 481 B.C. for site 13 and 1169 A.D. and 1049 A.D. for site 26. Both sets of dates were derived from samples taken at depths of 30 and 36 in.

Percentage index	Sites	Location
33	13-52	W-E
41	14-52	W-E
42	20-52	W-E
42	13-50	W-E
43	48-52	W-E
47	20-50	W-E
47	13-51	W-E
47	48-26	W-W
48	19-52	W-E
48	48-50	W-E
49	19-50	W-E
50	44-50	E-E
51	19-51	W-E
52	20-51	W-E
52	13-44	W-E
52	14-50	W-E
52	14-51	W-E
55	6-51	E-E
56	14-44	W-E
56	44-52	E-E
57	19-6	W-E
57	20-13	W-W
57	13-6	W-E
58	20-6	W-E
59	19-13	W-W
59	48-44	W-E
59	44-51	E-E
59	6-52	E-E
60	19-48	W-W
60	48-51	W-E
60	50-51	E-E
61	19-44	W-E
61	20-26	W-W
61	48-13	W-W
61	14-6	W-E
61	6-50	E-E
62	20-14	W-W
63	48-14	W-W
63	48-6	W-E
63	14-26	W-W
64	19-14	W-W
64	19-26	W-W
64	26-51	W-E
64	52-51	E-E
65	26-44	W-E
65	20-48	W-W
67	13-26	W-W
67	26-52	W-E
68	20-44	W-E
69	13-14	W-W
71	26-6	W-E
71	26-50	W-E
71	50-52	E-E
72	19-20	W-W
72	44-6	E-E

RADIOCARBON DATES

As stated in the Introduction, all excavated sites had European articles and bones of introduced mammals on the surface and in some of the upper levels. Whether these were left by European settlers or by aborigines is not known, but European origin is certain. Of the seven New Caledonian sites for which radiocarbon dates are recorded in table 46, two (sites 26 and 51) are now occupied by aboriginal villages. The five others are either occupied as ranches or used as plantations, barnyards, or fishing places (see site descriptions). Site 13 was last used as a native yam field.

The two early radiocarbon dates for site 13, together with the unique type of pottery found there, make it seem likely that this site was deserted in antiquity, perhaps before the time of Christ. According to the Reverend Auguste Wabealo, the latest aboriginal inhabitants were recent settlers, who apparently made no pottery at site 13. They were moved away by the Government in 1902.

Although some 400 samples of charcoal were collected in the course of our excavations very few were of sufficient size for carbon-14 measurement. Nine measurements for New Caledonia and four for Viti Levu (Fiji) have been kindly made by Professor H. R. Crane, Randall Laboratory of Physics, University of Michigan. The measurements for New Caledonia were made in 1953 and 1954, for Viti Levu in 1952 (specimen 5810) and in 1954.

Site 20: 36-42 in.; specimen 15321; years before present, 1335 ± 300.

Site 13; 24-30 in.; specimen 15631; years before present, 2800 ± 350.

Site 13; 30-36 in.; specimen 16226; years before present, 2435 ± 400.

Site 14; 42-48 in.; specimen 15660; years before present, 1700 ± 300.

Site 26; 24-30 in.; specimen 15788; years before present, 785 ± 300.

Site 26; 30-36 in.; specimen 15749; years before present, 905 ± 300.

Site 6; 24-30 in.; specimen 16362; years before present, 615 ± 300.

Site 50; 78-84 in.; specimen 15237; years before present, 1880 ± 350.

Site 51; 12-18 in.; specimen 16544; years before present, 385 ± 300.

Viti Levu site 17, location A; 24-30 in.; specimen 5810; years before present, 950 ± 300 (Gifford, 1951, p. 203; 1952, p. 327).

Viti Levu site 17, location A; 104-110 in.; specimen 6335; years before present, 2000 ± 500.

Viti Levu site 17, location B; 90 in.; specimen 5879; years before present, 1200 ± 500.

Viti Levu site 17, location B; 96-104 in.; specimen 6342; years before present, 1300 ± 500.

The two radiocarbon determinations for site 13 (given in table 46) are the reverse of the expected order, which is embarrassing. The fact that this ancient site had been worked over by the natives for use as a yam field—with broad ridges separated by deep depressions—may account for the inversion of dates shown in the table. Both dates, however, indicate the great antiquity of the site. In his letter of July 13, 1954, Professor Crane makes the following comment: "The inversion is within the standard deviations (± 350 years on 15631 and at least ± 400 on 16226)."

TABLE 46

Radiocarbon Dates*

(Minus sign indicates B.C.)

Depth of sample (in.)	Site								
	20	13	14	26	6	50	51	17A (Fiji)	17B (Fiji)
18							1569		
30		-846*		1169	1339			1000	
36		-481		1049					
42	619						1057		
48			254	735					
60	82+								
78			-756						
84						73			
90						-56			754
96					162				
102									654
108								-46	
126								-379	
138									174

*Underlined figures are median dates supplied by Professor H. R. Crane.

+The bottom figure in each column (except site 13) is the hypothetical beginning date. See text.

In the table Professor Crane's median figures are given in years of the Christian calendar, with dates before the Christian era indicated by a minus sign. Crane's dates are underscored. The last figure in each column is an estimate of the date when the deposit at that site began. No estimate is attempted for ancient site 13 because of the inversion of dates and because it was probably deserted in antiquity. These highly speculative dates have been calculated on the supposed rate of accumulation in the period between the median radiocarbon date and 1952, although some of the sites may have been deserted in the 1870's. This involves the assumption that the rate of accumulation was the same before as after the radiocarbon date. Of course it may not have been the same, and also the sites may not have been continuously occupied. All of the beginning dates must be regarded as wholly hypothetical and should be taken with great reservation.

The dubious character of these estimates, interesting though they are, is further attested by the different rates of accumulation at the various sites between the radiocarbon dates and the time of abandonment by the natives: site 20, time of abandonment unknown; site 13, abandoned in 1902 but probably also deserted in antiquity; site 14, time of abandonment unknown; site 26, still occupied; site 6, probably occupied quite late; site 50, probably also quite late; site 51, still occupied; site 17 (Fiji), occupied as late as 1876.

The rates of accumulation for two sites, 26 and 51, occupied in 1952 are roughly estimated as follows. Site 26 accumulated 30 inches of deposit between 1169 and 1952; thus in that period it took 156 years for each 6 inches to accumulate, whereas in the 120 years between 1049 and 1169, 6 inches accumulated. Site 51, also occupied in 1952, accumulated 18 inches of deposit between 1569 and 1952; that is, it took 127 years for each 6 inches to accumulate at this site. If sites 26 and 51 were unoccupied at any time between the radiocarbon dates and 1952 or were occupied by a reduced population, then the figures above are not accurate.

The rates of accumulation of the deposits at sites 20, 14, 6, 50, and the Fijian site 17 are calculated in the same way as the estimates for sites 26 and 51.

Site 20 accumulated 42 inches of deposit between 619 and 1952, a rate of 6 inches every 190 years. This slow accumulation suggests the possibility of early abandonment or of reduced population.

At site 14, 48 inches of deposit accumulated between 254 A.D. and 1952, a rate of 6 inches every 212 years, a rate that certainly suggests early abandonment or only occasional use as a fishing site. This rate, compared with those of sites 26 and 51, may mean that the site was unoccupied for considerable periods and that the estimated beginning date of 756 B. C. is too early.

Site 6 accumulated 30 inches between 1339 and 1952, a rate of 6 inches every 102 years. This rate seems more reasonable, but even so the process was perhaps accelerated by the action of the sea in piling up debris. The beginning date of 162 A. D. seems not unlikely, in view of the radiocarbon date of 73 A. D. for site 50 at a depth of 84 in.

Site 50 accumulated 84 inches between 73 and 1952 A. D., a rate of 6 inches every 134 years. Thus 56 B. C. is a reasonable beginning date for this site.

The two Fijian series—for A and B locations of site 17, which are about a quarter of a mile apart—are interesting. The rate of accumulation at A, estimated from 46 B. C., is 111 years for each 6 inches; estimated from 1000 A. D., it is 189 years for each 6 inches. The latter date was derived from a sample taken from a rock shelter which, in 1947, was so filled with debris as to be no longer usable and which quite possibly had been unusable for many decades. (Incidentally, the Fijian natives of Narewa village asked us to leave our rock-shelter pits at location A unfilled so that the shelter might be used by people caught out in heavy rains.) The date of 1000 A. D. is therefore probably less reliable as a basis for estimate of rate of accumulation than 46 B.C., which was derived from a sample taken in the open part of the deposit. The rate of accumulation, based on the interval between 46 B. C. and 1000 A. D. is only 80 years for 6 inches. The rate of 6 inches in 189 years gives a beginning date of 1816 B. C. for location A, while 6 inches in 80 years gives a date of 379 B. C. as entered in table 46.

Location B at site 17 was on the immediate shoreline, whereas location A was inland. The two radiocarbon dates for B indicate 12 inches of accumulation in the 100 years between 654 and 754 A. D. This rapid rate, 6 inches in 50 years, is evidently due to the littoral location; a quantity of shell was found at the lower levels of location B and this undoubtedly accounted for the more rapid accumulation. At location A, on the contrary, no shell was found in the lower levels. (See Gifford, 1951, p. 204, table 1, "Composition of Site 17 by Depth: Percentages of Weight.") In any event, the rapid accumulation of the deposit at location B indicates a later beginning date for this place than for location A, whether the date is based on the figures above or on the rate of accumulation (6 in. in 80 years) calculated from the accumulation (90 in.) in the 1193 years from 754 A. D. to 1947. It will be observed that this last rate of accumulation at location B agrees with the rate for location A. We arrive therefore at a beginning date for location B of 174 A. D. and for location A a beginning date of 379 B. C. If this is correct, settlement at A began 550 years before that at B.

The estimated rates of accumulation of 6-in. layers, given in the discussion above, are assembled in the tabulation which follows. We regard the shorter intervals as the more conservative and reliable, especially since they are fairly close in different sites.

Site 26, 156 years; 120 years
Site 51, 127 years
Site 20, 190 years
Site 14, 212 years
Site 6, 102 years
Site 50, 134 years
Site 17, location A, 189 years; 111 years; 80 years
Site 17, location B, 80 years; 50 years

The early radiocarbon dates for site 13 make the beginning dates for site 14 (756 B. C.) and for site 17 on Fiji (379 B. C.) seem more reasonable, even though these hypothetical beginning dates seem early for the remote eastern islands of Melanesia, New Caledonia and Fiji. They seem less unreasonable, too, in the light of Spoehr's radiocarbon date of 1527 B. C. for the Mariannas (Libby, 1952, p. 680). Crane's date of 1000 A. D. (Gifford, 1952) for charcoal from a depth of 30 in. in a Fijian rock shelter (site 17, location A) corresponds nicely with Kenneth P. Emory's date of 1005 A. D. for charcoal from a depth of 30 in. in a Hawaiian rock shelter (Libby, 1951, p. 295). The other three Fijian dates are in harmony with the Fijian rock shelter date.

Thus we may gradually derive a series of radiocarbon dates, which should place Oceanian chronology on a more stable basis than at present.

The types of artifacts from New Caledonia found in the

6-in. blocks from which the samples used in radiocarbon dating were taken are listed below, with references in parentheses to the plates and figures of the present paper in which these types are shown. The specimens pictured in these plates and figures are not necessarily from the sampled blocks but illustrate the type.

Site 20, 42 inches, 619 A. D.
- Bivalve shell net sinker (pls. 3, a, 7, g, h)
- Incised decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with incurved rim (fig. 4, b-d, l)
- Potsherd with round lip (fig. 4, b-h)
- Pottery handle (pl. 18)
- Pottery handle, "flat" cross section (pl. 18, b, f)

Site 13, 24-30 inches, 846 B. C.
- Potsherd with grooved lip (fig. 4, i-k)
- Flanged potsherd (pl. 16, aj)
- Bottle neck pottery (pl. 23, ai)
- Bivalve shell net sinker (pls. 3, a, 7, g, h)
- Perforated bivalve shell, other than net sinker (pl. 8, k-o, w, x)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with incurved rim (fig. 4, b-d, l)
- Potsherd with round lip (fig. 4, b-h)
- Potsherd with flat lip (fig. 4, a)
- Potsherd lip with inside bevel (fig. 4, l-n)
- Potsherd lip with outside bevel (fig. 4, o-p)
- Relief potsnerd, ribbed (pl. 12, n-x)
- Potsherd with gambreled shoulder (pl. 17, m-q)

Site 13, 30-36 inches, 481 B. C.
- Bivalve shell net sinker (pls. 3, a, 7, g-h)
- Perforated bivalve shell other than net sinker (pl. 8, k-o, w, x)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with incurved rim (fig. 4, b-d, l)
- Potsherd with round lip (fig. 4, b-h)
- Potsherd with flat lip (fig. 4, a)
- Relief-decorated potsherd, ribbed (pl. 12, n-z)
- Potsherd with gambreled shoulder (pl. 17, m-q)

Site 14, 42-48 inches, 254 A. D.
- Bivalve shell net sinker (pls. 3, a, 7, g, h)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with incurved rim (fig. 4, b-d, l)
- Potsherd with round lip (fig. 4, b-h)
- Potsherd with flat lip (fig. 4, a)
- Relief-decorated potsherd, ribbed (pl. 12, n-z)

Site 26, 24-30 inches, 1169 A. D.
- Conus eburneus money (pl. 6, i)
- Trochus niloticus bracelet (pl. 8, r, s)
- Conus literatus with ground periphery
- Bivalve shell net sinker (pls. 3, a, 7, g, h)
- Filed Conus literatus shell (pl. 6, m)
- Filed Conus marmoreus shell (pl. 6, l)
- Small spire-lopped Conus (pls. 7, c, 8, z, ab
- Conus literatus straight knife (pl. 8, v)
- Cut shell (pls. 7, b, 8, y, ae; 20, i)
- Octopus-lure Cypraea cap (pl. 7, j, l)
- Octopus-lure Cypraea remnant (pl. 7, i, k)
- Grindstone (pl. 10, v-x)
- Stone file (pl. 10, g)
- Chipped chopper (pl. 11, x, y)
- Chipped scraper-chopper (pl. 11, v, w)
- Hammerstone or pecking stone (pl. 11, z, aa-ac)
- Pot marker (?)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with incurved rim (fig. 4, b-d, l)
- Potsherd with round lip (fig. 4, b-h)
- Potsherd with flat lip (fig. 4, a)
- Relief-decorated potsherd, appliqué (pl. 12, y-al)

Site 26, 30-36 inches, 1049 A. D.
- Conus eburneus money (pl. 6, i)
- Conus literatus with ground periphery (pl. 6, c)
- Bivalve shell net sinker (pls. 3, a, 7, g, h)
- Filed Conus literatus shell (pl. 6, m)
- Filed Conus marmoreus shell (pl. 6, l)
- Small spire-lopped Conus (pls. 7, c, 8, z, ab)
- Univalve whole-shell paring knife (pl. 8, h, ac, ad)
- Cut shell (pls. 7, b; 8, y, ae; 20, i)
- Octopus-lure Cypraea remnant (pl. 7, i, k)
- Grindstone (pl. 10, v-x)
- Chipped end-scraper (pl. 11, a, b)
- Chipped chopper (pl. 11, x, y)
- Chipped scraper-chopper (pl. 11, v, w)
- Hammerstone or pecking stone (pl. 11, z, aa-ac)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with incurved rim (fig. 4, b-d, l)
- Potsherd with round lip (fig. 4, b-h)
- Relief-decorated potsherd, ribbed (pl. 12, n-z)

Site 6, 24-30 inches, 1339 A. D.
- Filed Conus marmoreus shell (pl. 6, l)
- Side-drilled univalve shell (pls. 7, a, e; 8, p)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with round lip (fig. 4, b-h)
- Potsherd with lip with inside bevel (fig. 4, l-n)
- Potsherd with lip with outside bevel (fig. 4, o, p)
- Potsherd with lip with double bevel (fig. 4, q, r)
- Relief-decorated potsherd, appliqué (pl. 12, y-al)

Site 50, 78-84 inches, 73 A. D.
- Bivalve shell net sinker (pls. 3, a; 7, g, h)
- Spire-lopped Oliva elegans (pl. 8, a, b)

Site 51, 12-18 inches, 1569 A. D.
- Bivalve shell net sinker (pls. 3, a; 7, g, h)
- Chipped side-scraper, two sides worked (pl. 11, h, i)
- Chipped end-scraper (pl. 11, a, b)
- Hammerstone or pecking stone (pl. 11, z, aa-ac)
- Incised decorated potsherd
- Relief-decorated potsherd
- Potsherd with straight rim (fig. 4, a, i-k, m-o)
- Potsherd with outcurved rim (fig. 4, e-h, p-r)
- Potsherd with round lip (fig. 4, b-h)
- Potsherd with flat lip (fig. 4, a)
- Potsherd with lip with inside bevel (fig. 4, l-n)

Site 51, 12-18 inches, 1569 A. D. (continued)
Potsherd with lip with outside bevel (fig. 4, o, p)
Potsherd with suspension holes (pl. 17, w-z)
Relief-decorated potsherd, gouged (pl. 12, e-h)
Relief-decorated potsherd, ribbed (pl. 12, n-z)
Relief-decorated potsherd, appliqué (pl. 12, y-al)
Potsherd with gambreled shoulder (pl. 17, m-q)

We list below the types of artifacts found in the 6-in. blocks from which samples were taken for radiocarbon dating of site 17 (locations A and B) in Fiji. References in parentheses are to Gifford, 1951.

Location A, rock shelter, 30 in., 1000 A. D. From charcoal in a hearth lying on sterile soil at the bottom of the deposit.
Solomon Island style of shell fishhook shank, the only one found (fig. 1, c, p. 220)
Resin-glazed potsherds (p. 224)
Potsherds decorated with incising (p. 227)
Potsherds decorated with cross relief (pp. 229, 230)
Potsherds decorated with ribbed relief (p. 230)
Potsherds decorated with appliqué relief (pp. 229, 230)
Potsherds decorated with gouged relief (p. 230)
Potsherds decorated with wavy relief (p. 230)

Location A, midden in front of rock shelter, 108 in., 46 B. C.
Potsherds decorated with cross relief
Potsherds decorated with ribbed relief
Potsherds decorated with gouged relief
Potsherds decorated with wavy relief

Location B, midden near shoreline, 90 in., 754 A. D.
Conus literatus ring (fig. 1, i, p. 220)
Potsherds decorated with incising
Potsherds decorated with cross relief
Potsherds decorated with ribbed relief
Potsherds decorated with gouged relief
Potsherds decorated with wavy relief

Location B, midden near shoreline, 102 in., 654 A. D.
Potsherds decorated with cross relief
Potsherds decorated with ribbed relief
Potsherds decorated with gouged relief
Potsherds decorated with wavy relief

FOREIGN CULTURAL RELATIONSHIPS

Much has been written, some of it speculative, about the overseas relationships of New Caledonian culture. Certainly, most New Caledonian traits are shared with other Oceanian cultures, especially with Melanesia, and our excavations probably add little new to the inventory. The big difficulty about making archaeological comparisons in this area lies in the dearth of systematic excavations, the work on Viti Levu being about the only one with depths recorded in the same fashion as in our New Caledonian excavations, that is, by 6-in. blocks. Consequently most of the foreign parallels cited are scattered and miscellaneous and lack depth data. This is not to say that our New Caledonian material could be exactly aligned with foreign material even on the basis of exact depth data. Probably only information about relative depths would justify any such comparison, but most of the available sources lack even relative depth data.

Most of our shell artifacts have parallels elsewhere in Oceania, with the probable exception of the Placostylus fishhooks, which represent a minimum of artisanship. Adzes and axes—of characteristic Melanesian lenticular type in contrast to the angular Polynesian blades—are duplicated by Neolithic types already cited from the Philippines. The double-drilled, disk-bladed ceremonial mace, or monstrance axe, seems distinctively New Caledonian. This, an archaeological specimen, was presented to us at Oundjo (fig. 3, d), and the Museum of Anthropology possesses a hafted ethnological example (pl. 9, a).

A number of archaeological specimens excavated in Fiji in 1947 have counterparts in our New Caledonian collection. The tabulation below lists those illustrated or discussed in our text or in the Fijian report (Gifford, 1951).

Pottery decorative styles seem to offer the best field for exploring possible overseas relationships, and we present below what seem to be definite parallels with other island groups. The Loyalty Islands are excluded from this discussion, since their close relationship with New Caledonia has already been so adequately set forth in Sarasin's exhaustive ethnological work (1929).

Relief decoration: There are resemblances between our relief styles—cross-relief, nubbined, ribbed, and appliqué—and those of Fiji (Gifford, 1951, pls. 19, 22, 24). The cross-relief or checkerboard style occurs also in Borneo (H. L. Roth, 1896, p. 391), Indo-China (Janse, 1947, pl. 151, and others), and Sumatra (Van der Hoop, 1940, pl. 83, figs. 2835g and 3310). The nubbined sherds of New Caledonia are of two types, only one of which is found in Fiji, and that, rarely (Gifford, 1951, pl. 19, j) In New Caledonia the nubbins are formed by pressure from within, whereas in Fiji they are usually appliquéd (Gifford, 1951, pl. 18, d). Avias (1949a) also remarks upon the likeness between the nubbined pottery of Yaté and Moindou (New Caledonia) and that of New Britain. Van der Hoop illustrates (1940, pls. 81-83) relief-decorated potsherds from Lake Kerinchi, central Sumatra; the ribbed sherds shown in the center figure of his plate 81 look like the ribbed sherds in our plate 12. Appliqué relief designs running around the vessel seem to be a local specialty in New Caledonia. Gifford (1951, pl. 24, r) shows one Fijian specimen which may be fairly close to some of the New Caledonian sherds shown in plate 12. Otherwise, however, Fijian appliqué is very different.

Incised decoration: Site 13 incised sherds are of a unique type, which will be discussed later. Many incised designs from the other New Caledonian sites resemble the decorated sherds from the New Hebrides and the northern Solomons pictured by MacLachlan (1939, 1938). These parallels seem somewhat closer than those with Fijian pottery (Gifford, 1951, pls. 16-22, 25, 27), though in this respect it is difficult to distinguish between cultures, all of which have such close relationships with New Caledonia.

	Fiji (Gifford, 1951)	New Caledonia
Conus literatus shell ring	Fig. 1, i	Pl. 6, a-h
Trochus niloticus bracelet	Fig. 1, e	Pl. 8, r-t
Paring knives, univalve shells	Fig. 1, a	Pls. 8, h, ac, ad
Cardium "pot scribe"	Fig. 1, g	Pl. 7, d
Arca scapha net sinker	Pp. 214-217	Pls. 3, c; 7, g, h
Heterocentrotus mammillatus spine	P. 220	P. 31
Stone pottery anvils	P. 222	P. 70
Hammerstone	P. 222	Pl. 11, z, aa-ac
Lenticular adzes	Fig. 4, a, c, f	Figs. 1, b, d, f; 2, a, d, e, g, h
Rectangular adzes	Figs. 3, f, j, 4, g, i	Figs. 2, b, c, f; 3, f
Resin-glaze potsherds	P. 224	P. 70
Incised potsherds	Pls. 16, 17, 19-22, 25, 27	Pls. 13-16, 22, 23
Relief potsherds	Pls. 18, 22-27	Pl. 12
Crossed	Pl. 22	Pl. 12, l, m
Ribbed	Pl. 24	Pl. 12, n-x
Gouged	Pls. 22, 24, 25	Pl. 12, e-h
Appliqué	Pls. 18, 24	Pl. 12, y-al
Potsherds perforated for suspension	P. 224	P. 71; pl. 17, e-g
Pottery disk	Pl. 27, d	P. 72
Potsherds with calcite	Pl. 29	P. 105

Some of the incised sherds resemble Lau Islands sherds pictured by Thompson (1938, p. 113, pl. A, fig. 1); also sherds from Viti Levu illustrated by Gifford (1951, pls. 20, 21, 27). The resemblance is not sufficient to warrant assertion of a common origin; incised ware is, of course, frequent in both Melanesia and Malaysia.

In Malaysia, Indo-China, and Japan, there are resemblances to New Caledonian incised sherds. It is not clear, of course, whether these are historically significant or whether these simple designs are merely the result of similar techniques. Some of the incised sherds from the Philippines pictured by Gifford (1951, pl. 20, d-p) can be nearly matched by New Caledonian sherds (pls. 13-15), although the resemblance to Fijian sherds (Gifford, 1951, pl. 20, q-x) is closer.

Saurin illustrates (1940, pls. 28-30) sherds with incised decoration from northern Annam that are similar to some of the New Caledonian specimens shown in our plates 13 to 15. Also, most of the prehistoric Ainu potsherds of the Proto-Jomon period have incised rather than relief decoration;many of their designs (Groot, 1951, pls. 1-13) duplicate New Caledonian patterns.

Site 13 incised sherds: This site, as has been said, yielded a quantity of sherds of a unique type of incised ware. Judged by the two radiocarbon dates assigned to the site (846 B.C. and 481 B.C.) this pottery is the oldest obtained in New Caledonia. Its overseas analogues are consequently especially interesting and carry chronological implications.

The first and nearest parallel to the incised sherds from site 13 are the sherds unearthed by Lenormand (1948) and Avias (1950a, p. 131, pl. 3, figs. 1-3) in the Ile des Pins. (See our section on incised sherds from site 13 for examples of exact duplication.)

The pattern on a sherd from a flat-bottomed vessel (pl. 23, ah) closely resembles that of a Viti Levu specimen illustrated by Gifford (1951, pl. 19, c). Other site 13 examples are shown in plate 17, h-l. Also a Viti Levu sherd with a design of continuous ornamental loops (Gifford, 1951, pl. 19, d) suggests our site 13 specimen (pl. 22, ag), which has the same sort of loop pattern. The roulette (dotted line) marks on Tongan pottery also suggest site 13 and Ile des Pins styles. It is probably significant that Guiart's map (Guiart, 1953) indicates social connections between Ile des Pins and Tonga but it is possible that the pottery designs traveled from Ile des Pins to Tonga rather than vice versa. An even more remote parallel with the Ile des Pins sherds of Lenormand and Avias has been cited by O'Reilly and by Avias, based on the finds by Father Otto Meyer (1909) on the island of Vuatom off the north coast of New Britain, discussed in a communication by Father O'Reilly (1940). Since our site 13 incised sherds are of the same type as the Ile des Pins sherds, the following quotation from Avias (1950a, pp. 131-132) would seem appropriate.

> De retour à Paris à la fin de 1948, ayant passé en revue la collection de poteries océaniennes du Musée d l'Homme, j'ai alors eu la surprise de trouver toute une collection de poteries de facture et de style identique avec le même double facies mélanésien et évolué. Ces poteries, découvertes par le R. P. Otto Meyer de 1909 à 1924 à Vuatom, petite île située entre la Nouvelle-Irlande et la Nouvelle-Bretagne et dépendant administrativement du territoire de la Nouvelle-Guinée, dans des conditions de gisement analogues avaient été rapportées au Musée de l'Homme, en 1934, par le R. P. O'Reilly. Elles firent l'objet de la part de celui-ci d'une communication à la Société des Océanistes, le 9 février 1940.
>
> En mars 1949, je faisais une communication à l'Institut français d'Anthropologie, où j'annonçais l'identité des styles trouvés à l'Île des Pins et à Vuatom, îles pourtant distantes de près de 2.000 kilomètres. A la même époque (début 1949) et indépendamment le R. P. O'Reilly, alors en mission dans le Pacifique, ayant eu l'occasion de voir des échantillons de la collection Lenormand, fut également frappé de leur identité avec ceux qu'il avait rapportés de Vuatom, et me confirma le fait à son retour à Paris au printemps de la même année.

Less assured resemblances are to be discerned much farther afield, namely, in Celebes. Among incised sherds pictured by Van Stein Callenfels (1951, pls. 14-18) from prehistoric sites on the Karama River in west Torajaland, Central Celebes, are some which suggest our site 13 sherds, except that they do not seem to have any roulette markings (cf. our pls. 16, 22, 23). Two of the Celebes sherds shown in the left half of his plate 14 appear to have gambreled shoulders or else to be bottom sherds like those in our plates 17, h-l, and 23, ah. Several of our New Caledonian decorative motives appear in Callenfels' Karama sherds, e.g., the acute hatched triangle (his pl. 15), the checker design (his pls. 14, 17), the scroll (his pl. 15), the "eyes" or little rings (his pl. 16). However, without actual potsherds for comparison it is risky to say more than that the resemblances suggest widely diffused motives.

The fact that we found no archaeological site in New Caledonia as deep as the two excavated by Gifford in Viti Levu, Fiji, suggests at first thought that New Caledonia may have been settled by Melanesians later than Fiji. However, this is by no means certain. The great extent, but lesser depth, of the coastal kitchen middens in New Caledonia may mean that people moved about considerably in times past and really does not answer the question whether the arrival of the first immigrants was later or earlier than in Fiji.

We found no pre-pottery cultural level. All of the deposits excavated yielded pottery down to the lowest cultural levels. This would seem to indicate that the first settlers on these sites, as in Fiji, were already potters. Needless to say, they must also have had sea-going vessels in order to have reached distant New Caledonia. There is no evidence, at least so far as our excavations are concerned, that any people arrived in a Palaeolithic stage of culture, and certainly not in the Palaeolithic age of culture. Indeed, we found pottery at greater depths than chipped stone artifacts.

Jean Poirier has recently (1951, 1953) summarized the theories regarding the origins of population and culture in New Caledonia. He rightly sees the necessity of attacking the problem from all possible approaches, not the least of which is archaeological exploration. We agree with his statement that today we do not have a single Palaeolithic site in New Caledonia. Our limited excavations certainly revealed none. To be sure, they produced chipped stone implements of the utmost crudity, far cruder than those pictured by Movius (1949, figs. 10-16) for the Patjitanian Palaeolithic culture of Java; our chipped stone tools, however, were always accompanied by potsherds. The New Caledonian data make it obvious that typology alone is no basis for chronological conclusions unless validated by stratigraphy.

In Volume 9 (1953) of the Journal de la Société des Océanistes, celebrating a century of French occupancy

of New Caledonia and devoted entirely to articles on the island, Professor Avias has published an excellent summary of the data bearing on the problems of the prehistory of New Caledonia.

With the poorly developed chipped stone industry in New Caledonia went a highly developed but limited Neolithic industry, manifested in fine adzes and axes. These are of Melanesian (lenticular) rather than Polynesian (angular) type. This lenticular type can apparently be identified with Beyer's Philippine Early Neolithic (Beyer, 1948, fig. 8, cross sections 1-4; 1949, pl. 6). Polished stone implements were extremely rare in our screenings, appearing only in upper levels (0-18 in.). The fact that we found none below 18 in. may mean that they were not in use in the periods represented by the lower levels of the deposits. This negative evidence, if reliable, would seem to point to the late arrival or development of these tool types and therefore to cultural stratification.

Unfortunately the potsherds, often a good chronological index, did not yield in New Caledonia any such clear-cut succession of types as Gifford found in Fiji. The only unique pottery that was perhaps limited to ancient times —on the basis of radiocarbon dating rather than stratification—is the rich and varied incised ware of site 13 on Foué Peninsula.

Only four sites (14, 44, 6, and 51) yielded potsherds with appliqué relief decoration, 19 sherds in all. Although many have ribbonlike fillets which evidently encircled the vessel, none of these was actually at the rim, like the decoration on the two sherds found by Eugene Dijou near Moindou at a depth of 6 m., which Professor Avias has figured (Avias, 1950a, pl. 3, p. 137, and fig. F, items 11 and 12, p. 124), labeling them "wreathed or garlanded." Perhaps the Moindou sherds are an early type and ours a later one, although the unusual depth at which the former were found is no absolute assurance of great antiquity since the deposit was alluvial.

Two important traits of Melanesian and Malaysian pottery concern the method of manufacture: the use of the paddle and anvil and the use of a stamp or grooved paddle to produce relief decoration. These traits are also found in eastern Asia and in North America. The distribution suggests an origin on the mainland of Asia and subsequent diffusion to the island world and to North America. Gifford (1928, pp. 364-368) and Wendorf (1953, pp. 165-166) have discussed the distribution of the paddle and anvil technique. Tolstoy (1953) has taken up the problem of the distribution in Asia and America of pottery decorated by the use of the stamp, grooved paddle, and cord-wrapped paddle.

The authors just mentioned incline to the theory of Asiatic origin of both traits, an opinion which doubtless applies also to the Malaysian and Melanesian occurrences, in view of the widespread distribution of these traits. The alternative would be to accept the theory of independent invention, which seems to us unlikely, at least in Oceania.

Let us now turn to certain noncultural evidence which may bear on the origin of New Caledonian culture. Graydon in his discussion of Polynesian blood groups states (1952, pp. 332-333): "The New Caledonians, who have Melanesian, Polynesian and Australoid elements, lie in the area just where such a group would be expected—between the areas occupied by the component groups." See his figure 1.

Avias (1949c, p. 459) adds a fourth component and regards the New Caledonians as composed of four racial ingredients: "Aïnoïdes, Mélanésiens, Australo-Tasmanoïdes, Polynésiens."

Certainly, as we saw the aborigines in 1952 we were impressed with their diversity: negroid Melanesians, Polynesian types, and lastly very hairy individuals with prominent supraorbital ridges, whom we regarded as Australoid, though some of them were perhaps Professor Avias' "Aïnoïdes."

If we consider the cultural products found in our excavations from the standpoint of the racial components of the indigenous population, it would appear that we have nothing specifically Australian unless it is the crude chipped stone implements. There are no doubt some Polynesian elements, e.g., the cowry shells, which we interpreted as parts of octopus lures. Potsherds, the most abundant artifacts, extending to a greater depth than chipped stone, bear resemblances to Tongan, Melanesian, Annamese, and proto-Jomon (presumably prehistoric Ainu) sherds, as far as decoration is concerned. The discreteness of physical and cultural traits should, however, not be forgotten, hence we are not actually suggesting the physical traits as evidence of the origin of the cultural.

APPENDIXES

APPENDIX I

UNEXCAVATED SITES

In our search for promising sites for excavation, we visited a number of places on both east and west coasts. This appendix describes sites which we examined but did not excavate.

Site 1: Mouth of Dumbea River.—This site, visited February 6, is about 6 mi. south of the main paved highway just northwest of the Dumbea River bridge. It is an ancient fishing site, which is still used by the aborigines. Our guide, a native named Léon, lived near Conception, a few miles from Nouméa. The site, about 75 yds. square, is about 100 yds. from the end of the promontory on the north side of the Dumbea River mouth, and on the eastern side of the promontory.

No potsherds or other native artifacts were found, but the surface of the ground around three dilapidated, modern, native houses was gray and there were marine shells scattered about. There was a dense growth of bushes and trees. Léon could give us no name for the place except Dumbea, which he thought was not the ancient name. Among the shell samples obtained was a Strombus canarium, a species which Léon said was formerly made into a scraper by abrading the lip to a sharp edge.

Site 2: Nakutakoin.—This site, in a freshly ploughed field which covers about 160 acres, is said to have been once occupied by a large village. It is a scant 3 mi. inland from the Dumbea River site 1. The guide, Léon, said that the place had not been inhabited for over a century. No artifacts were found. If it had not been for our guide, we should not have recognized the place as a village site.

Site 3: Dumbea River.—Site 3 is about 1/3 mi. upslope and up a small stream from site 2, some distance from the right bank of Dumbea River. Léon did not know its name. We made our way up a practically dry creek bed, with only an occasional pool, to two large Araucaria cooki trees, 8 ft. apart, which are said to have flanked the doorway of the chief's house, which was about 30 ft. in diameter. The ground was covered densely with pine foliage and overgrown with shrubs. No artifacts or shells were visible.

Site 4: Anse Vata Creek.—This site is about 2/10 mi. from the Biarritz Restaurant at Anse Vata beach and on the right bank of a small unnamed creek that flows at the foot of the hill at the eastern end of the beach. The site, about 50 yds. upstream from the creek's mouth and just above a bridge, has been badly disturbed by wartime construction. Its extension back from the creek was not determined since there were buildings on it; its length, as exposed along the creek, is about 40 yds. The depth of the midden is apparently about 16 in., though sherds which had presumably weathered out were found at a depth of 29 in. on the creek bank. These, however, were found in sand, not midden. The edge of the site has been eroded by stream and tide action. The midden is marked by charcoal, black soil, fire-fractured cooking-stones, and shell.

Site 5: Paama village.—On February 9, Dr. Jean Guiart showed us this site as an example of a clan origin place. It is said to have been once occupied by the Pomo clan, which has moved away or may be extinct. The site is in Paama village, about 1/8 mi. from the east shore and 5 mi. south of Poindimié on the inland side of the east coast highway. The area, about 100 ft. square, is farmed at present by Pura, a Paama villager, and part of it is planted to coconut, taro, and bananas. The site shows no elevation above the surrounding ground and there was no shell visible. It would have been wholly unrecognizable without native guidance.

Evidently there were once two houses, at least, in ancient times. Two small test pits were dug. From the first, at the site of what was said to be a very old house, shell, charcoal, potsherds, and a fragment of the house center post were obtained. The second pit was dug a few yards west of the first where there was a tripod of sticks called taboo sticks. These were of a wood that rots very slowly and are said to have been left by the Pomo clan for the purpose of keeping war away from the country.

Ten undecorated sherds were found at the site, mostly by digging to a depth of 12 to 15 in. We also found two pieces of charcoal and a possible chipped stone artifact.

Site 7: Ponerihouen River mouth.—Site 7 is said to be the origin place of the Goronde clan, according to Dr. Guiart, who took us to the spot on February 9. A member of this clan, named Philip, was living there then. Two test pits were dug in the light-colored earth, but there was no evidence of former habitation and no shells or artifacts were found. The site is on an elevation overlooking the sea, with Philip's house below it. It is situated at the mouth of the Ponerihouen River, on the right bank, just beyond the end of the automobile road shown on map No. 4 of the sectional maps of New Caledonia.

Site 8: Ponerihouen coast.—We visited this site with Dr. Guiart on February 9. It is on the shore about 1/4 mi. southeast of Philip's house (see site 7), and like site 7, was occupied by the Goronde clan. There is a definite house mound, with the center pole of the house still standing and the door stones still in place. The stones of the fireplace were also undisturbed. No sherds or shells were seen, but we were told that shell was thrown into a near-by cocoanut grove, instead of being cast on the house mound. This resembles the modern Fijian practice of having a special spot for dumping shell refuse. The area of the house mound is about 12 by 12 ft.; its height is probably 2.5 ft.

Site 9: Ponerihouen River.—On February 9, Dr. Guiart took us to this third Ponerihouen site about a quarter of a mile from site 7 along the road to the modern village of Ponerihouen. The site, about 30 ft. in diameter, is between the road and the river and about 60 ft. from the road. It is marked by the remains of a chief's house, approached by an avenue lined with coconut trees and Araucaria cooki. The wooden center pole of the house has fallen. Although the earth is dark, there were no potsherds, charcoal, or shell. A globular stone, slightly

less than the size of a fist, was obtained; it was said to serve as a protection against evil.

Site 10: Gorotendo.—This site, on Mr. Pierre Thonon's coffee plantation in the same little valley as sites 11 and 12, was visited on February 9. A small creek, which is a left affluent of the Ponerihouen River, runs through the valley. The site lies 60 yds. up the slope from the road, 5 mi. inland from Ponerihouen Ferry. The village formerly on this site was called Gorotendo. It is said to have been last inhabited fifteen generations ago. A test pit, dug to about 18 in. in front of what was said to be the location of the doorway of the chief's house, yielded chips of serpentine and potsherds.

Site 11: Gorotabiaye.—Site 11, which we visited on February 9 with Dr. Guiart, is reached by the same road as sites 10 and 12. This is a side road which takes off to the left from the main highway a few hundred yards north of Ponerihouen Ferry. The distance from the ferry landing to the lower edge of the site is 6.3 mi. The site, a gentle, grassy incline, lies on a low curving ridge about 325 yds. long, sloping down first to the southeast, then swinging around to the east. It is on the property of Paul Thonon, on land used for grazing cattle. It is in the same little valley as sites 10 and 12, drained by a small left affluent of the Ponerihouen River. There was no black soil or shell on the site.

Sites of nine dwellings (including the chief's, which was the highest on the hillside) and an assembly house were found. The assembly-house site, about 65 yds. below the chief's house to the southeast, is now marked by the rectangular foundations of a house built by an Englishman named Matelot. Below it, the main street of the village, actually an easy ramp about 25 ft. wide, runs down to the east. It is about 255 yds. long and is raised artificially—at least, an 18-in. step had been cut on each side and the ramp built up with the earth dug out. This street and the step on either side were used ceremonially. For illustrations of such streets or avenues see Leenhardt, 1930, page 15, figure 5; plate 5, figure 2.

A stepping-stone marked the entrance of the chief's house on the southeast. The opposite side of the house backed up against the hill, which rises here more steeply above the grassy slope. The house mound was about 25 ft. in diameter. Mr. Chevalier dug a hole a foot deep in the center of the floor and found two small undecorated sherds. A similar hole in the assembly-house floor yielded nothing. The eight ordinary dwellings were all on the upper part of the site, some of them beside the assembly house, some between it and the chief's house.

The cemetery for exposing the dead of the village was on top of the hill, which was called Gowéon; we did not visit it.

Our informants here, two elderly men, were classificatory brothers, i.e., parallel cousins. They told us that their fathers had never seen houses here. The site was formerly occupied by the Nimbaye clan.

One house, about 60 yds. below the chief's house and 6 yds. above the assembly house, was called Poani. The subchief who dug yams for the chief lived here. He ranked second in the village and took care of the chief's food supply.

The family that ranked third in the village had a house named Nowanabai just south of the assembly house.

Site 12: Gotipu.—This site, also visited on February 9, was the third one on the property of the Thonon family. It is 7 mi. from Ponerihouen Ferry and in the same little valley as sites 10 and 11. It is said that the village has not been occupied for fifteen generations, as the result of a quarrel between two clans.

The site is on the left of the stream, on a grassy slope with the creek at the bottom and a "cemetery" at the top of the hill, which is about 150 ft. high. The part of the site near the creek was used chiefly by the women, who kept apart from the men for a good part of the day.

There was no shell, but five sherds and two stone pieces which may be flaked artifacts were found in a test pit not more than a foot deep dug in the main site area. A smaller test pit was dug in a "taboo ceremonial mound," about 5 ft. in diameter and a foot high, but with no results. According to Dr. Guiart this mound was probably used in connection with ceremonies.

The "cemetery" on top of the hill behind the village comprised three crude rectangular stone platforms on which the bodies of the dead were exposed until they decomposed. The skulls were then removed and secreted at a place still higher on the hill. The platforms were 8 by 8 ft., 4 by 6 ft., and 3 by 3 ft., respectively. The first two were separated by 15 ft.; the third was 8 ft. down the slope. Bone fragments, enough to fill a small bottle, were collected at the "cemetery."

Site 15: Ouaoue.—On February 11, Mr. Chevalier and Dr. Guiart conducted us to this large cave. It is reached from the main highway between Nouméa and Bourail, the road leading to the village of Ouaoue taking off from the main highway 7.8 mi. south of Bourail. A trip of 1.4 mi. on the side road to the southwest brings one to Ouaoue village, a hamlet of eight houses and a church.

The entrance to the cave is in a rock pile on the south side of the summit of the hill above Ouaoue village and is reached by a trail well known to the villagers. The main floor of the cave is at least 100 ft. below the entrance. Descent is made by a 10-ft. or 12-ft. ladder, immediately below the entrance. Thereafter one clambers down over slippery damp boulders more or less coated with speleothem from dripping water. The floor of the cave gave evidence of an underground stream in rainy weather. Here and there openings in the roof let in a bit of sunlight. There were many small chambers at various levels in the cave, some of which yielded potsherds. The natives once used the cave as a hideout from soldiers.

In five places in the cave we collected a large number of potsherds, as well as molluscan shells, stone flakes, and fragments of human bone.

Site 16: Koné wharf.—This site, visited on February 10, is on the hill that forms the headland of Foué Peninsula. The site lies on the edge of a cut in the hill, made by the road that skirts the bay; it is on the inshore side of the road, about 50 to 100 yds. from Koné wharf. Dr. Guiart and Mr. Chevalier did a bit of exploratory digging, which yielded sherds, and some were also found on the surface. There was relatively little shell in the ground.

Site 17: Girard.—This small site is on the edge of a bluff about 300 yds. southeast of Alfred Girard's ranch house, which is back from the beach. The low bluff (perhaps 8 or 9 ft. high) slopes down to the beach south of the ranch house. The talus slope has been broken down by cattle trails and the small midden has been partly eroded. There are a number of coconut trees on the beach, which are visible from site 14, about a half-mile to the northwest. Dr. Guiart found a portion of a greenstone axe or adze on the beach.

Site 18: Anse Vata.—This shell midden, visited on February 14, is 3/10 mi. from the bridge across the creek on which site 4 is situated. The midden, marked by black earth, shell, and sherds, is on the beach below the coast road that runs southeast around a promontory from Anse Vata to the east or southeast side of Nouméa. A beach road, taking off from the main coast road at the northwest end of the promontory, crosses the midden and runs eastward to Dr. Raymond Magnin's property (on which is site 19). An open cut revealed black midden material, perhaps a foot deep, covering an area 50 by 60 ft. The presence of a drainage pipe in this cut apparently indicates a source of water for the site in ancient times. This site should probably be regarded as the western extension of site 19, but vegetation and wartime concrete construction prevented our verifying this supposition.

Site 21: Tomo Bay, north side.—This site, to which Mr. Chevalier took us on February 15, is situated inshore (east) from a chrome-ore wharf, in use at the time of our visit. The site had been ruined by scraping operations, but as far as we could judge, the shell midden was only about a foot deep. One human long bone and sixteen potsherds were found.

Site 22: Bourake.—This site is at the end of the road to the shore at Bourake. It is on the rounded surface of a gently sloping rocky hill, facing the high island of Lepredour, the Gôvernor's deer preserve. There are sherds in the side road cutting across the site, which is heavily overgrown with lantana. It is 9.4 mi. from the main paved highway running up the west coast.

Site 23: Tomo Bay, south side.—This site is 1 mi. across Tomo Bay from site 21. The ruined wharf at the site is 0.4 mi. from the paved highway where the road takes off just north of the residence of Edmond Poulet. Traces of midden were seen along the beach edge south of the wharf. Behind the beach is swamp. It is possible that the site was once larger and that wave action has eroded it to the present narrow strip. Sherds were found on the beach and in the midden edge.

Site 24: Baie de l'Orphelin.—This site, visited on February 16, lies 1.5 mi. west of the entrance to the Institut Français d'Océanie, and is on the edge of the western coast road from Nouméa to Anse Vata, where the road cuts into the low hill that forms the promontory on the south shore of Baie de l'Orphelin. Here a side road, running up to a residence on the promontory, takes off from the main road. The remnants of the midden, about a foot thick, are exposed on the east side of the bottom of the hill, where the coast road cuts the site. In three or four minutes' stop with the car four sherds were picked out of the midden, which was evidently once more extensive. The shell in the midden was mostly clam: Arca, etc.

Site 25: Tiaré.—This is a small shallow shell midden only a few square yards in extent among the trees in the picnic grounds, about 50 yds. back of the beach near the east end of Tiaré beach, Tia Bay, and not far from the sandbar connecting the mainland with To N'du Island. At the back (i.e., to the north) is the rather abrupt end of a low knoll with banyan trees growing over it. Two small black sherds were found on the midden surface on February 17.

Site 27: Koumac Wharf.—Site 27 is at Koumac Wharf on the shore at the mouth of a small valley flanked by hills more or less precipitous at this point. Here, about 8 ft. above sea level, is a shell midden with a depth of 18 to 24 in. and an area of 30 by 70 yds. Like most coastal middens, this one was exposed vertically at the beach, owing apparently to erosion. From this exposed part we collected potsherds.

Site 28: Koumac.—Beyond the hill which forms the southeast side of the little valley at the mouth of which Koumac Wharf and site 27 are situated is a small sandy kitchen midden. It lies at an elevation of about 4 ft. and occupies an area of 20 by 20 yds., about 1/8 mi. southeast of the wharf. The deposit is apparently not more than 8 in. deep. We visited it on February 20 with Mr. Chevalier, when we also went to site 26 (Oundjo) and site 27. On this occasion, Mr. Chevalier kindly made arrangements with chief Bome for our later excavation of site 26, our most productive site.

Site 29: Karembe.—This site, visited on February 20, is on the low shore at Karembe, a mile from the main west coast highway and at the end of a lateral road running to the coast. A European family lives on the site, which is about 3 acres in extent and is cut in half by a stream. The site is flat and the midden undoubtedly thin, since its surface is only 2 or 3 ft. above high tide level. Shell and potsherds marked the site.

Site 30: Rock shelter.—About 8 mi. north of Koumac on the road to the Diahot River, a huge limestone crag (like those in the Tiouandé and Hienghéne districts on the east coast) stands near the road. A creek runs between the crag and the road. No site was found on the slopes at the base of the crag, but about 50 ft. up and about 150 ft. above the level of the road, there was a rock shelter, roughly 20 by 20 ft., which gave evidence of at least temporary occupation. One fireplace was seen and two undecorated potsherds and a stone, mistaken for an adze, were found. As usual, samples of shell species were collected. This spot was visited on February 20.

Site 31: Ouaco.—This site, visited on February 20, is situated on a gentle rocky slope facing the sea behind the home of Colonel H. P. Dix, manager of the beef cannery at Ouaco. It lies at an elevation of about 45 ft. between two roads leading to the sea. The midden, not more than 10 in. deep, has been cut by the road and disturbed by gardening to such an extent that its exact boundaries cannot be determined. The midden, indicated by black soil, potsherds, and shells, is apparently about 40 by 50 ft. in area.

Site 32: Pouenlotch.—This large midden site, 0.4 mi. long and 5 acres in area, was visited on February 21 with Mr. Chevalier. It is 9.1 mi. northwest of Voh, and the highway marker at its southern end indicates that it is 327 km. from Nouméa. It lies on the upslope of a hill on the southwest side of the west coast highway. On the opposite side of the highway, and parallel to it, flows a small creek. Probably the midden extended across the present road. It is said to be about a mile from the sea, which lies beyond the hill. At the time of our visit, postholes were being dug; the depth of the deposit varied from 18 to 24 in. (see pl. 5, f). From the surface we collected a large number of potsherds and a few stone flakes.

Site 33: Voh Wharf.—This site was visited on February 21. It is a small midden, about 1/2 acre in area, partly on level ground and partly on a hill slope, behind the beach at Voh Wharf. The road cuts the midden more or less in half. The soil was sandy and rocky. Potsherds were collected.

Site 34: Gatop.—In several sections of this modern village on Voh Peninsula, which we visited on February 21, we picked up four undecorated sherds from the surface of the thin and scattered shell midden. This was one of the villages at which we saw a casting net weighted with Arca shells.

Site 35: Gouaro District.—On February 22, we found, on the southwest side of the road, 8.8 mi. from Bourail in the Gouaro District on the northwest side of the lower Nera River, a small midden, about 50 by 50 ft. in area, on property occupied by a Javanese family. Dark earth, shell, and sherds marked the site, which was planted to manioc.

Site 36: Gouaro District.—Also visited on February 22 was a small shell midden, area about 60 by 40 ft., in a coconut grove on the edge of the road, 4.7 mi. from Bourail, in the Gouaro District, northwest of the lower Nera River. Fourteen undecorated sherds were collected here.

Site 37: Roy and Kaddour ranches.—This site, which we visited on February 22, is in the district on the southeast side of the lower Nera River, 7.2 mi. from Bourail by the road on the left bank of the river. The site lies on both sides of the road, which divides it into two sections, the lower part in a coconut grove belonging to Mr. Kaddour, the upper part on a knoll, part of it very rocky, which belongs to Mr. Roy. Mr. Roy's houses and a coffee plantation occupy the knoll. The total area of the two sections of the site is estimated at 6 acres.

A stone adze, found near Mr. Roy's house, and some problematical pieces of chipped stone were collected. Sherds were fairly abundant.

Site 38: Pindai.—The site called Pindai, visited on February 22, lies on the northwest slope of the Nepoui Peninsula, a region with an abundance of gaiac shrubs. There were scattered shell and potsherds strewn over an area of 3/4 of an acre, from the beach up to an elevation of 30 ft. No source of fresh water was found, so it may be assumed that this was a temporary camp rather than a village.

Site 39: Touaourou.—The village of Touaourou, 11 km. by road from Yaté, on the southeast coast south of the mouth of the Yaté River, is the modern representative of ancient Touaourou, which stretches in shallow midden along the coast for perhaps three-quarters of a mile. The low-lying coast is fringed with coconut trees growing in a grassy lawnlike area, so that the region has a parklike appearance, with native houses scattered along it (Sarasin, 1917, fig. 124). The village chief, a man named Victor Jonn, served as guide and took us to the oldest known section, where he showed us the mound of a chief's house. The next oldest section, across a small creek to the south, was not visited. The site of the mission church and school constitutes the third and latest section of Touaourou. Three small creeks cross the present village area.

Back from the shore a hundred yards or so are rough piles of what looked like reef rock, containing many nooks, crannies, and shelters. In these were human long bones, shells, and an occasional potsherd. Most of the skulls had been removed for deposit elsewhere. One ancient skull had a hole in the temple.

A modern club of ancient design was purchased from a villager. Our trip to Touaourou was made possible through the courtesy of Dr. Marc Tivollier, who took us with him on a routine tour of medical inspection.

About 2/3 mi. from Touaourou on the road to Yaté we were shown a circle, about 20 ft. in diameter, of irregular, unshaped stones, where cannibal feasts were formerly held. Sloping gently down from this to the east was a broad "avenue," where victory dances were celebrated, the chief watching these from the vantage ground of the stone circle. There was a rough boulder on the edge of the circle that served as a lookout. Roots of two kinds of ferns and the leaves of a leguminous plant were eaten with the human flesh—these were all wild species, not cultivated. Specimens of these plants were collected for us.

The chief of the Service Agriculture, Eaux, et Forêts kindly sent our botanical specimens to Professor M. Guillaumin in Paris for us. Dr. Guillaumin identified them as (1) Pteridium aquilinum Kuhn var. esculenta (Forst.); (2) Dryopteris gonzylades O. Ktze, or Kaukeana O. Ktze; (3) Pueraria neo-caledonica Harms. These plants are different from the wild plants eaten by the Fijians with human flesh (Seemann, 1862, p. 176).

Site 40: Costa.—On March 12, Mr. Chevalier took us to the farm of Mr. Antoine Costa in a district called Robinson, between Conception and Saint Louis, 8 mi. southeast of Nouméa on the main paved highway to Plum. The farmhouse is on the slope of a low hill. Mr. Costa had collected potsherds from the cultivated midden area in front of and below his house. The presence of shells in the soil gave further indication of a midden.

The Costa property, lying between the highway and the sea, was used some fifty years ago as a government experimental garden. An old road, bordered by a stone embankment, runs down a gully along its southeast edge to the shore and along the rocky shore to the northwest. A hill rises abruptly from the shore, leaving but little level ground. The construction of this road disturbed the midden deposits along the shore, and sherds found below the high tide level are evidently from this narrow fringe of level land. There could have been at most only a few native dwellings here, and we saw a few level spots which might have been house platforms. We walked about a half-mile from Mr. Costa's house along the shore, but dense growth prevented examination of the hill region between the house and the sea.

Mr. Costa presented us with some of his potsherds, and we collected some ourselves near his house and along the shore.

Site 41: Moindou.—On March 16, Gifford and John Kiernan of the South Pacific Commission visited Mr. Eugène Dijou of Moindou, who has two potsherds with a band of relief decoration encircling the rim (Avias, 1950a, pl. 3 and figs. 6-7). Mr. Dijou had found these at a depth of 5 to 6 m. during well-digging operations on a neighbor's property. The depth corresponds to the depth reported by Glaumont (1889, p. 215) for the four vessels found in the alluvial plain of Niza, near Bourail.

Site 41 is on Mr. Dijou's property, about a mile upstream from Moindou village, on a hillside that slopes gently down to the west. There was no trace of shell. All the specimens we obtained came from a ploughed

field, planted to eggplant. This field resembles the ploughed field of site 40 and would not be recognized as an archaeological site except for the presence of potsherds. Heavy pottery handles were a conspicuous feature of the sherds collected at the site. Mr. Dijou possesses several of these handles, attached horizontally to the vessel walls.

Site 42: Canala Hotel.—On April 1-3, Gifford, Mrs. Gifford, and Mr. Chevalier made a reconnaissance of the Canala district. The first site seen, marked by dark earth, shell, and potsherds, was a tiny affair, about 20 by 20 ft., in the garden of the hotel operated by Mr. and Mrs. Just Mayet. At first it was thought that this material had been hauled in for garden purposes, but the owner, Mr. Benjamin Nicholls, assured us that this was a true habitation site. The depth of the midden could not have been more than a few inches. Only potsherds were collected.

Site 43: Nakéty Slough.—On April 2, we investigated a small grass-covered knoll on the river side of the road to Nakéty Bay, 1.4 mi. from the junction of the road with the Nakéty-Thio highway. We were attracted to the spot by the presence of a taboo post, with carved and badly eroded top, which stood beside the road on the right bank of the Nakéty River or slough, about a mile from its mouth at Nakéty Bay. A bit of digging beneath the grass to a depth of only a few inches yielded a conch shell, like those put on house tops, and a few tiny sherds.

The grass made it difficult to estimate the size of the site, which at best was small. It was in a small area, 50 to 75 ft. wide, between the road and the slough bank. There was no indication of it on the inland side of the road, where there is an abrupt rocky slope.

Site 45: Patana and Poinge.—Through the courtesy of Colonel H. P. Dix, who supplied the transportation in a 4-wheel-drive pick-up with Mr. Gustave Martin as the skilled driver, we were able to visit this site on the coastal plains to the northwest of the mouth of the Pouenlotch River, 6 mi. from the main west coast highway.

There are actually two sections in this site, which are about 1/4 mi. apart; the southeastern part is called Patana (site 45 A), the northwestern part, Poinge (site 45 B). A few house mounds were evident at both places. Shell and a few potsherds gave further indication of past occupation. The area had been bulldozed to prepare it for pasture, and bushes and small trees had been removed.

Site 46: New Zealand quarry.—This site was never inhabited, but is merely a heap of boulders on a hillside in which human bones have been deposited in crannies. It was brought to our attention by Mr. René Tavernier, of Bourail, and Mr. Arthur Hudson, of Brisbane, who were using stone from the hillside for the construction of the cemetery for the New Zealand war dead. Mr. Tavernier kindly drove us to the site, about 2/3 mi. from the cemetery. The cemetery, a few miles south of Bourail, is visible from the main west-coast highway.

One skull and miscellaneous bones of more than one individual were obtained.

Site 47: Sekodé.—Six and a quarter miles from Canala Hotel, a side road branches off from the main road to Nakéty. The modern village of Sekodé is on this side road, a little more than 1/4 mi. from the main highway on a slope above a sluggish stream that forms a pond. We were taken to Sekodé on May 5 by Cesar Nakéty, a native member of the crew employed at site 44.

Up the slope, above the present houses, were old house terraces, their lower edges marked by stone retaining walls. At the lower edge of the terrace of a former chief's house, two damaged pottery bowls were found, one almost complete, the other three-fifths whole. These pieces undoubtedly represent pottery made in the early years of French occupation. (See pl. 19.)

Site 49: Poindia.—This site, which we visited on June 8 with Mr. Pierre Deligny, postmaster of Poindimié, is on the property of Mr. Ernest Gastaldi on the seaward side of the main east-coast highway a few miles north of Touho. The site lies on the right bank of Tipei Creek, near its mouth, and is reached by a side road leading from the main highway to Mr. Gastaldi's house, which is at one edge of the midden area. The name of the village formerly on the site was Poindia.

This is a shell kitchen midden, about 4 acres in extent, most of it now planted to garden, especially to maize. Some of it was being cleared at the time of our visit. It is a few feet above sea level, in sandy soil and apparently not very deep. The soil is gray rather than black. There were numerous sherds on the surface.

Parts of two skeletons were found under the roots of a fallen coconut tree, in pure beach coral sand. These may not be associated with the adjacent midden. A fine large nephrite bead was found with the skeletons. (See fig. 3, c).

Site 53 (Tiaoué).—On August 3, Shutler, with Father Pierre Gueneau, the Catholic priest of Tiaoué, visited the village to see one of the few old-style conical native houses left in New Caledonia. The village of Tiaoué lies in the mountains approximately 12 mi. by road northeast of Koné. It is a rather large village, covering about 100 acres, with a good-sized stream cutting back and forth through the village four times. There is a road, passable in dry weather, as far as the upper end of the village. From there on there is only a horse trail over the mountains to the east coast.

After photographing the house, Shutler went with Father Gueneau to the upper end of the village where the priest was building a new church, complete with fluorescent lights and stained-glass windows.

Father Gueneau had accumulated in New Caledonia and the Loyalties some fifteen thousand photographs of all phases of native life, including native economy and the ceremonies. He is still engaged in cataloguing this vast collection, which will make an invaluable addition to the Musée de l'Homme, to which he intends to give it.

Examination of the surface of the ground at Tiaoué revealed potsherds; where open bank cuts were visible, a little depth of deposit was noted. A small surface collection of potsherds was made, and Father Gueneau was kind enough to present the expedition with a polished stone axe, an adze, and two biconical slingstones. He possessed other fine specimens of axes and adzes and a small collection of whole pottery vessels.

APPENDIX II

PETROGRAPHY OF POTTERY

By

G. H. CURTIS

The predominant temper in the twenty-six sherds examined in thin sections is sand derived from weathering of metamorphic rocks, principally recrystallized quartz sandstone known as quartzite, but also recrystallized arkose, graywacke, slate, and serpentine. In most instances, the metamorphic origin of the sand temper may be readily discerned, as each sand grain is actually composed of several grains of quartz and other minerals tightly cemented together (pl. 21, a). However, where weathering or abrasion has completely disaggregated the meta-sandstones, producing individual mineral grains of quartz, orthoclase, epidote, and biotite, their origins are not evident; hence, in the accompanying table, these minerals have been listed separately from metamorphic rock chips, although most, if not all of them, have come from metamorphic sandstones. Although serpentine is, in a sense, both igneous and metamorphic, it is usually found in metamorphic terranes, and in this instance has the same significance as the metamorphic rocks and minerals present. It is possible that some of the rock chips listed as "sedimentary" or "igneous" were also derived from metamorphosed sedimentary and igneous rocks but were not sufficiently recrystallized to show easily recognizable metamorphic characteristics.

Plagioclase, pyroxene, glass, unaltered olivine, and some of the sedimentary, acid igneous, and basic igneous rock chips, have been derived from younger rocks than the metamorphic group. Calcite shell fragments and foraminifera are, of course, contemporary marine organisms.

It would appear superficially that there is a basis for assigning the various sherds to one of four categories, depending upon the predominance of one of the principal temper-types, namely, metamorphic, sedimentary, igneous, or organic. As may be seen in table A, however, the amounts of these major constituents vary independently of each other, and in only a few cases are the differences marked strongly enough to be significant.

In eighteen of the slides the grains are subrounded to subangular and are moderately well sorted as to size, which suggests that a natural sand, either marine beach sand or river sand, was used as temper. Almost half of the slides contain fragments of marine shells, and it is probable that beach sand was used in these instances. To be sure, it is possible that some of these shells were derived secondarily from sedimentary rocks, but no fragments of sedimentary rocks were observed with shell matter in them. In specimens 20840 and 20754, which are composed in large part of well-sorted shell fragments and foraminifera, there can be no question that beach sand has been used for temper (pl. 21, b).

Six of the slides, namely, 17002, 17928, 18057, 21469, 25333, and 26566, contain sand which is poorly sorted as to size, have no shell fragments, and contain numerous subrounded pebble-size grains of rocks which are easily abraded during transportation in a fluid medium (pl. 21, c). It is likely that the temper for these was obtained along small streams.

In only one specimen (17446) is there clear evidence that the temper is not natural sand but has been prepared by crushing solid rock to sand size. The temper used in this specimen is diallage gabbro, a coarse-grained igneous rock composed of pyroxene and plagioclase. Most of the fragments in the sherd show frayed edges which could not possibly have been formed by natural processes of weathering (pl. 21, d). Although over 90 per cent of the temper in this specimen is diallage gabbro, traces of other materials are present, such as a well-rounded shell fragment. How such contaminating sand grains got here is a matter of speculation.

Pumice appears in only one specimen, 3399. The refractive index of the glass composing the pumice is 1.505, which indicates the composition to be that of rhyolite. Pumice is indicative of explosive volcanic eruptions, and usually the products of such activity are widespread. Specimen 3399 is from the Ile des Pins, not from New Caledonia.

Most of the specimens do not show signs of weathering owing to long burial. However, in specimens 18057, 20053, 20754, 21406, 22354, 27153, and particularly 27947, there is a suggestion of decomposition of the feldspar grains subsequent to burial. The criterion of such weathering is the peripheral development of clay minerals in the feldspar grains, which, in these specimens is, at most, very slight.

The proportion of temper to clay is remarkably uniform throughout the twenty-six specimens, averaging 1:2.

Mineralogically, the tempers in the pottery sherds of the New Caledonian suite and the suite from Fiji are quite similar; the striking difference is in the proportions of the constituents (Gifford, 1951, p. 239). Whereas the New Caledonian sherds are characterized by abundant metamorphic and sedimentary sand grains, the Fiji sherds are rich in volcanic rocks and minerals, such as plagioclase and pyroxene, although they also have some quartzite grains (counted with quartz). In most thin sections these criteria serve to identify the area of their origin. Two notable exceptions to this rule are present, however, one from each suite.

Specimen 10334 from site 26 in Fiji is very similar in its mineralogy and general characteristics to the New Caledonian sherds, even to having some basic igneous grains, the like of which are not to be found in any of the other Fijian sherds but which are common in the New Caledonian sherds. Whether or not the high

proportion of shell fragments in this specimen is significant remains to be determined.

Specimen 20053 from New Caledonia has characteristics common to both areas. Its high content of augite, a pyroxene, is typically Fijian, whereas its basic igneous chips are New Caledonian. Again, it should be noted that this specimen is abnormally high in shell fragments.

There may or may not be any significance to the fact that the proportion of temper to clay in the sherds from both localities is the same, namely 1:2.

TABLE A

Petrography of Pottery

(4, abundant; 3, common; 2, scarce; 1, trace)

Specimen	Clay percentage	Quartz	Plagioclase	Orthoclase	Pyroxene	Amphibole	Biotite	Olivine (Iddings)	Iron ores	Epidote	Glass	Shell fragments (Calcite)	Rock chips	Acid igneous	Basic igneous	Sedimentary	Metamorphic	Miscellaneous*	Serpentine	Site
17002	69	2	1	1				2	1							4	2			19
17446	61	2	2		4				1	1				1			2			20
17928	55	3	1					2	2	1					1		3	3	2	20
18057	56	2	2					3	2					2	1	4	1		1	20
20053	62	2	1		2			1	1		1	4			3		2		1	13
20369	63	3	1		1			1	2	2		1				1	4			13
20754	65	1			1			2		1		4				1	1		2	13
20840	58	1				1						4					2			13
20841	53	2	1		1		1	1	2	2							4		1	13
21406	57	4			1	1			1		1	2			4	2	2		1	14
21469	51	3			1	1		3	3	2						1	4		1	14
21712	71	2	1		2				1			2			2	3	1		1	14
22354	55	3	1	1	1			1	1	1		1				2	4	1	2	26
23445	59	3			2			3	2							1	3			26
25073	70	2						1	1					1			4		1	44
25333	53	2						2	3								4		1	44
26566	72	2						2	3								3		3	6
27153	70	1			1			2	1							1	4		2	6
27711	64	4							2			3					4			6
27947	55	3						2	2			1				3	2			6
29499	59	3			2			1	1	1						1	4		1	50
29992	73	3	1		3			2	2	3		1				1	4		1	50
31487	59	1					1	1	2	2							4			51
31585	55	2			2	1		3	2	1							3		1	51
31650	61	1			1	1		1	2						1	1	4		2	51
3399		1	2		3	3		1						2			1			...

*Miscellaneous refers to unidentified minerals and rock chips, and to such rare minerals as tourmaline, sillimanite, garnet, etc.

NOTES TO TABLE A

These notes give provenience, pottery types, and memoranda on the sectioned sherds.

17002. Site 19, A25-26 B25-26, 0-6 in. Incised type. Contains poorly sorted stream sand, no shell. For type, see pl. 21, c.

17446. Site 20, A1-2 B1-2, 0-6 in. Incised type. Only sectioned sherd exhibiting temper prepared by crushing solid rock to sand size. Temper diallage gabbro, a coarse-grained igneous rock composed of pyroxene and plagioclase. For type, see pl. 21, d.

17928. Site 20, A12-13 B12-13, 6-12 in. Plain type. Contains poorly sorted stream sand, no shell. For type, see pl. 21, c.

18057. Site 20, A12-13 B12-13, 42-48 in. Plain type. Contains poorly sorted stream sand, no shell. For type, see pl. 21, c.

20053. Site 13, A2-3 B2-3, 0-6 in. Ribbed relief type. There is a suggestion of decomposition of the feldspar grains subsequent to burial.

20369. Site 13, A4-5 B4-5, 0-6 in. Ribbed relief type.

20754. Site 13, A12-13 B12-13, 6-12 in. Incised type. Temper composed of well-sorted shell fragments and foraminifera, beach sand used. For type, see pl. 21, b.

20840. Site 13, A12-13 B12-13, 36-42 in. Incised type. Temper composed of well-sorted shell fragments and foraminifera, beach sand used. For type, see pl. 21, b.

20841. Site 13, A12-13 B12-13, 36-42 in. Ribbed relief type.

21406. Site 14, C2-3 D2-3, 36-42 in. Cross-relief type. There is a suggestion of decomposition of the feldspar grains subsequent to burial.

21469. Site 14, C2-3, D2-3, 60-66 in. Ribbed relief type. Contains poorly sorted stream sand, no shell. For type, see pl. 21, c.

21712. Site 14, A1-2 B1-2, 48-54 in. Ribbed relief type.

22354. Site 26, A14-15 B14-15, 0-6 in. Cross-relief type. There is a suggestion of decomposition of the feldspar grains subsequent to burial.

23445. Site 26, Loc. B, A14-15, 0-6 in. Incised type.

25073. Site 44, Loc. A, A8-9 B8-9, 0-6 in. Cross-relief type.

25333. Site 44, Loc. B, A2-3 B2-3, 24-30 in. Ribbed relief type.

26566. Site 6, A9-10 B9-10, 12-18 in. Cross-relief type. Contains poorly sorted stream sand, no shell. For type, see pl. 21, c.

27153. Site 6, L8-9 M8-9, 6-12 in. Ribbed relief type. There is a suggestion of decomposition of the feldspar grains subsequent to burial.

27711. Site 6, Loc. A, A3-4 B3-4, 6-12 in. Plain type.

27947. Site 6, Loc. A, A3-4 B3-4, 84-90 in. Plain type. There is a suggestion of decomposition of the feldspar grains subsequent to burial.

29499. Site 50, surface. Incised type.

29992. Site 50, A1-2 B1-2, 66-72 in. Incised type.

31487. Site 51, A7-8 B7-8, 30-36 in. Ribbed relief type.

31585. Site 51, A15-16 B15-16, 18-24 in. Ribbed relief type.

31650. Site 51, C1-2 D1-2, 0-6 in. Ribbed relief type.

3399. Collected by M. H. Lenormand on Ile des Pins. Intricately incised type. Only sherd that contains pumice as part of tempering material.

APPENDIX III

DÉCAPODES RECOLTES AU COURS DE LA MISSION ARCHÉOLOGIQUE EN NOUVELLE-CALÉDONIE, 1952

Par

J. M. Remy

Les Décapodes brachyoures étudiés appartiennent a des espèces marines, littorales ou de faible profondeur, encore représentées dans la faune indo-pacifique actuelle; plusieurs même ont déjà été signalées par les zoologistes sur les côtes de l'Ile (Lupa pelagica, Scylla serrata, Actaea rüpelli, Phymodius nitidus, Sesarma [Sesarma] meinerti, S. [S] smithii). La composition de cette faune n'est donc pas surprenante à cet endroit.

Cependant ces restes se signalent à l'attention du paléontologiste par ce qu'ils montrent l'origine lointaine des espèces actuelles correspondantes et surtout par un mode de gisement très particulier.

Les gisements se répartissent en trois groupes: Sites 6, 44 (côte E). Site 19 (côte O) très peu fossilifères. Sites 20, 26 (A, B, C) (côte O) très fossilifères. Les sites 50, 51 (côte E) et 48 (côte O) n'ont livré que de rares restes indéterminables. Les formations composant ces sites ont une origine continentale et les restes fossilisés sont uniquement représentés par des débris de pince ou de carapace accumulés dans un espace restreint.

La présence de restes marins dans une formation continentale et leur accumulation suppose un transport difficilement expliquable par l'action d'un agent mécanique. Par contre l'intervention humaine offre une solution trés satisfaisante. Or il se trouve que dans les gisements de crabes, il a été trouvé des restes humains. Il parait alors tout à fait vraisemblable que la constitution de ces "ossuaires" soit le fruit d'une activité humaine.

Plusieurs faits apportent une confirmation à cette hypothèse. C'est tout d'abord l'aspect des restes. Les méropodites très abondants portent tous, à l'une de leur extrémité, une brisure dont les dimensions ont exactement l'importance requise pour l'extraction de la chair contenue dans cette partie du membre. En outre, il n'a pas été trouvé de carapaces entières. Or il est nécessaire de briser celle-ci pour en extraire les parties comestibles, et ce sont précisément ces seuls débris qui ont été retrouvés. Enfin, parmi les espèces identifiées: Lupa pelagica, Scylla serrata, dont les restes sont très abondants, sont connues comme comestibles et encore aujourd'hui vendues sur le marché de Nouméa.

Il parait ainsi vraisemblable qu'une partie au moins de ces débris soient des restes de repas; l'origine de l'autre partie pouvant d'ailleurs être assimilée à la première dans notre ignorance de sa valeur alimentaire ou de la variation des goûts de l'homme.

Cependant les Décapodes et particulièrement les crabes, en dehors du domaine de l'alimentation et surtout dans les régions pacifiques où ils sont si nombreux, jouent aussi un rôle important dans la médecine primitive, la sorcellerie ou la mythologie. Cet usage éventuel peut donc être aussi envisagé pour les restes récoltés. (Voir à ce sujet, M. Ward, 1937, pp. 211-216.)

Sous le rapport de la fossilisation, mis à part Coenobita hilgendorfi qui doit être enfoui depuis très peu de temps, les restes présentent, dans un même gisement, un état d'avancement plus ou moins accentué. Ce phénomène doit donc s'explique par des particularités chimiques ou structurales des restes et non par des enfouissements chronologiquement différents.

ÉTUDE SYSTEMATIQUE

Ordre DECAPODA

Famille CALLIANASSIDAE

Callianassa sp. indet.

Doigt mobile développé, bord inférieur festonné et tranchant, traces d'embase de poils.

Famille COENOBYTAE

Coenobyta hilgendorfi Terao 1913

Latreille, P. A. 1826, p. 277. (C. clypeata)
Hilgendorf, F. 1869, p. 98, pl. 6, figs. 3c, 4a. (C. clypeata)
Terao, A. 1913, p. 388.

P. I. propodite plus haut que large, face externe convexe, face interne sinueuse, tubercules, doigt mobile tombant.

Famille CALAPPIDAE

Calappa hepatica (Linné) 1766

Linné, C. 1766, p. 1043. (Cancer)
De Haan. 1837, p. 70.
Tweedle, M. 1950, p. 106.
Barnard, K. 1950, pp. 348-350, fig. 66, a-d.

P. I. doigt mobile grêle, recourbé, tuberculé sur le bord supérieur, apophyse externe saillante.

Famille PORTUNIDAE

Lupa pelagica (Linné) 1764

Linné, C. 1764, p. 434. (Cancer)
Milne-Edwards, H. 1834, p. 450.

Lupa pelagica (cont.)
Milne-Edwards, A. 1873, p. 156. (Neptunus) (Nouvelle Calédonie)
Ward, M. 1942, p. 79, pl. 5, fig. 4.((Portunus mauritianus)
Barnard, K. 1950, pp. 153-154, fig. 27 b.
P. I. doigt fixe et doigt mobile très longs, acérés, parcourus dans leurs longueurs par plusieurs sillons, puissamment armés de dents.

Scylla serrata (Forskål) 1755
Forskål, P. 1755, p. 90 (Cancer)
De Haan, 1837, p. 44.
Milne-Edwards, A. 1873, p. 162. (Nouvelle Calédonie)
Barnard, K. 1950, p. 160.
P. I. doigt fixe et doigt mobile légérement crochus à leurs extrémités, dent d'arrêt développée, les autres dents irrégulières et mousses, présence de plusieurs sillons.

Famille XANTHIDAE

Actaea rüpelli (Krauss) 1843
Krauss, F. 1843, p. 28, pl. I, figs. I, a-d. (Aegle)
Odhner, T. 1925, pp. 45-46, pl. 3, fig. 6.
Barnard, K. 1950, p. 235. figs. 37, d, 43, i, j.
Signalé en Nouvelle Calédonie par:
Milne-Edwards, A. 1873, p. 192. (A. rugata)
Synonymie in T. Odhner, 1925, pp. 45-46 (A. rugata = A. rüpelli)
P. I. propodite trapézoïdal, trois lobes sur le bord supérieur, tubercules importants sur la face externe, à peine marqués sur la face interne sauf au voisinage du bord superieur. Tubercules à la base du doigt mobile et du doigt fixe. Carpopodite avec lobes transversaux et un sillon longitudinal médian. Tubercules uniformément répartis sur la face externe.

Carpilius sp. indet.
Doigt mobile court, massif, recorubé en forme de bec. Une grosse dent mousse.

Phymodius nitidus (Dana) 1852
Dana, J. 1852, p. 218, pl. 12, fig. 7 (Pilodius)
Balss, A. 1938, pp. 55-56.
Tweedie, M. 1947, pp. 28-29.
Signalé en Nouvelle Calédonie par:
Milne-Edwards, A. 1873, p. 217. (Chlorodius sculptus) Synonymie in A. Balss, 1938, pp. 55-56. (Chlorodius sculptus = Phymodius nitidus)
P. I. doigt mobile et doigt fixe grêle, arqué, spatulé, une dent médiane bien marquée. Doigt mobile avec articulation rectangulaire et vouteé sur son bord supérieur.

Thalamita spinimana (Dana) 1849
Dana, J. D. 1849, p. 283, pl. 17, fig. 8.
Milne-Edwards, A. 1873, pp. 165-166, pl. 4, fig. 5. (Nouvelle Calédonie)
Shen, C. J. 1937, p. 131.
Tweedie, M. 1950, p. 109.
P. I. carpopodite armé de pointes, face externe avec ornementation compliquée de sillons et de verrues. Propodite parcourus de carènes longitudinales, pointes sur le bord supérieur. Doigt fixe et doigt mobile avec sillons.

Xantho gracilis (Dana) 1849
Dana, J. O. 1849, p. 210, pl. 9, fig. 13. (Chlorodius)
De Man, J. G. 1887b, p. 287, pl. II, fig. 2.
Odhner, T. 1925, p. 80.
Sakai, T. 1939, p. 465.
Tweedie, M. 1950, p. 115.
P. I. carpopodite et propodite lisse. Doigt fixe et doigt mobile coloré en brun, fins spatuliformes, et finement dentés.

Famille GRAPSIDAE

Sesarma (Sesarma) meinerti (de Man) 1887
De Man, J. G. 1887a, pp. 648, 668.
Tesh, J. J. 1917, pp. 171-172.
Chace, F. A. 1942, p. 201.
Barnard, K. 1950, pp. 125-126, figs. 25, e, f.
Signalé en Nouvelle Calédonie par A. Milne-Edwards, 1873, p. 304. (Sesarma tetragonum) Synonymie in J. G. De Man, 1887a, pp. 648, 668 (S. tetragonum = S. meinerti)
P. I. doigt fixe de section triangulaire, deux lignes de dents.

Sesarma (Sesarma) smithii (H. Milne-Edwards) 1853
Milne-Edwards, H. 1853, p. 149, pl. 9, fig. 2.
Milne-Edwards, A. 1873, p. 305. (Nouvelle Calédonie)
Tesch, J. J. 1917, p. 199.
Barnard, K. 1950, p. 124.
P. I. doigt fixe et doigt mobile effilés, une seule série de dents, à la base une dent accentuée. Sur le bord supérieur interne du doigt mobile, deux gros tubercules.

Famille OCYPODIDAE

Uca sp. indet. 1
P. I. doigt mobile, fin, accéré, dents très petites.

Uca sp. indet. 2
P. I. doigt mobile fin, accéré, présence de petits tubercules.

BRACHYOURES indet.

Méropodite (Xanthidae?)
Doigts fixes (Xanthidae?)
Doigts mobiles (Cancridae?)

TABLEAU A

Répartition et d'Abondance

(TR, très rare, un ou quelques échantillons; R, rare; A, abondant)

Décapodes	Côte Est			Côte Ouest				
	Site 6	Site 44		Site 19	Site 20	Site 26		
		A	B			A	B	C
Callianassa sp.					TR			
Coenobita hilgendorfi	TR							
Calappa hepatica					R		TR	R
Lupa pelagica			TR		A	A	A	A
Scylla serrata		TR		A	A	A	A	A
Actaea rŭpelli				TR	TR			
Carpilius sp.				TR	A		A	A
Phymodius nitidus	TR				A	A	A	A
Thalamita spinimana					A		TR	A
Xantho gracilis					A	A	A	A
Sesarma (S) meinerti					A	A	A	A
Sesarma (S) smithii					A	A	A	A
Uca sp. (1), (2)	TR(2)				TR(1)			
Méropodite (Xanthidae?)					A	A	A	A
Doigts fixes (Xanthidae?)					A	A	A	A
Doigts mobiles (Cancridae?)					A	A	A	A

TABLEAU B

Répartition et d'Abondance

(TR, très rare, un ou quelques échantillons; R, rare; A, abondant)

Décapodes	Profondeur (pouces)								
	0-6	6-12	12-18	18-24	24-30	30-36	36-42	42-48	48-54
Site 19									
Scylla serrata	A	A	A						
Actaea rŭpelli	TR								
Carpilius sp.		TR							
Site 20									
Callianassa sp.					TR			TR	
Calappa hepatica	R		R	R	R				
Lupa pelagica	A			A	A	A			
Scylla serrata	A	A	A	A	A	A	A	R	R
Actaea rŭpelli							TR		
Carpilius sp.		A	A	R			R		
Phymodius nitidus		A		A	A	R			
Thalamita spinimana			A	A	A				
Xantho gracilis		R	A	A	A				
Sesarma (S) meinerti		A	A			A			
Sesarma (S) smithii		A	A		A				
Uca sp. (1)									TR
Méropodite Xanthidae?			A						
Doigt fixe Xanthidae?		A					A		
Doigt mobile Cancridae?		A	A	A	A		A		
Site 26									
Loc. A									
Lupa pelagica	A	A							
Scylla serrata	A	A	A						
Carpilius sp.		TR							
Phymodius nitidus	A	A	A						
Xantho gracilis	A	A							

TABLEAU B (cont.)

Répartition et d'Abondance

Décapodes	Profondeur (pouces)								
	0-6	6-12	12-18	18-24	24-30	30-36	36-42	42-48	48-54
Site 26 Loc. A (cont.)									
Sesarma (S) meinerti	A	A							
Sesarma (S) smithii.....	A	A	R						
Méropodite Xanthidae?	A	A							
Doigt fixe Xanthidae?	A	A	A						
Doigt mobile Cancridae?	A	A	A						
Loc. B									
Calappa hepatica				TR		TR			
Lupa pelagica		A	A						
Scylla serrata.....	A	A	A	A	A	A			
Carpilius sp.	R		R	A	A	R			
Phymodius nitidus	A	A	A	A	A	A	A		
Xantho gracilis.....			A	R					
Sesarma (S) meinerti	R	A	A	R	R	R			
Sesarma (S) smithii.....	A	A	A	A		A	R		
Méropodite Xanthidae?		A		R					
Doigt fixe Xanthidae?	R	A	A	A	A	A			
Doigt mobile Cancridae?	A	A	A	A	A	A		R	
Loc. C									
Calappa hepatica	R		R						
Lupe pelagica	R	A	A	A					
Scylla serrata.....	A	A	A	A	A	A			
Carpilius sp.	A	A	R	R	R				
Phymodius nitidus	A	A	A	A	A				
Thalamita spinimana.....	A	A	R		R				
Xantho gracilis.....	A	A	A	A	A				
Sesarma (S) meinerti	A	A	A	A	R				
Sesarma (S) smithii.....	A	A	A	A	A	R			
Méropodite Xanthidae?	A	A	A	A	A				
Doigt fixe Xanthidae?	A	A	A	A	A				
Doigt mobile Cancridae?	A	A	A	A	A				
Site 44									
Loc. A									
Scylla serrata.....	TR								
Loc. B									
Lupa pelagica	TR								
Site 6									
Coenobita hilgendorfi	TR								
Phymodius nitidus					TR				
Uca sp. (2)		TR							

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UC	University of California Publications
-AR	Anthropological Records
-PAAE	American Archaeology and Ethnology

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EXPLANATION OF FIGURES 1-5

Fig. 1. Stone sinker and adzes; pottery "yam charm." a. Sinker; fine-grained basalt; width, 138 mm.; length, 108 mm.; donor, Chief Bome, of Oundjo; site 26; 24965. b-f. Adzes: b. Nephrite serpentine; length, 89 mm.; donor, Sam, of Oundjo; site 26, dug from a depth of 6 in. while getting material for house walls; 24971. c. Fine-grained basalt; length, 51 mm.; site 13, talus slope on beach edge; 19459. d. Nephrite serpentine; length, 80 mm.; donor, Father Pierre Gueneau, of Tiaoué; 24975. e. Nephrite serpentine; length, 41 mm.; site 19, 6-12 in.; 17029. f. Nephrite serpentine; length, 64 mm.; donor, Father Pierre Gueneau, of Tiaoué; 24970. g. Pottery "yam charm"; length, 145 mm.; donor, Ernest E. Féré; site X on road from Canala north to Kouaoua; 24992.

Fig. 2. Adzes. a. Nephrite serpentine; length, 94 mm.; donor, Philip, of Paama village; 25000. b. Nephrite serpentine; length 92 mm.; donor, Cale Fosberry, of Oundjo; site 26; 24972. c. Nephrite serpentine; length, 89 mm.; donor, John Linwood Barnes, of Yaté; 24988. d. Nephrite serpentine; length, 78 mm.; donor, André Ragot, of Tiouandé; site 50, surface; 29495. e. Nephrite serpentine; length, 150 mm.; donor, Henri Delorme, of Nouméa; found near Voh; 24967. f. Nephrite serpentine; length, 88 mm.; donor, Cesar Nakéty, of Canala; 24976. g. Nephrite serpentine; length, 79 mm.; donor, Louis Gayon, of Touho; site 49; 24999. h. Nephrite serpentine; length, 91 mm.; donor, Philip Bougan, of Pourouote; 24973.

Fig. 3. Adze, mace, axes, bead. a. Fragment of large adze or axe; nephrite serpentine; length, 222 mm.; donor, Chief Bome, of Oundjo; site 26; 24968. b. Axe; nephrite serpentine; length, 108 mm.; donor, Dr. Jean Guiart; found by native of Bako village near Koné; 24978. c. Nephrite bead; length, 33 mm.; found with burial 8591, site 49; 16708. d. Mace fragment; nephrite serpentine; donor, Cale Fosberry, of Oundjo; site 26; 24977. e. Axe; nephrite serpentine; length, 79 mm.; donor, Chief Bwae, of Tiouandé; found near site 51; 31338. f. Adze; nephrite serpentine; length, 105 mm.; site 26, 6-12 in.; 22478. g-i. Axes: g. Nephrite serpentine; length, 91 mm.; donor, Father Pierre Gueneau, of Tiaoué; found near village of Tiaoué; 24974. h. Nephrite serpentine; length, 160 mm.; donor, Eliane Kabai, of Poindimié; found in site 6 area; 24966. i. Nephrite serpentine; length, 169 mm.; donor, Father Theodore Zimmermann, of Koné; found at village of Aléou near Koné; 24969.

Fig. 4. Rim and lip types. Exterior of potsherd is to the right.

Rim types. a, i-k, m-o. Straight rim: a. Site 13, location A, 0-6 in.; 20545. i. Site 13, 24-30 in.; 19694. j. Site 13, location A, 12-18 in.; 20617. k. Site 13, location A, 0-6 in.; 20066. m. Site 20, 18-24 in.; 18308. n. Site 20, 0-6 in.; 18982. o. Site 13, location A, 12-18 in.; 19975.

b-d, l. Incurved rim: b. Site 26, location C, 6-12 in.; 24845. c. Site 26, location C, 18-24 in.; 24741. d. Site 48, surface; 19286. l. Site 13, location A, 6-12 in.; 20766.

e-h, p-r. Outcurved rim: e. Site 26, location B, 6-12 in.; 22685. f. Site 6, location B, 0-6 in.; 29125. g. Site 51, 6-12 in.; 31618. h. Site 13, location A, 6-12 in.; 20911. p. Site 13, location A, 0-6 in.; 20379. q. Site 13, location A, 0-6 in.; 20377. r. Site 14, 48-54 in.; 21713.

Lip types. a. Flat lip. b-h. Round lip. i-k. Grooved lip. l-n. Inside beveled lip. o, p. Outside beveled lip. q, r. Double beveled lip.

Fig. 5. Design elements of incised pottery from sites other than site 13.

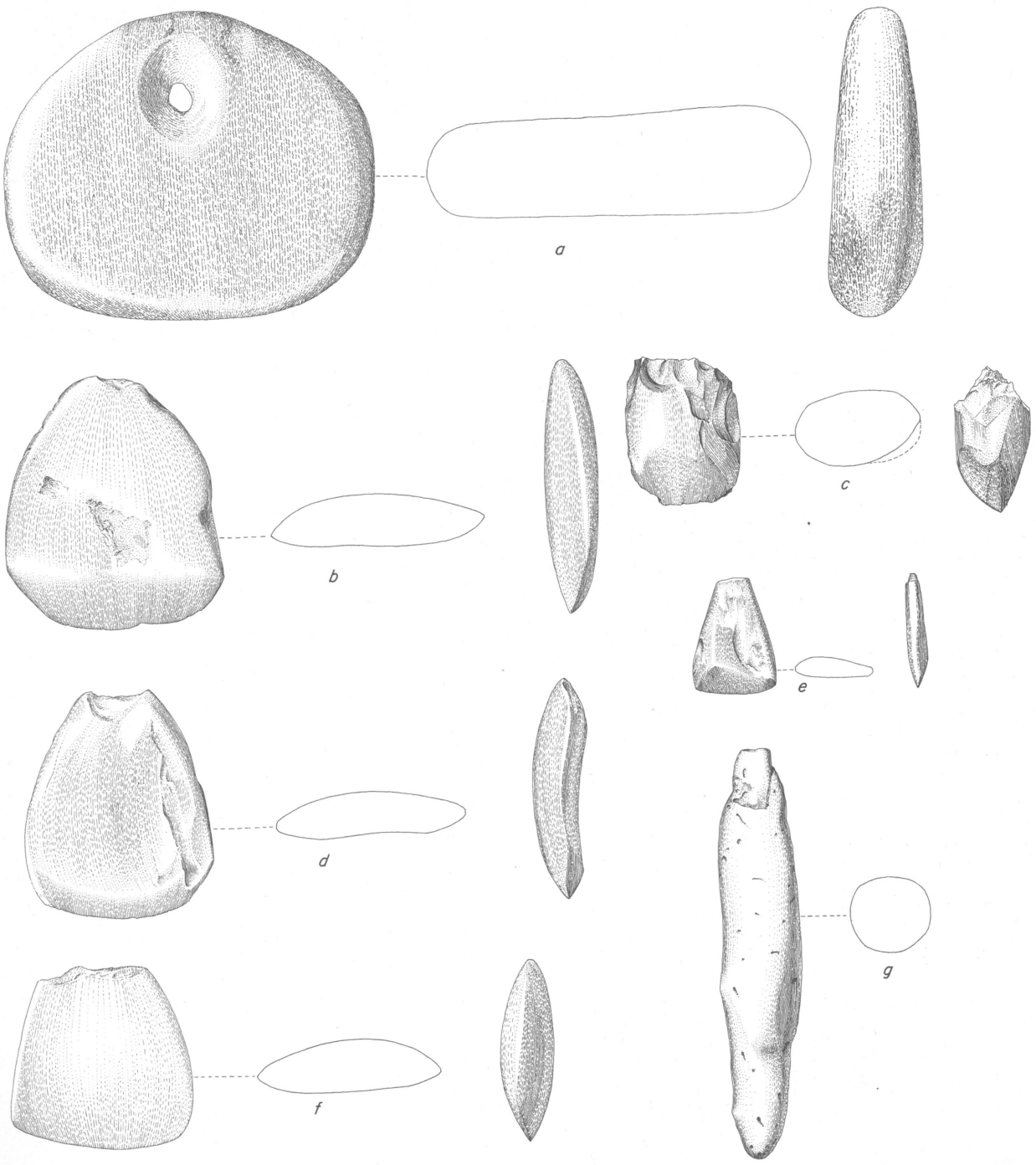


Fig. 1. Stone sinker and adzes; pottery "yam charm"

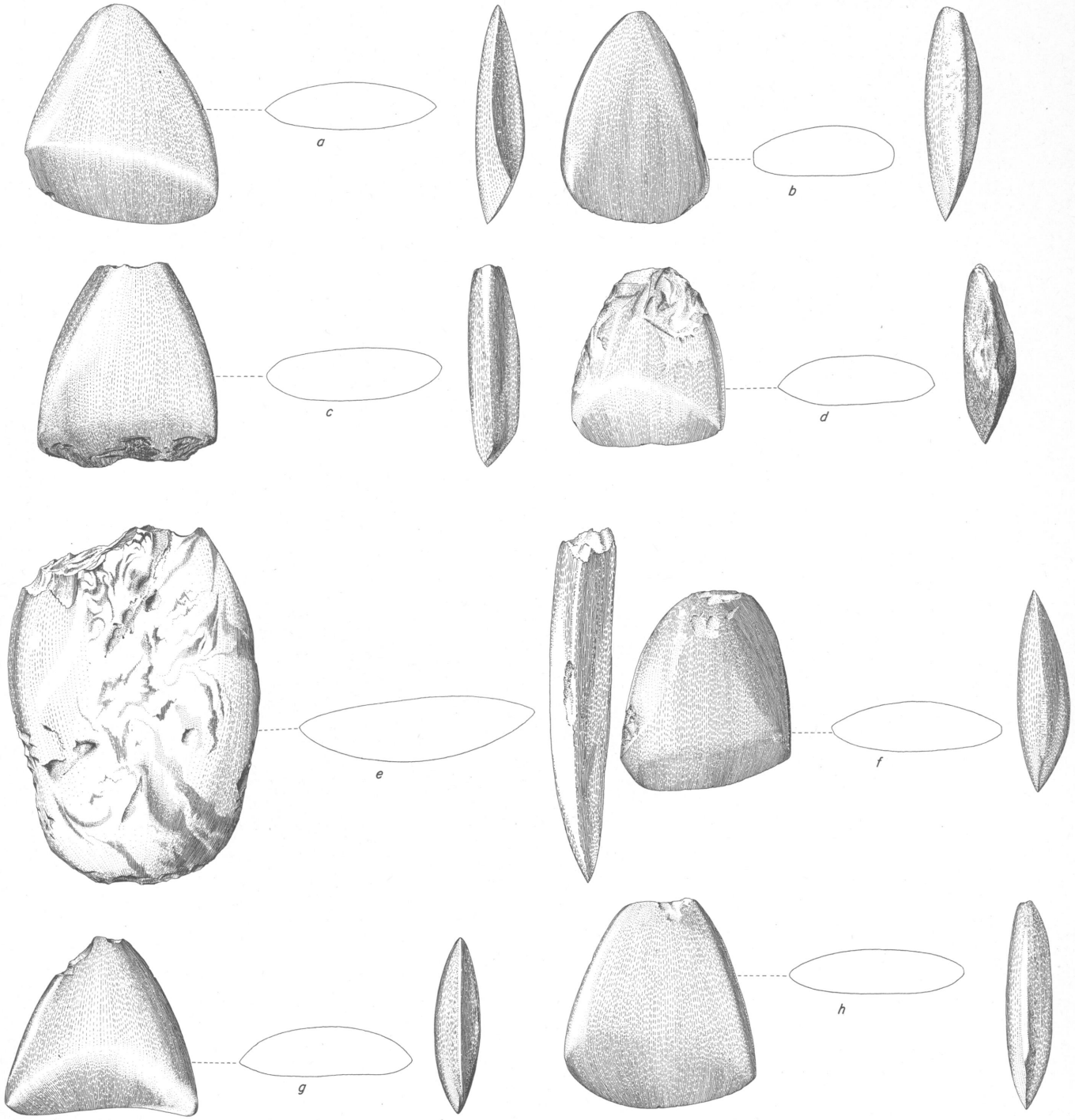


Fig. 2. Adzes

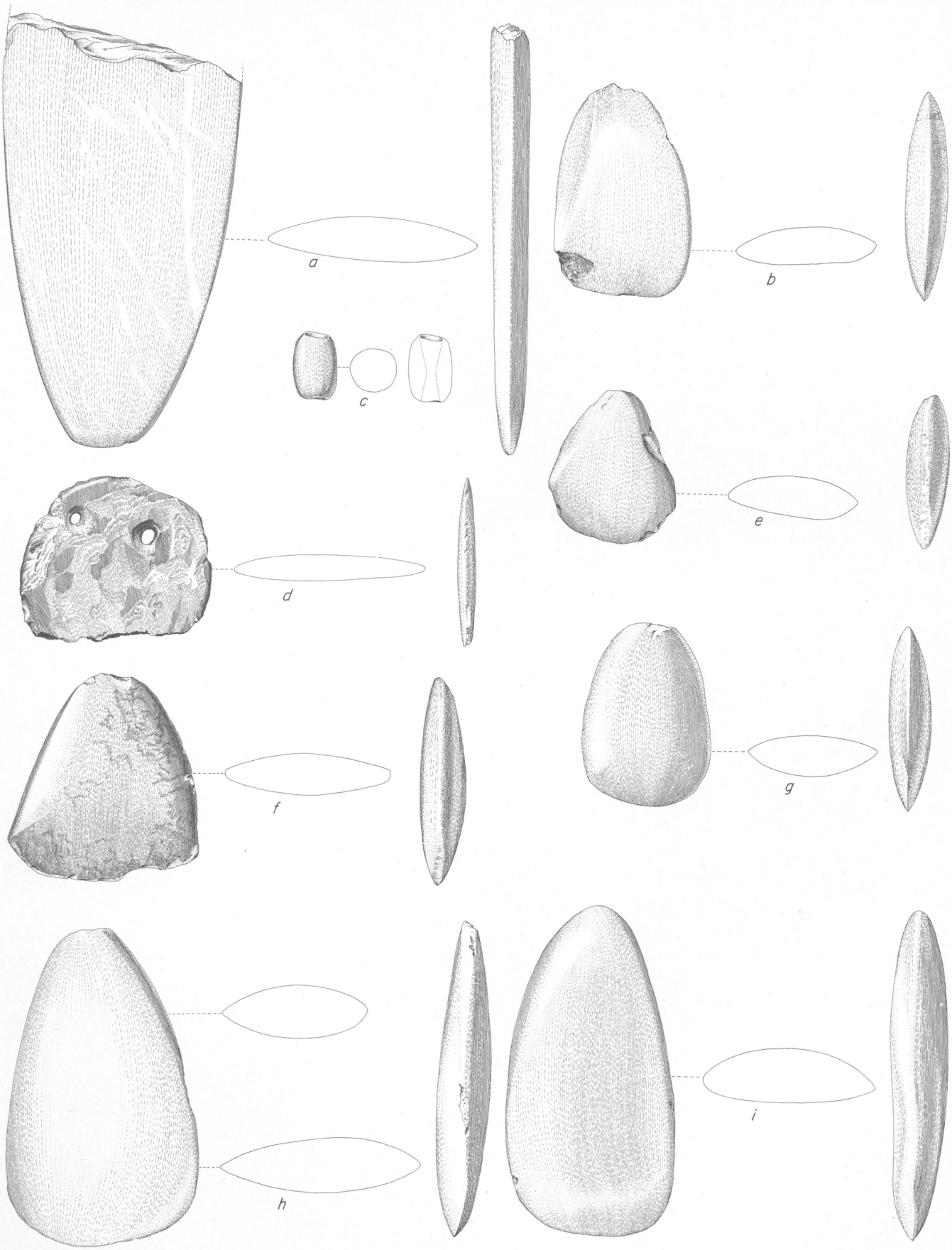


Fig. 3. Adze; mace; axes; bead

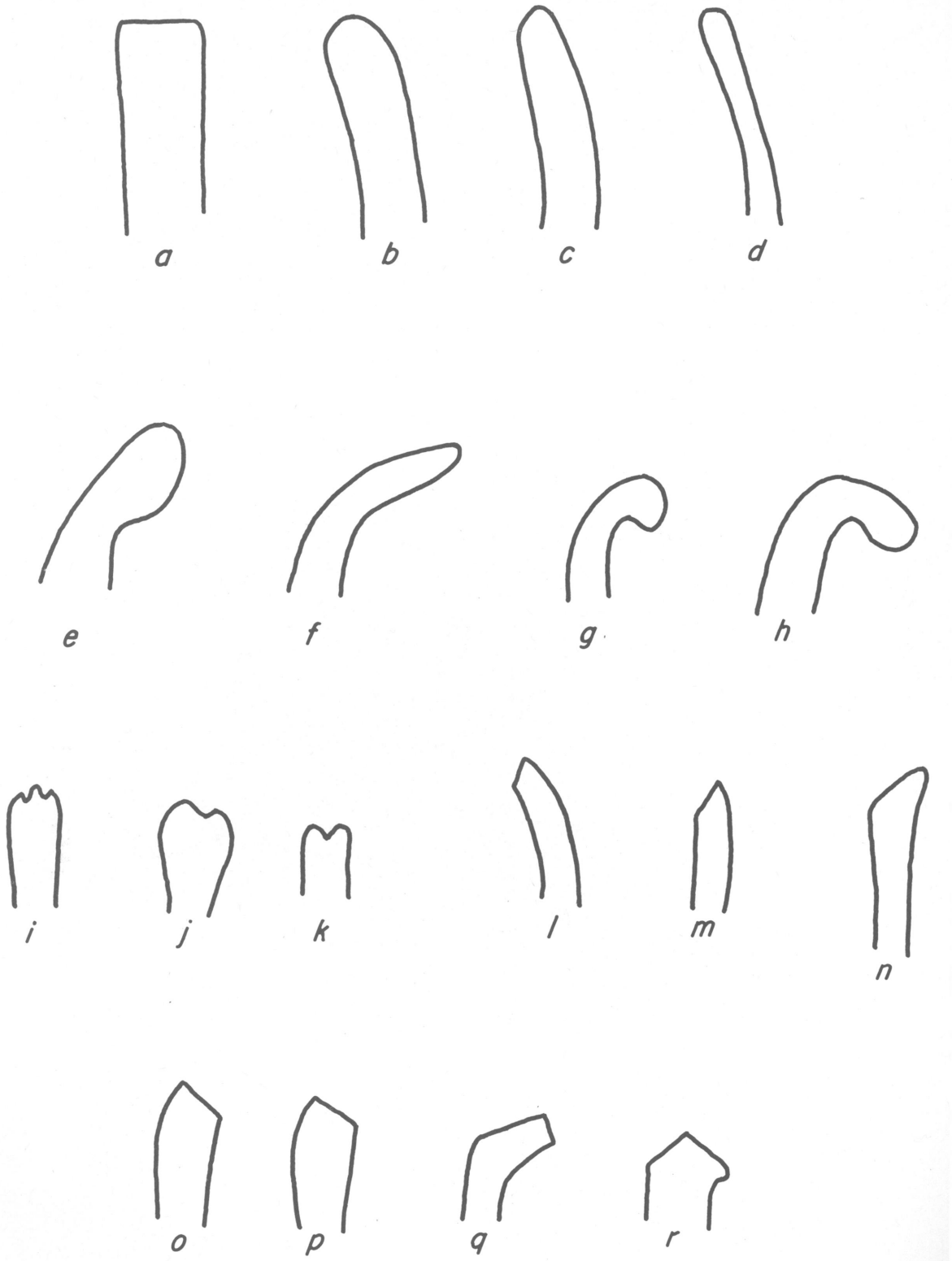


Fig. 4. Rim and lip types of potsherds

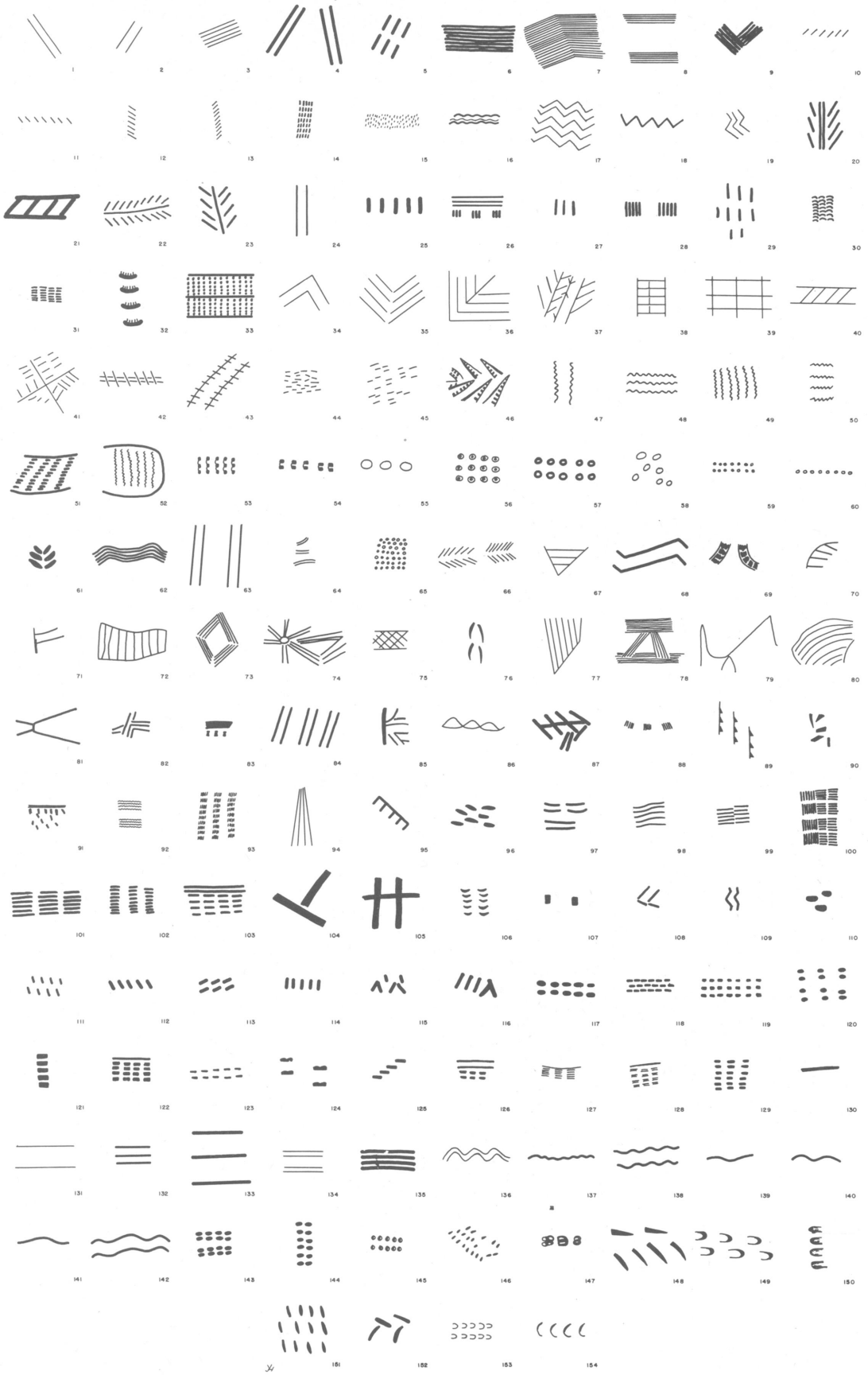


Fig. 5. Design elements of incised pottery

PLATES

EXPLANATION OF PLATES

PLATE 1

Excavations at sites 19, 20, and 48. a. Site 19. Looking north along excavated area. b. Site 20. Profile on wall B12 A12, showing contrast between dark and underlying sandy soil. c. Site 20. Group of Placostylus shells in rectangle A14-15 B14-15 in 24-30 in. block. d. Site 48. Excavation showing screens and surrounding acacia-like shrubs.

PLATE 2

Excavations at sites 13, 14, and 26. a. Site 13. Showing profile of wall B1 A1 after top 12 in. had been dug, as indicated by shelf and wall B2 A2 in back. b. Site 13, location A, showing midden edge at beach and datum telephone pole. c. Site 13, location A, showing profile of wall A1 B1. d. Site 13, location A, excavated area, datum telephone pole, and Koniene Island in background. e. Site 14, showing profile of wall C2 D2. f. Site 26, location B, showing sea edge of location at low tide, grid stakes at left, low hill in background, shell screenings in left foreground.

PLATE 3

Specimens and excavations at Oundjo, site 26. a. Fish net showing modern use of Arca scapha sinkers by fishermen of Oundjo. b. Turtle-roasting hearth of modern Oundjo. c. Location B, showing wall B1 A1 with layer of Trochus niloticus shells. d. Location B, showing probable distal end of house post excavated in ground water in 24-30 in. block. e. Location C, showing excavations and Trochus niloticus shells from screenings. f. Location C, showing wall B2 A2 with heavy concentration of shell above black soil.

PLATE 4

Excavations at sites 44 and 6. a. Site 44, location B, showing profile of wall A1 B1, with black midden material above and alluvium below. b. Site 6, showing datum telephone pole and rock outcrop across road from excavation. c. Site 6, showing profile of wall B11 A11 with contrast between black midden material and underlying beach debris. d. Site 6, location A, showing profile of wall A5 A6, which was dug to 96 in., deeper than the picture shows.

PLATE 5

Excavations and general views, sites 50, 52, 51, and 32. a. Site 50, looking over excavations to east coast highway and bridge over the Tiouandé River. b. Site 50, showing profile of wall A7 B7 at a depth of 36 in.; bottom of trench cut in steps. c. Top of crag at base of which is site 52. d. Site 52 (Ouapa), showing excavations and opening of a small rock shelter at base of crag. e. View across Tiouandé River, showing crag at base of which is site 51, the modern village of Tiouandé. f. Site 32, Pouenlotch, unexcavated, but showing black midden from posthole digging.

PLATE 6

Conus shell artifacts. a. Conus literatus ring from fibula of skeleton in hillside ossuary; site 6; 25962. b. Conus literatus bracelet, ethnological; from Houailou; 2851. c. Fragment of unfinished Conus literatus ring showing filed and chipped lower edge and flat-ground upper edge; site 26, 18-24 in.; 23640. d. Fragment of Conus literatus ring showing attachment of lip and body whorl; site 13, 0-6 in.; 20860. e. Fragment of finished Conus literatus grooved bracelet; site 13, 0-6 in.; 20047. f. Fragment of finished Conus literatus bracelet of same style as h but wider; site 26, 6-12 in.; 23181. g. Fragment of finished Conus literatus bracelet, both edges of even thickness; site 13, 0-6 in.; 20528. h. Fragment of finished Conus literatus bracelet, lime-encrusted, showing thicker upper edge; site 14, 36-42 in.; 21645. i. Conus eburneus with spire ground off; site 26, 6-12 in; 23731. j. Conus eburneus unmodified shell; site 26, 24-30 in.; 23263. k. Conus literatus, from which spire has been removed, showing saw marks around shell for removal of upper portion for a ring; site 26, 12-18 in.; 23216. l. Conus marmoreus base showing beveled edge where upper part has been cut off for a ring; site 26, 6-12 in.; 24291. m. Conus literatus base showing beveled edge where upper part has been cut off for a ring; site 26, 0-6 in.; 22252. Length of i 45 mm.; all others to same scale.

PLATE 7

Shell artifacts. a. Side-drilled Turbo setosus; site 26, 0-6 in.; 24806. b. Cut piece of Meleagrina sp.; site 13, surface or talus; 19458. c. Conus marmoreus with top of spire removed by grinding; site 26, 6-12 in.; 24139. d. Cardium enode valve, perhaps used as a "pot scribe"; site 20, 24-30 in.; 24958. e. Drilled fragment of Cassis; site 44, surface; 25004. f. Charonia lampas shell with hole in upper part of spire; site 43, 0-6 in.; 16696. g. Arca passa net sinker; site 50, 42-48 in.; 29646. h. Arca passa net sinker; site 50, 30-36 in.; 29847. i. Cypraea tigris base; site 20, 30-36 in.; 18160. j. Cypraea tigris cap; site 6, 12-18 in.; 26728. k. Cypraea vitellus base; site 26, 30-36 in.; 24078. l. Cypraea vitellus cap; site 26, 24-30 in.; 24218. m. Lambis chiragra paring knife; site 4, surface; 16569. Length of b 87 mm.; others to same scale.

PLATE 8

Shell artifacts. a. Spire-lopped Oliva elegans; site 50, 48-54 in.; 29658. b. Spire-lopped Oliva elegans; site 50, 36-42 in.; 29870. c. Spire-lopped Oliva ispidula; site 50, 0-6 in.; 31075. d. Spire-lopped Oliva ispidula; site 26, 0-6 in.; 23900. e. Conus literatus

pendant, probably made from fragment of shell ring; site 13, 12-18 in.; 20611. f. Cypraea annulus with side-abraded opening; site 26, 0-6 in.; 22651. g. Patella stellaeformis with apical portion removed; site 6, 30-36 in.; 26781. h. Paring knife (?) of Sistrum albovaria; site 20, 12-18 in.; 17731. i. Disk ground from top of Conus shell; site 13, 18-24 in.; 20795. j. Cardium "pot scribe"; site 19, 6-12 in.; 16777. k. Perforated Arca cruciata; site 6, 36-42 in.; 29101. l. Modern pearl-shell button; site 26, 6-12 in.; 22919. m. Small Arca shell with perforated umbo; site 50, 66-72 in.; 29989. n. Perforated Chama nivalis; site 13, 18-24 in.; 19616. o. Perforated Tellina palatam; site 6, 24-30 in.; 26764. p. Perforated Terebra dimidiata; site 52, 0-6 in.; 31774. q. Chama shell with hole made by abrasion; site 50, 48-54 in.; 29660. r. Fragment of bracelet of Trochus niloticus; site 26, 0-6 in.; 24504. s. Fragment of bracelet of Trochus niloticus; site 26, 12-18 in.; 22859. t. Fragment of bracelet of Trochus niloticus; site 26, 24-30 in.; 24052. u. Chama shell with hole made by abrasion; site 50, 54-60 in.; 29675. v. Knife from lip of Conus literatus; site 20, 6-12 in.; 17489. w. Drilled fragment of Meleagrina shell; site 26, 12-18 in.; 22702. x. Perforated fragment of Meleagrina shell; site 26, 6-12 in.; 22484. y. Cut fragment of Trochus niloticus shell; site 26, 18-24 in.; 22945. z. Spire-lopped Conus ebraeus; site 50, 18-24 in.; 30661. aa. Conus catus with hole in side made by abrasion; site 50, 6-12 in.; 31130. ab. Spire-lopped Conus catus; site 50, 42-48 in.; 31001. ac. "Paring knife" of Strombus luhuanus; site 26, 30-36 in.; 22589. ad. "Paring knife" of Strombus luhuanus; site 20, 0-6 in.; 17458. ae. Cut clam shell; site 50, 18-24 in.; 29570. af. Bone tip of dagger (?); site 26, 12-18 in.; 23773. ag. Scraper of Pecten janus shell; site 20, 0-6 in.; 18377. ah. Pecten radula shell; site 14, 6-12 in.; 21524.

PLATE 9

Ethnological specimens. a. Hafted greenstone mace, with tapa-wrapped handle; blade, 184 mm. by 147 mm.; no provenience; 56. b. Turtle-net sinker, with sinnet binding; 230 mm. long; from village of Oundjo (site 26), gift of Ramon, of Oundjo; 21941.

PLATE 10

Miscellaneous ground stone artifacts. a-e. Beads: a. Site 26, 12-18 in.; 23774. b. Site 26, 12-18 in.; 24180. c, d. Site 26, 6-12 in.; two specimens numbered 22481. e. Site 26, 12-18 in.; 22701. f. Steatite pendant; site 26, 6-12 in.; 22679. g. Barrel-shaped piece of coral; site 19, surface; 16728. h, j. Incipient beads: h. Site 26, 6-12 in.; 23177. j. Site 26, 12-18 in.; 22700. i, k, l. Beads: i. Site 26, 6-12 in.; 22831. k. Site 26, 0-6 in.; 23005. l. Site 20, 0-6 in.; 18081. m-o, q-s. Slingstones: m. Village of Nakéty; 24980. n. Village of Nakéty; 24981. o. Village of Tiaoué; 24985. p. Stone with two encircling grooves; site 6, 6-12 in.; 27287. q. Saint Louis Mission; 24989. r. Saint Louis Mission; 24990. s. Village of Oundjo, site 26; 24979. t. Incised steatite; site 26, 12-18 in.; 24177. u. Smoothing stone fragment; site 26, 24-30 in.; 23402. v-x. Grindstone fragments: v. Site 26, 12-18 in.; 22858. w. Site 26, 18-24 in.; 24726. x. Site 26, 0-6 in.; 24087. y. Spatulate pendant; site 51, 0-6 in.; 31683. z. Site 26, 6-12 in.; 22477. aa. Sinker or anchor stone; site 20, 6-12 in.; 17692. y is 132 mm. long and 66 mm. wide; all others to scale.

m, n. Gift of Cesar Nakéty, of Canala. o. Gift of Father Pierre Gueneau, of Tiaoué. q, r. Gift of John Linwood Barnes, of Yaté. s. Gift of Michael Bear, of Oundjo.

PLATE 11

Chipped stone tools. a, b. End scrapers, both specimens of chalcedony: a. Site 20, 0-6 in.; 18814. b. Site 13, 0-6 in.; 20361. c-e. End and side scrapers: c. Chalcedony; site 13, surface; 19460. d. Quartz; site 51, 12-18 in.; 31577. e. Chalcedony; site 26, 12-18 in.; 23972. f, g. Side scrapers of chalcedony, one side worked: f. Site 13, 0-6 in.; 20529. g. Site 20, 0-6 in.; 17444. h, i. Side scrapers of chalcedony, two sides worked: h. Site 13, 0-6 in.; 20048. i. Site 13, 0-6 in.; 20881. j. Flake knife of serpentine; site 20, 18-24 in.; 17528. k. Shaft scraper of basalt; site 13, 0-6 in.; 20363. l. Flake knife of obsidian; site 13, talus slope; 19491. m-o. Gravers of chalcedony: m. Site 13, 0-6 in.; 20706. n. Site 13, 0-6 in.; 20049. o. Site 26, 0-6 in.; 24499. p-r. Utilizable flakes: p. Silicified (?) rhyolite (lava); site 44, 30-36 in.; 25797. q. Chalcedony; site 13, surface; 19461. r. Chalcedony; site 26, 12-18 in.; 24451. s-u. Utilized flakes exhibiting use-flaking: s. Chalcedony; site 26, 0-6 in.; 24107. t. Rhyolite; site 26, 30-36 in.; 22761. u. Chalcedony; site 13, 0-6 in.; 20529. v, w. Scraper-choppers of chalcedony: v. Site 14, surface; 21116. w. Site 26, 24-30 in.; 23849. x, y. Choppers of chalcedony: x. Site 26, 18-24 in.; 22532. y. Site 26, 6-12 in.; 24143. z-ac. Hammerstones and pecking stones: z. Basalt; site 26, 30-36 in., 22587. aa. Chalcedony; site 32, surface; 16651. ab. Basalt; site 9, surface; 16585. ac. Quartz; site 44, 0-6 in.; 25099. ad. Scraper-hammerstone of chalcedony; site 26, 18-24 in.; 23803. h. is 61 mm. long and 35 mm. wide; all others to scale.

PLATE 12

Relief-decorated potsherds. a-d, i-k. Nubbin potsherds: a-d show exterior surface; i-k show interior surface. a. Site 20, 0-6 in.; 17447. b. Hardness 6; site 20, 0-6 in.; 18256. c. Site 48, 6-12 in.; 19361. d. Site 44, 0-6 in.; 25085. i. Site 6, 6-12 in.; 28878. j. Site 37, surface; 16670. k. Site 44, 6-12 in.; 25075. e-h. Gouged potsherds: e. Hardness 2.5; site 50, 6-12 in.; 30088. f. Site 50, 6-12 in.; 30469. g. Site 51, 6-12 in.; 31521. h. Site 14, 24-30 in.; 21388. l, m. Cross-relief potsherds: l. Hardness 3.5; site 26, 0-6 in.; 22167. m. Site 6, 12-18 in.; 26379. n-x. Ribbed potsherds: n. Site 26, surface; 21957. o. Hardness 3.5; site 13, surface; 19824. p. Site 38, surface; 16678. q. Site 13, surface; 19482. r. Site 13, surface; 19820. s. Site 13, 0-6 in.; 20369. t. Site 14, 48-54 in.; 21263. u. Site 13, 0-6 in.; 20534. v. Site 13, 0-6 in.; 20053. w. Curved ribs; site 13, 6-12 in.; 20902. x. Hardness 5; site 14, surface; 21112. y-al. Appliqué potsherds: y. Site 6, 12-18 in.; 26962. z. Hardness 2.5; site 6, 12-18 in.; 26742. aa. Hardness 2.5; site 14, surface; 21108. ab. Site 14, 36-42 in.; 21229. ac. Site 51, 12-18 in.; 31419. ad. Site 6, 6-12 in.; 27291. ae. Site 6, 12-18 in.; 29344. af. Site 6, 72-78 in.; 28553. ag. Site 14, 12-18 in.; 21356. ah. Site 14, 24-30 in.; 21592. ai. Site 6, 12-18 in.; 29235. aj. Site 6, 30-36 in.; 26793.

ak. Site 14, 12-18 in.; 21356. al. Site 6, 12-18 in.; 29157. s is 52 mm. long and 47 mm. wide; all others to scale.

PLATE 13

Potsherds with incised designs represented by single specimens. See design element chart, figure 5, for individual elements. a. Site 40, surface; 16684. b. Site 19, 0-6 in.; 16818. c. Hardness 2.5; site 19, 0-6 in.; 17189. d. Site 20, 0-6 in.; 17563. e. Site 20, 0-6 in.; 17902. f. Site 20, 6-12 in.; 17691. g. Site 20, 6-12 in.; 17929. h. Site 20, 6-12 in.; 18091. i. Site 20, 12-18 in.; 17956. j. Site 20, 12-18 in.; 18114. k. Site 20, 18-24 in.; 19201. l. Site 20, 24-30 in.; 18459. m. Hardness 3; site 15, surface; 16607. n. Site 15, surface; 16600. o. Site 14, 18-24 in.; 21559. p. Site 14, 48-54 in.; 21712. q. Site 26, 0-6 in.; 23554. r. Site 26, 0-6 in.; 22263. s. Site 26, 6-12 in.; 24300. t. Site 26, 6-12 in.; 24302. u. Site 26, 6-12 in.; 24847. v. Site 26, 6-12 in.; 23584. w. Site 26, 12-18 in.; 24324. x. Site 26, 12-18 in.; 23467. y. Site 26, 18-24 in.; 22952. z. Site 26, 18-24 in.; 24738. aa. Site 26, 24-30 in.; 23123. ab. Hardness 4.5; site 26, 24-30 in.; 23508. ac. Site 26, 30-36 in.; 22770. ad. Site 33, surface; 16659. ae. Site 44, 6-12 in.; 25166. af. Site 44, 12-18 in.; 25841. ag. Site 6, surface; 25969. ah. Site 6, 0-6 in.; 25968. ai. Site 6, 6-12 in.; 27290. aj. Site 6, 6-12 in.; 28973. ak. Site 6, 12-18 in.; 27530. al. Site 6, 12-18 in.; 29030a. am. Site 6, 18-24 in.; 26097. an. Site 6, 36-42 in.; 26817. ao. Hardness 4; site 49, surface; 16723. ap. Site 50, 0-6 in.; 29497. aq. Site 52, 0-6 in.; 31808. ar. Site 51, 12-18 in.; 31528. a is 62 mm. long, 45 mm. wide; all others to scale.

PLATE 14

Potsherds with incised designs found only at one site (except ai-al). See design element chart, figure 5, for individual elements. a. Hardness 2.5; site 19, 0-6 in.; 16920. b. Site 19, 0-6 in.; 16769. c. Site 19, 0-6 in.; 16836. d. Site 20, 0-6 in.; 17562. e. Site 20, 0-6 in.; 18817. f. Site 20, 0-6 in.; 18077. g, h. Site 20, 6-12 in.; 18091 (2 specs.); hardness of h, 3. i. Hardness 5; site 20, 6-12 in.; 18836. j. Site 14, 18-24 in.; 21557. k. Site 14, 36-42 in.; 21225. l. Site 26, surface; 21953. m, n. Site 26, surface; 21949 (2 specs.). o. Site 26, 0-6 in.; 22260. p. Site 26, 0-6 in.; 22304. q. Site 26, 0-6 in.; 22165. r. Site 26, 6-12 in.; 24299. s. Site 26, 6-12 in.; 23445. t. Site 26, 6-12 in.; 22189. u. Site 26, 6-12 in.; 24848. v. Site 26, 6-12 in.; 24438. w. Site 26, 6-12 in.; 23446. x. Site 26, 12-18 in.; 22022. y. Site 26, 12-18 in.; 23378. z. Site 26, 18-24 in.; 23648. aa. Site 26, 18-24 in.; 23096. ab. Site 26, 18-24 in.; 24739. ac. Hardness 4.5; site 26, 18-24 in.; 22541, 22542. ad. Site 26, 18-24 in.; 23098. ae. Site 6, 0-6 in.; 26338. af. Site 6, 6-12 in.; 26220. ag. Site 50, 12-18 in.; 30018. ah. Site 50, 66-72 in.; 29965. ai, ak, al. Potsherds with incised designs occurring at more than one site: ai. Site 51, 0-6 in.; 31717. aj. Site 51, 0-6 in.; 31454. ak. Site 51, 6-12 in.; 31619. al. Site 49, surface; 16717. a is 37 mm. long, 46 mm. wide; all others to scale.

PLATE 15

Potsherds with incised designs that occur at more than one site. See design element chart, figure 5, for individual elements. a. Site 19, surface; 16731. b. Hardness 4.5; site 19, surface; 16736. c. Site 19, 0-6 in.; 16768. d. Site 19, 0-6 in.; 16904. e. Site 19, 0-6 in.; 17154. f. Site 19, 6-12 in.; 16803. g. Site 20, 0-6 in.; 18983. h. Site 14, 12-18 in.; 21153. i. Site 26, surface; 21950. j. Site 26, surface; 21955. k. Site 26, 0-6 in.; 23557. l. Site 26, 0-6 in.; 22351. m. Site 26, 0-6 in.; 21998. n. Site 26, 0-6 in.; 24509. o. Site 26, 0-6 in.; 24270. p. Site 26, 0-6 in.; 24269. q. Site 26, 6-12 in.; 22087. r. Site 26, 6-12 in.; 24153. s. Hardness 3; site 26, 12-18 in.; 24188. t. Site 26, 12-18 in.; 24328. u. Hardness 4.5; site 26, 12-18 in.; 23074. v. Site 26, 18-24 in.; 24022. w. Site 26, 24-30 in.; 24486. x. Site 39, surface; 16681. y. Site 45, surface; 16702. z. Site 6, surface; 25971. aa. Site 6, 0-6 in.; 28588. ab. Site 49, surface; 16712. ac. Site 49, surface; 16724. ad. Site 49, surface; 16711. ae. Site 15, surface; 16594. af. Site 50, 0-6 in.; 30063. ag. Site 50, 6-12 in.; 30836. ah. Site 50, 42-48 in.; 30529. ai. Site 52, 0-6 in.; 31806. aj. Site 52, 0-6 in.; 31932. ak. Site 52, 6-12 in.; 31950. al. Hardness 3.5; site 51, 6-12 in.; 31730. ad is 54 mm. long, 31 mm. wide; all others to scale.

PLATE 16

Site 13 potsherds with incised designs. a-h. Surface; 19465, 19819, 19483, 19474, 19817, 19483, 19826, 19473. i-u. 0-6 in.; 19907, 20371, 20720, 20734, 20714, 20373, 20214, 20052, 20065, 20542, 20722 (perforated rim sherd), 20065, 19832. v-aa. 6-12 in.; 20268, 20766, 20901, 19946a, 20910, 20765. ab, ac. 12-18 in.; 19578, 20927. ad, ae. 18-24 in.; 20945, 20806. af-aj. 24-30 in.; 20975, 20974, 20817, 19695, 19697. q is 42 mm. long, 30 mm. wide; all others to scale. Hardness: b, 2; d, 2.5; g, 2.5; k, 2; r, 2.5; ai, 2.5.

PLATE 17

Miscellaneous potsherds. a-d. Drilled potsherds, possibly for mending: a. Site 13, surface; 19479. b. Site 13, 0-6 in.; 20876. c. Site 13, 6-12 in.; 20768. d. Site 26, 6-12 in.; 24296. e-g. Beveled, disk-shaped potsherds, use unknown: e. Site 13, 0-6 in.; 20229. f. Site 13, 18-24 in.; 20804. g. Site 13, 6-12 in.; 20594. h-l. Base fragments of flat-bottomed vessels: h. Site 13, talus slope; 19819. i. Site 13, 0-6 in.; 20060. j. Site 13, 0-6 in.; 19833. k. Site 13, 6-12 in.; 20757. l. Site 13, 12-18 in.; 20624. m-q. Fragments of vessels with gambreled shoulders: m. Site 48, surface, 19285. n. Site 13, 0-6 in.; 20377. o. Site 13, 6-12 in.; 19950. p. Site 13, 6-12 in.; 20585. q. Site 13, 18-24 in.; 20650. r, s. Potsherds, with organic matter as tempering material: site 26, 6-12 in.; 22009 (2 specs.) t. Potsherd with sherd tempering material; site 26, 12-18 in., 24689. u, v. Potsherds showing use of coiling technique in construction of vessel wall: u. Site 16, surface; 16618. v. Site 17, surface; 16622. w-z. Potsherds with holes for suspension: w. Outside of vessel; site 26, 6-12 in.; 24845. x. Inside of vessel; site 17, surface; 16624. y. Inside of vessel; site 26, 6-12 in.; 22187. z. Outside of vessel; site 52, surface; 31765. w is 90 mm. long, 68 mm. wide; all others to scale.

PLATE 18

Pottery handles. a. Oval type, with a deep longitudinal groove on the convex face; width, 4 cm.; thickness, 2.9 cm.; site 26, 18 in.; 24991. b. Flat type; width, 3.6 cm.; thickness, 1.1 cm.; site 14, 18-24 in.; 21176. c. Circular type, with a punctate design; diam., 1.7 cm.; site 6, 30-36 in.; 26792. d. Circular type, with a portion of deeply incised pattern; diam., 3.2 cm.; site 19, 6-12 in.; 17392. e. Circular type; diam., 3.3 cm.; site x, surface; 24994. f. Flat type; width, 4.1 cm.; thickness, 2.3 cm.; site 20, 36-42 in.; 18624. g. Oval type; width, 4.1 cm.; thickness, 3.2 cm.; site x, surface; 24993. h. Oval type, showing successive applications of clay in manufacture; width, 4.2 cm.; thickness, 3.9 cm.; site 31, surface; 16649a. i. Oval type; width, 4.9 cm.; thickness, 3.9 cm.; site 20, 18-24 in.; 18907.

PLATE 19

Pottery vessels. a. Undecorated bowl; max. outside diam., 165 mm.; diam. of orifice, 98 mm.; inside depth, 94 mm.; site 47, surface; 24962. b. Broken, undecorated bowl; max. outside diam., 215 mm.; diam. of orifice, 125 mm.; inside depth, 135 mm.; hardness 2.5; site 47, surface; 24963.

PLATE 20

Solomon Islands and New Caledonian specimens. a. Solomon Islands dance stick hung with spire-lopped Oliva funebralis; gift of Mrs. Phoebe A. Hearst; 403. b. Scraper of Gafrarium tumidum shell; site 26, 6-12 in.; 24141. c. Bar of Meleagrina shell, partly drilled; site 26, 0-6 in.; 22278. d. Ethnological shell money comprising woven holder with attached Meleagrina ornaments and Conus eburneus beads; from Houailou; gift of Mr. and Mrs. John S. Hampel; 2846. e. Clay pipe bowl; site 44, 0-6 in.; 25703. f. Clay pipe stem, labeled Glasgow and Murray; site 44, 6-12 in.; 25209. g. Clay pipe stem, labeled McDougall and Glasgow; site 44, 6-12 in.; 25868. h. Clay pipe bowl; site 44, 0-6 in.; 25191. i. Cut and ground fragment of Tridacna shell; site 26, 36-42 in.; 22619. j. Blue glass bead; site 44, 0-6 in.; 25190. k. Keeled green glass bead; site 44, 0-6 in.; 25949. l. Green glass bead; site 26, 6-12 in.; 23178. m. Hexagonal blue glass bead; site 26, 6-12 in.; 22830. n. Grooved fragment of Conus (?); site 14, 24-30 in.; 21190; length of fragment 64 mm., all other specimens to same scale.

PLATE 21

Thin sections of potsherds magnified 13.5 diameters.

PLATE 22

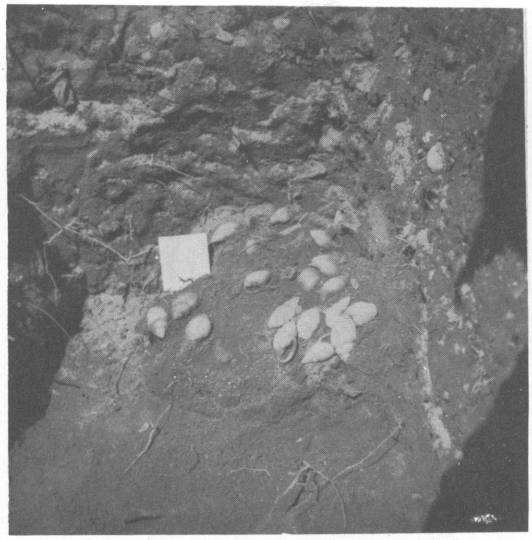
Site 13 potsherds with incised designs. a, b. 0-6 in.; 20713a, 20215. c. 18-24 in.; 20652. d, e. 0-6 in.; 20870a, 20535. f. 6-12 in.; 20410. g, h. 0-6 in.; 20713b, 20538. i. 12-18 in.; 21059. j. 0-6 in.; 20720. k. 12-18 in.; 20613. l. 42-48 in.; 19804. m. 0-6 in.; 20533. n. 12-18 in.; 20920. o. Talus; 19485. p. 12-18 in.; 19971. q. 24-30 in.; 20664. r, s. 0-6 in.; 20870b, 20870c. t. 24-30 in.; 20817. u. 0-6 in.; 20713c. v. 6-12 in.; 19945. w. 0-6 in.; 20213a. x. 6-12 in.; 20581. y. 0-6 in.; 20213b. z. Talus; 19464. aa. 18-24 in.; 20799. ab, ac. 0-6 in.; 20368, 20214. ad. 18-24 in.; 20940. ae. 24-30 in.; 20970. af. 6-12 in.; 20901. ag. 0-6 in.; 20863. ah. Lug sherd; 6-12 in.; 20753. ai, aj. 18-24 in.; 20798, 20938. ak. Concave neck sherd; 12-18 in.; 20627. al. 0-6 in.; 20866.

PLATE 23

Site 13 incised potsherds. a. 24-30 in.; 19682. b. 6-12 in.; 20756a. c, d. 0-6 in.; 20713a, 20716. e. 6-12 in.; 19944. f, g. 0-6 in.; 20867, 20733. h. Talus; 19484. i, j. 0-6 in.; 20368, 20863a. k. 24-30 in.; 20968. l. 0-6 in.; 20863b. m. 12-18 in.; 20920a. n. 0-6 in.; 20730. o. 6-12 in.; 20754. p-r. 0-6 in.; 20052a, 20538, 20052b. s. 18-24 in.; 20940. t. Talus; 19816. u-w. 0-6 in.; 20533a, 20864a, 20215. x. 6-12 in.; 19951. y, z. 0-6 in.; 20864b, 20533b. aa, ab. 6-12 in.; 20756b, 20586. ac-af. 0-6 in.; 20368, 20713b, 20213, 20533c. ag. 6-12 in.; 19943. ah. Vessel bottom; 0-6 in.; 20561. ai. Bottle-neck sherd; 24-30 in.; 20972. aj. 30-36 in.; 20991. ak. 0-6 in.; 20533d. al. Talus; 19811. am. 12-18 in.; 20920b. an. 0-6 in.; 20533e.

a

b

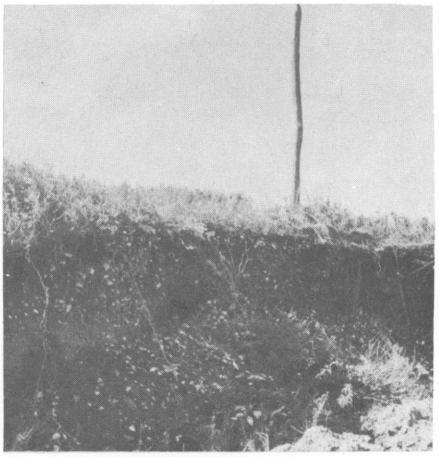


c

d

Plate 1. Excavations at sites 19, 20, and 48

a



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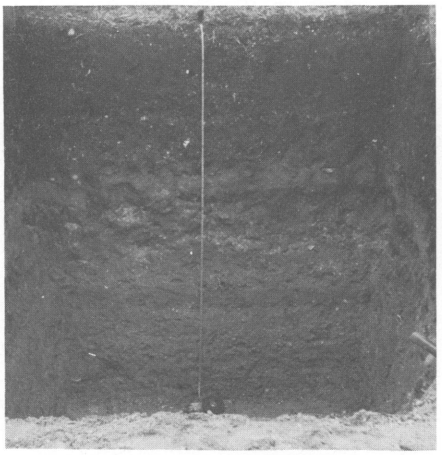

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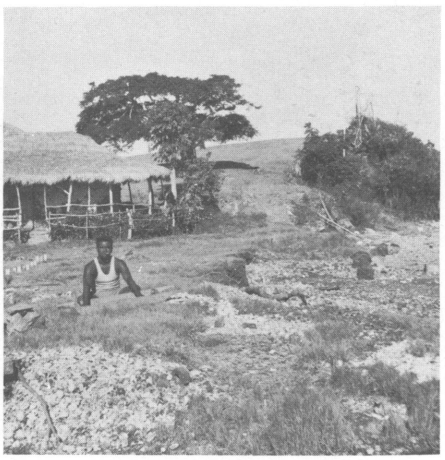

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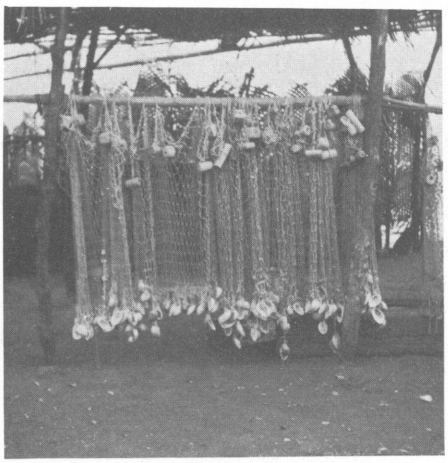
Plate 2. Excavations at sites 13, 14, and 26



a

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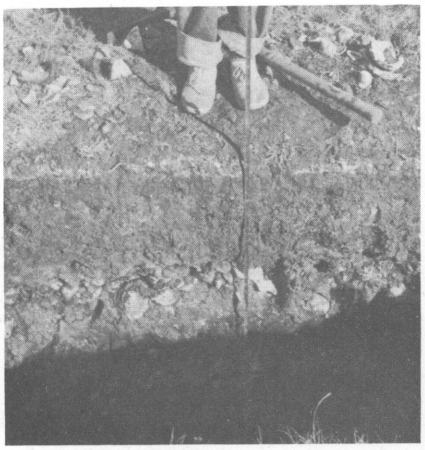

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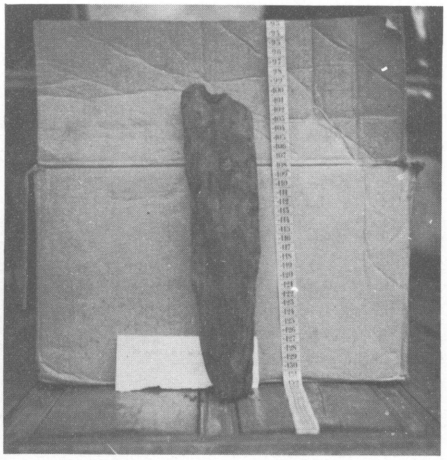
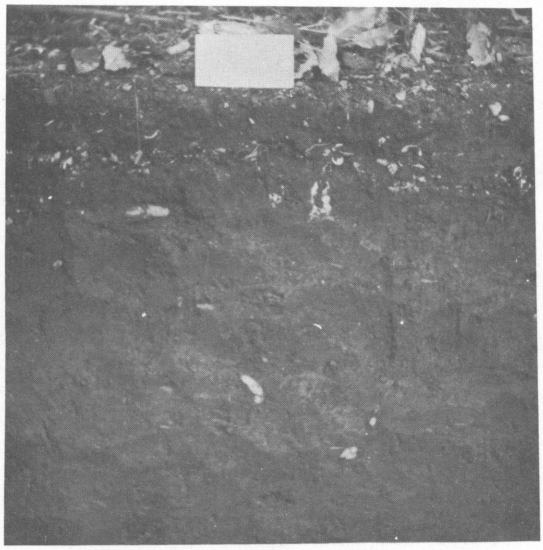


d

e

f

Plate 3. Excavations at Oundjo, site 26, and specimens



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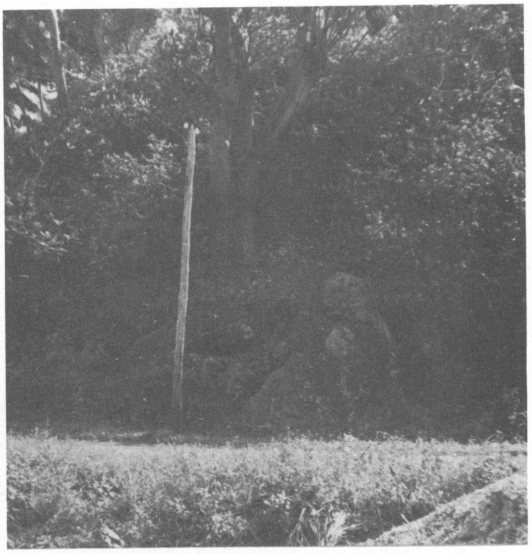

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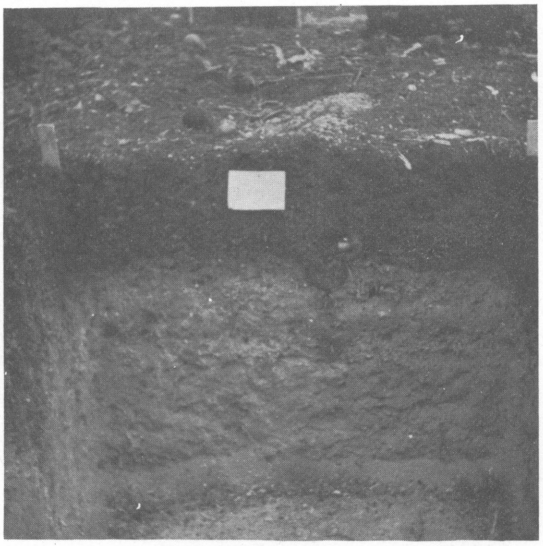
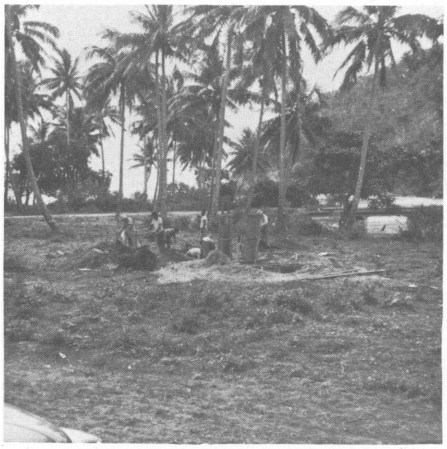


c

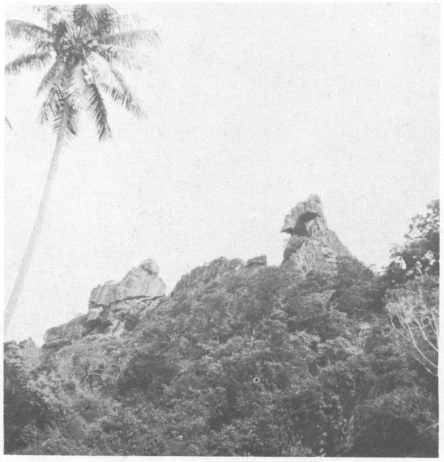
d

Plate 4. Excavations at sites 6 and 44



a

b



c

d

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f

Plate 5. Views of sites 32, 50, 51, 52, and excavations

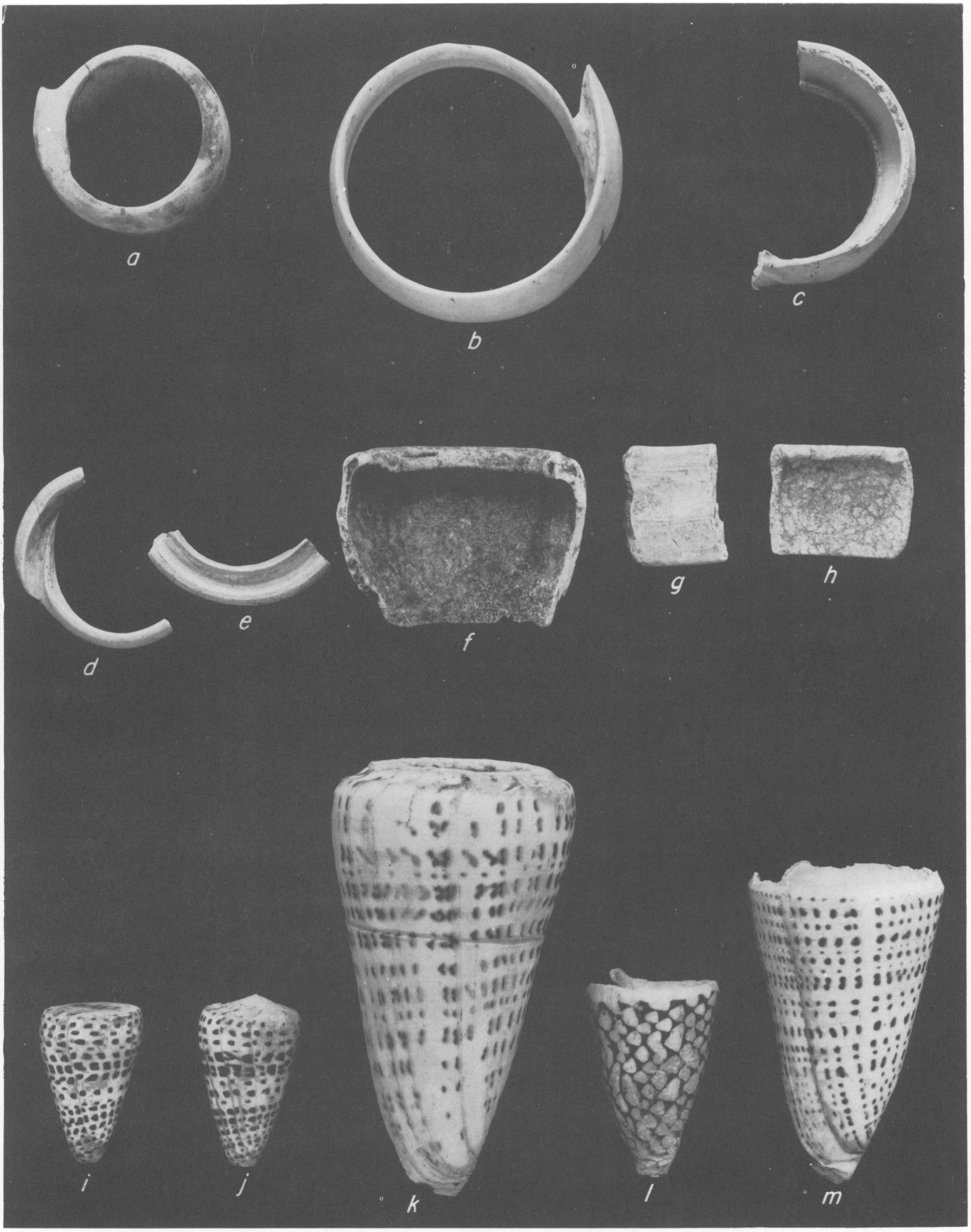


Plate 6. Conus shell artifacts

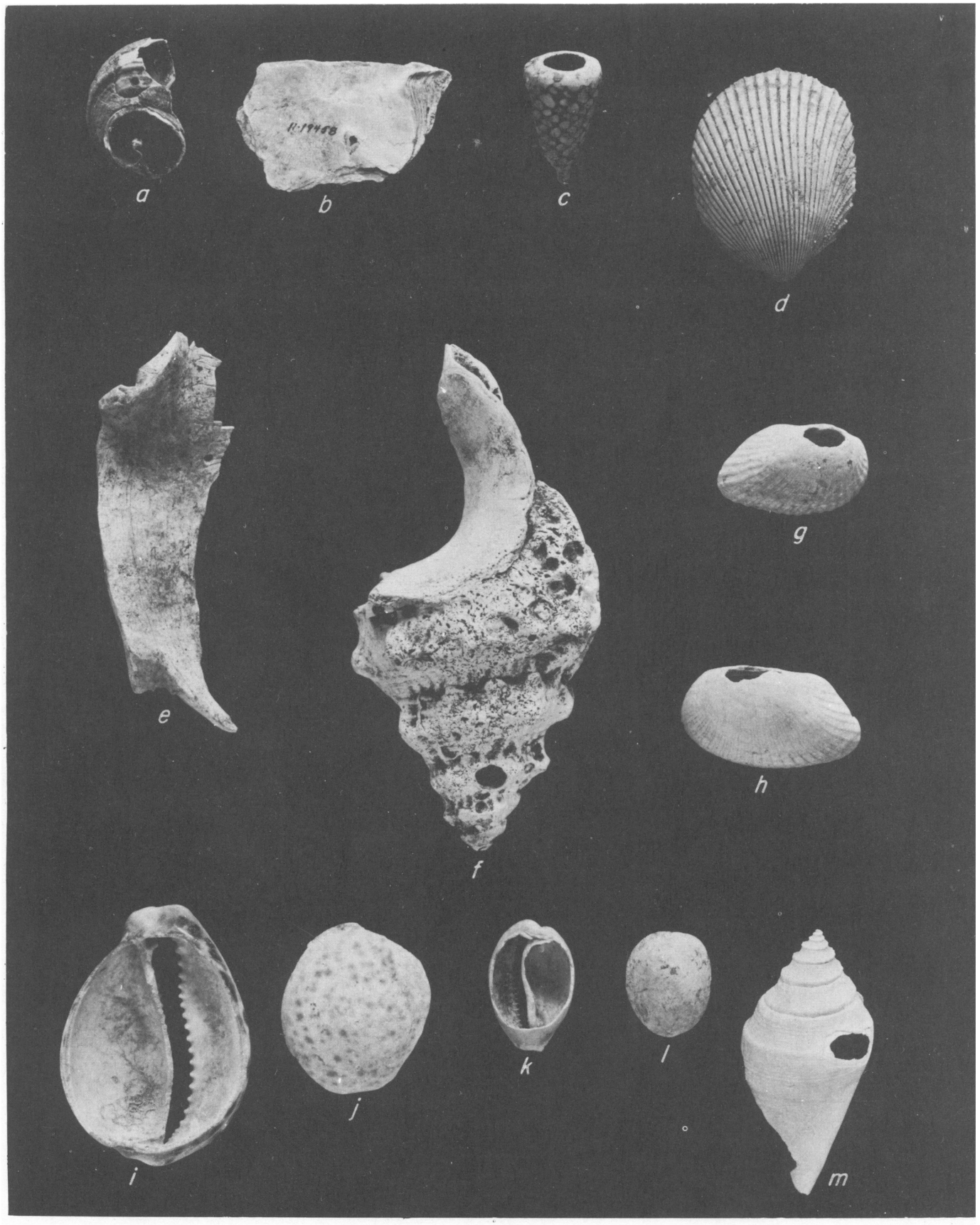


Plate 7. Shell artifacts

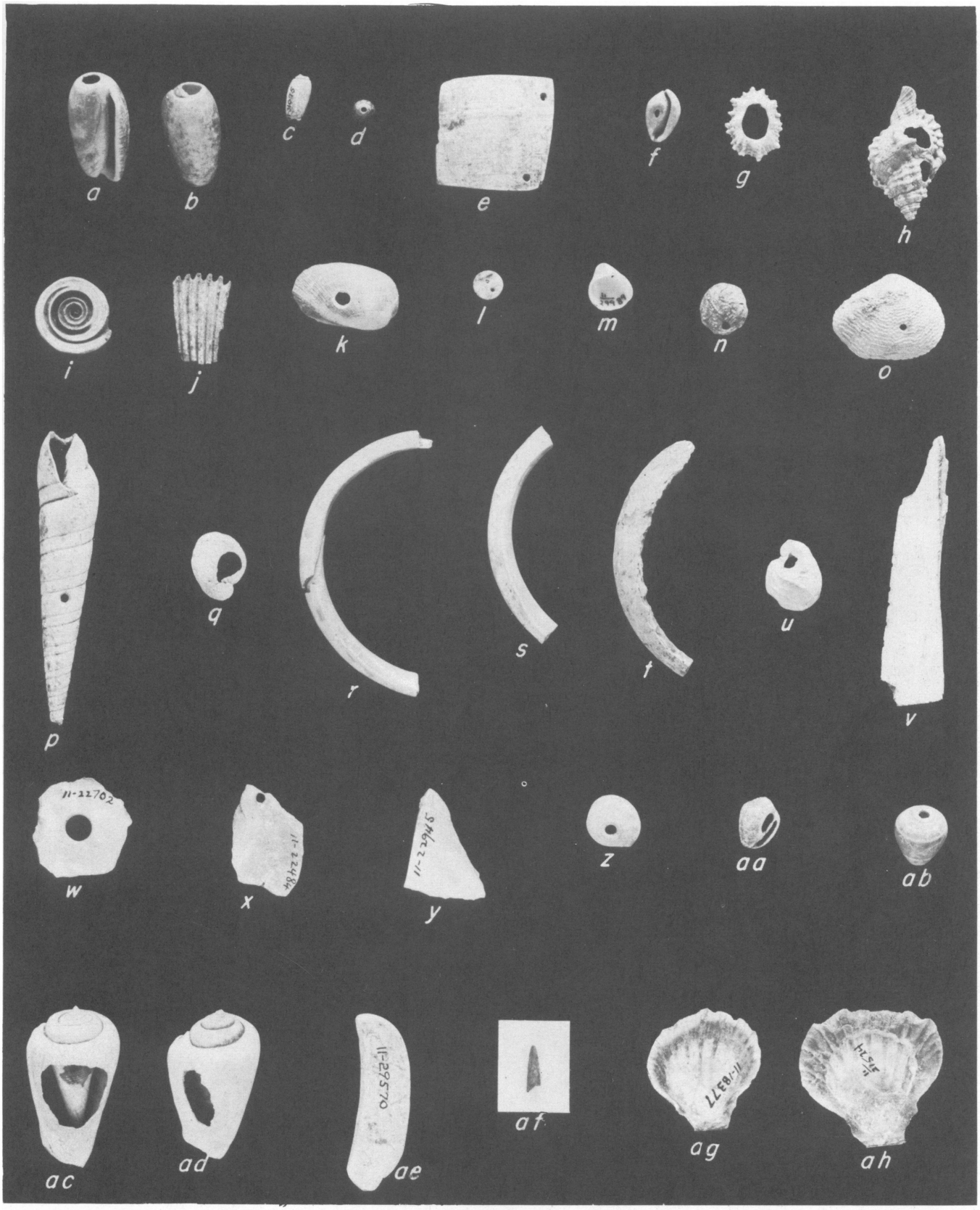


Plate 8. Shell artifacts

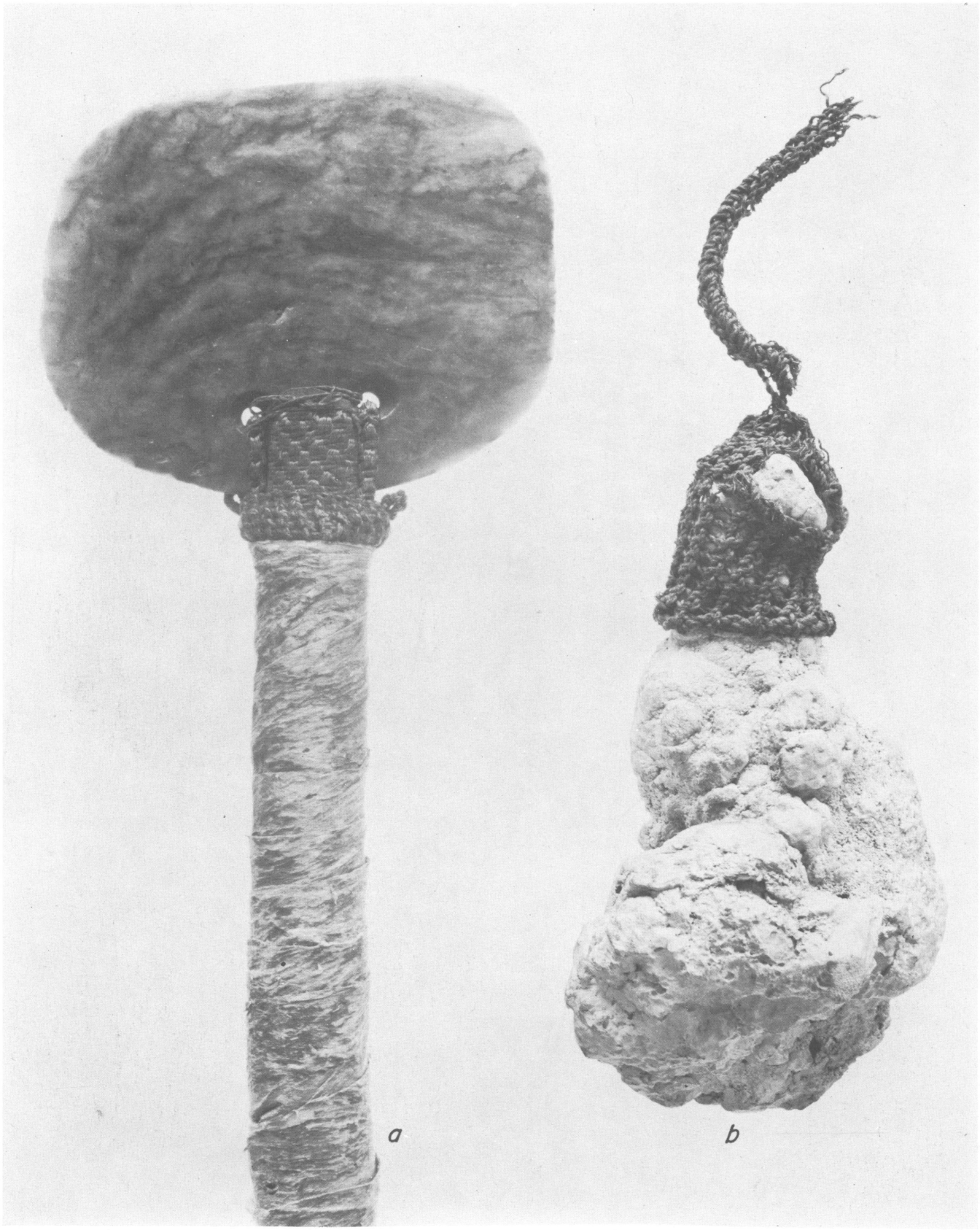


Plate 9. Ethnological specimens

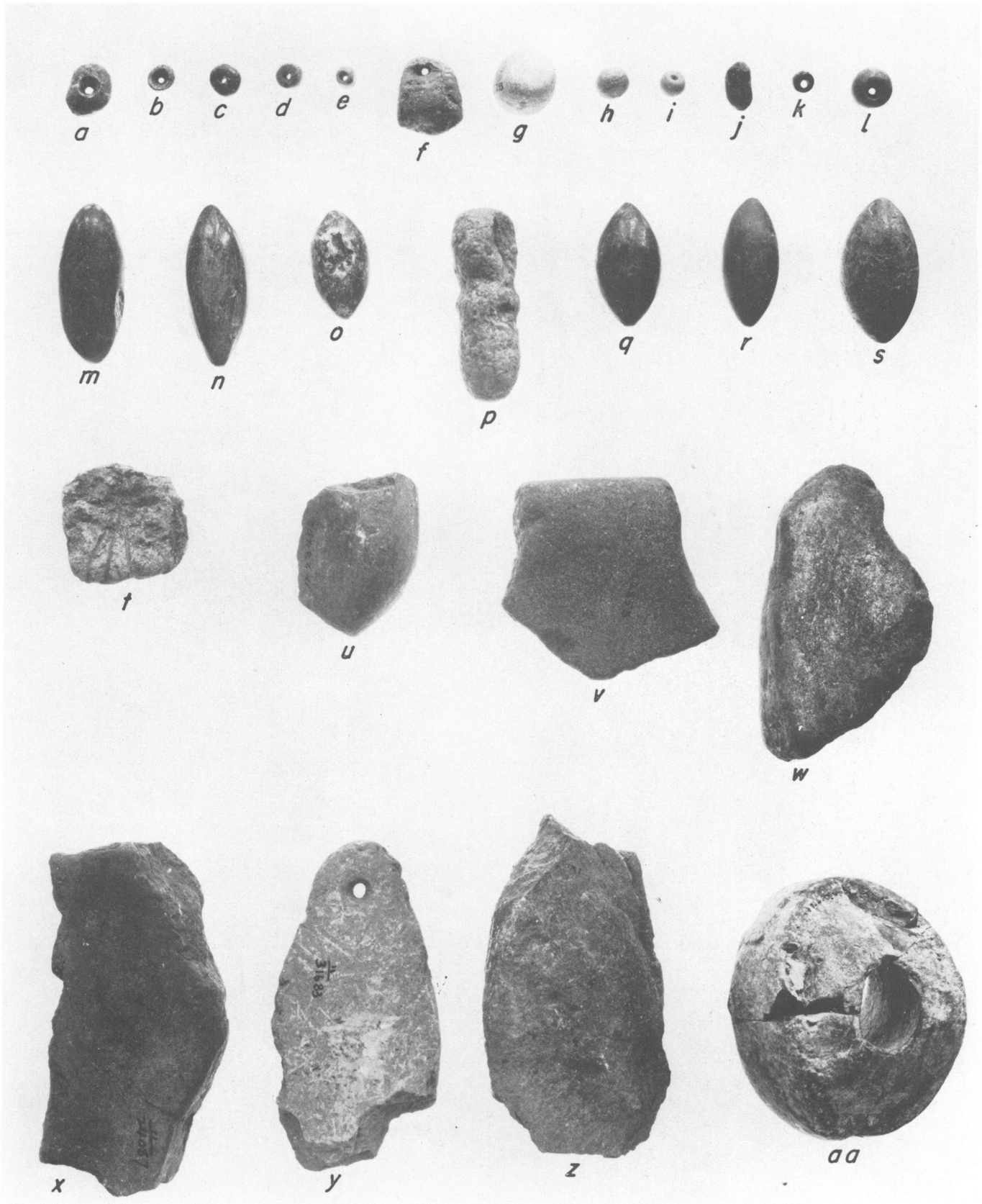


Plate 10, Miscellaneous ground artifacts

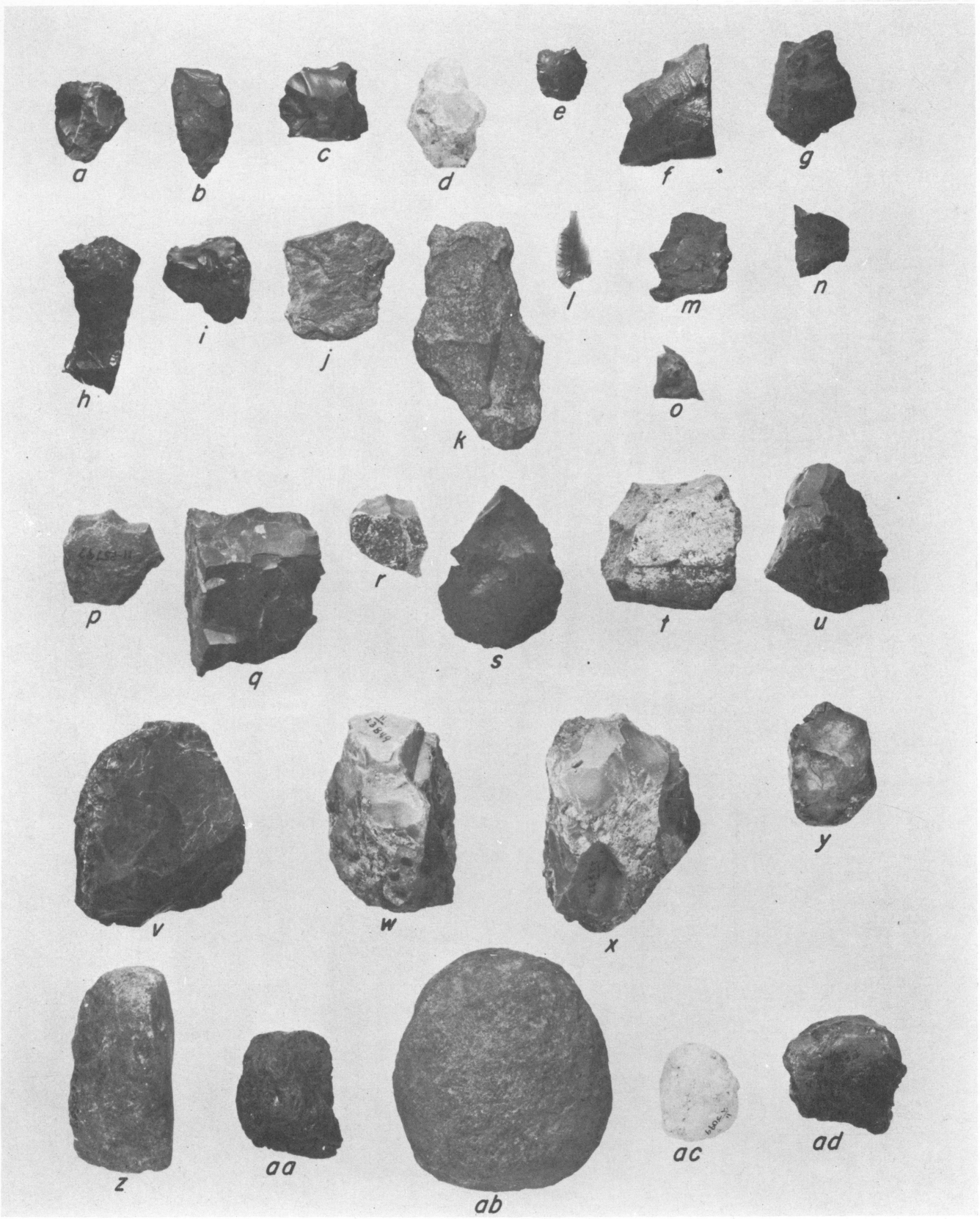


Plate 11. Chipped stone tools

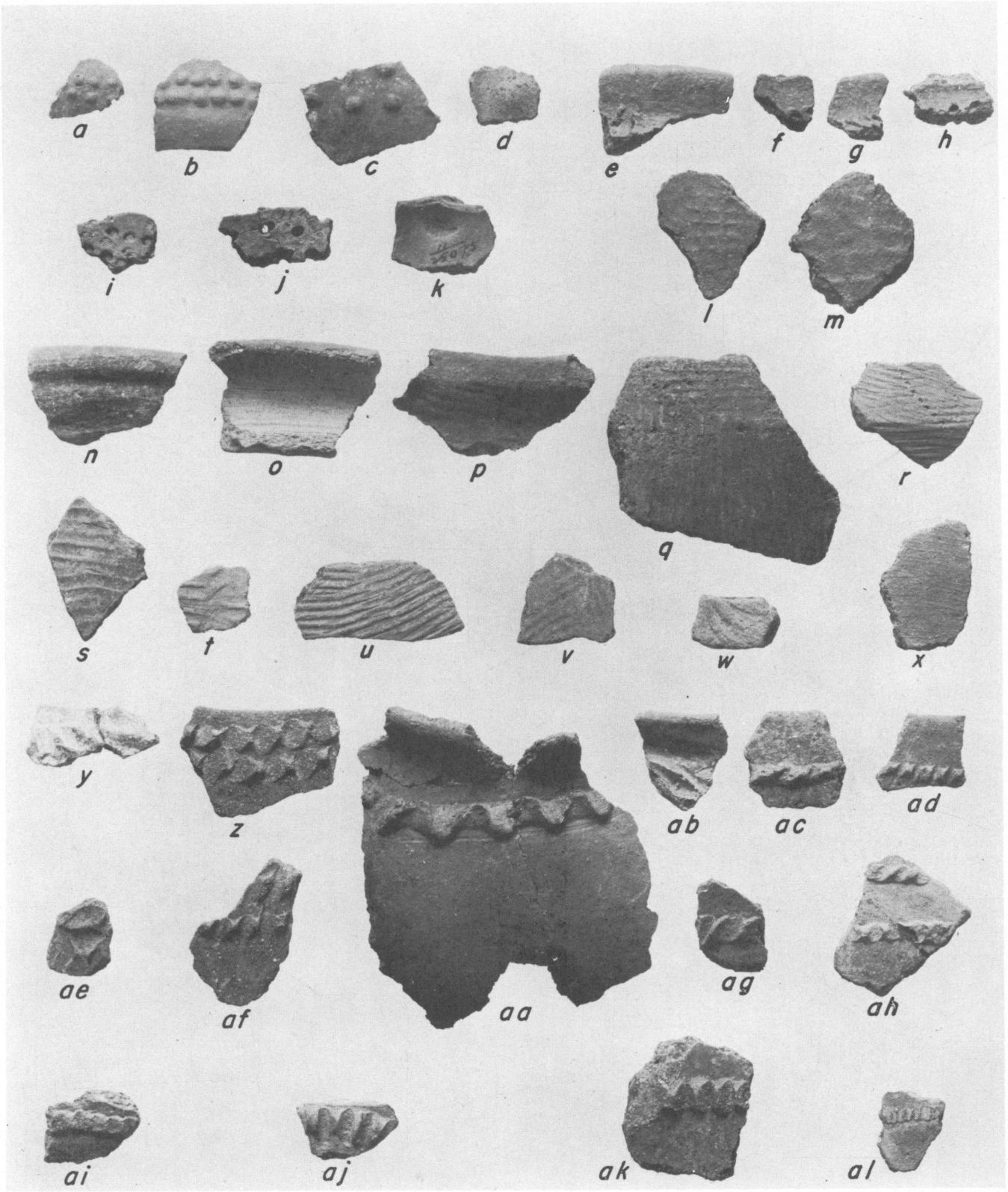


Plate 12. Relief-decorated potsherds

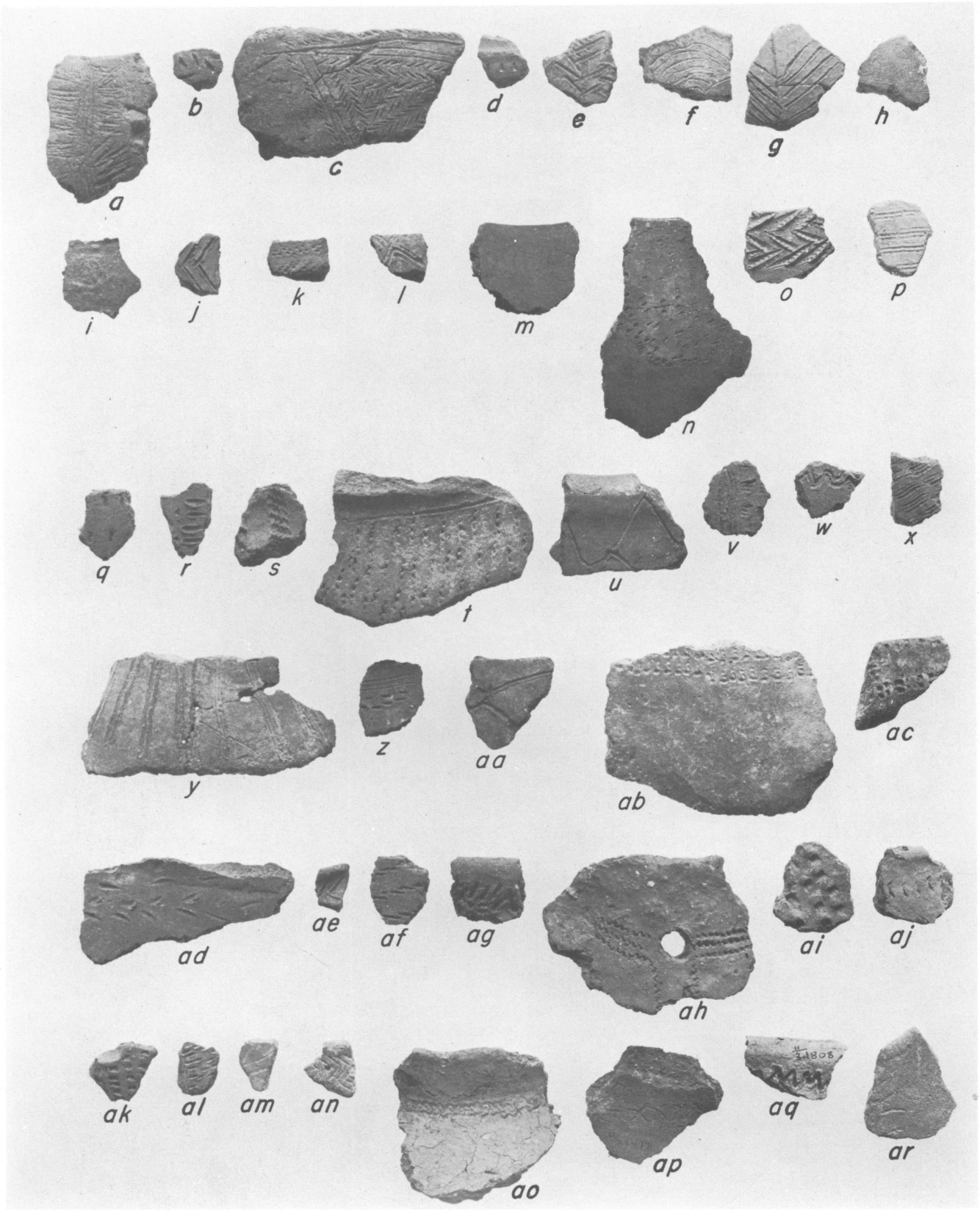


Plate 13. Potsherds with incised designs; single specimens

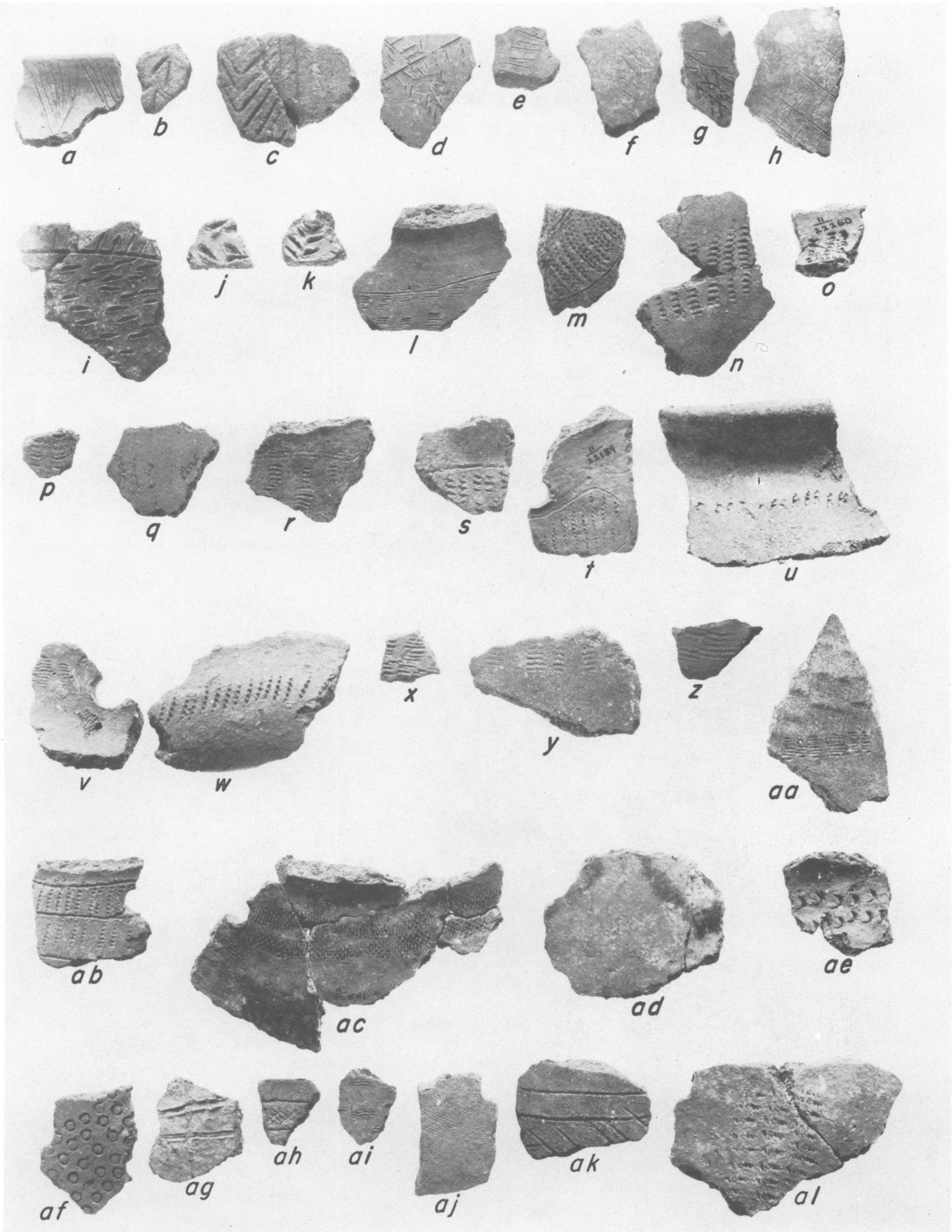


Plate 14. Potsherds with incised designs found only at one site

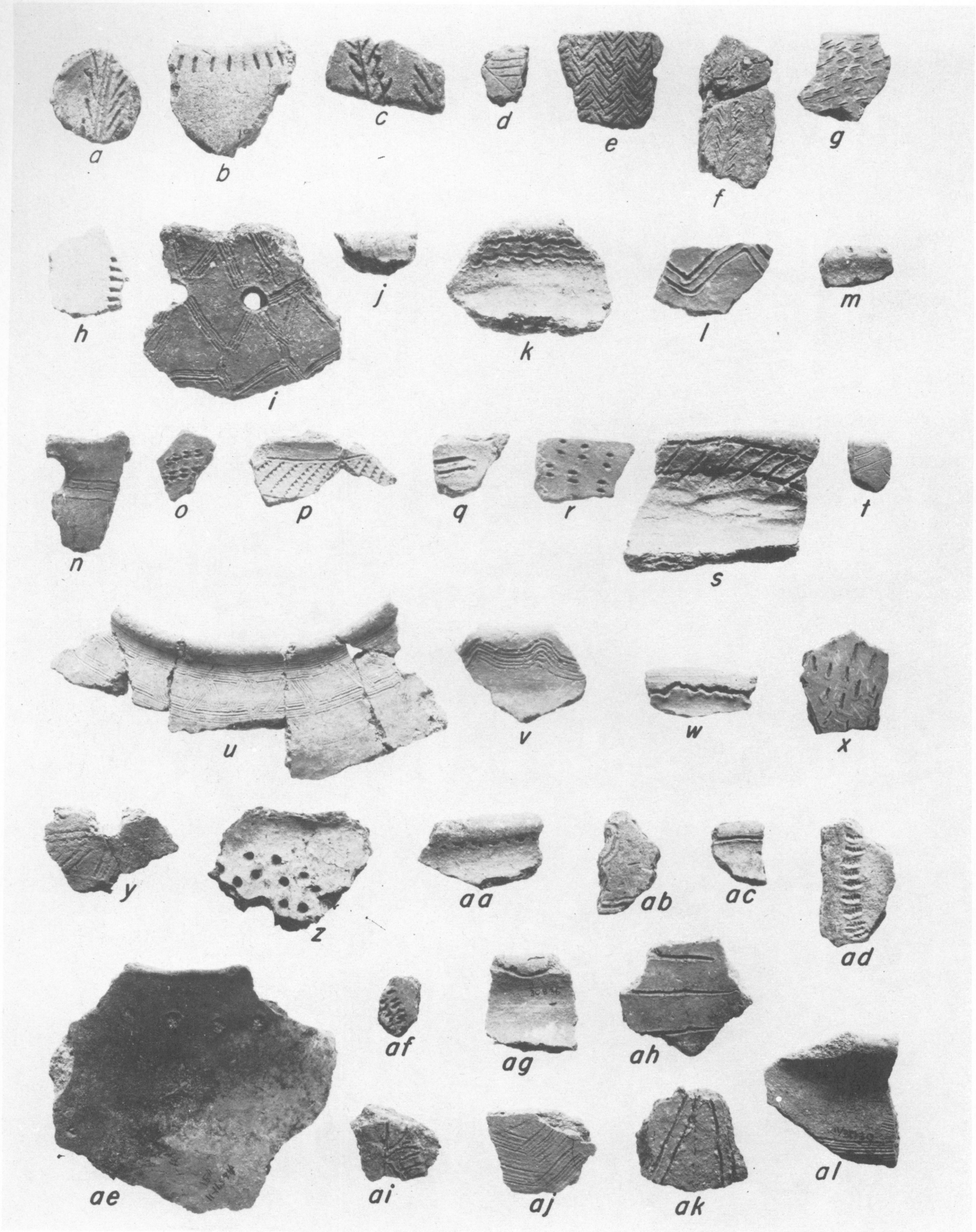


Plate 15. Potsherds with incised designs from various sites

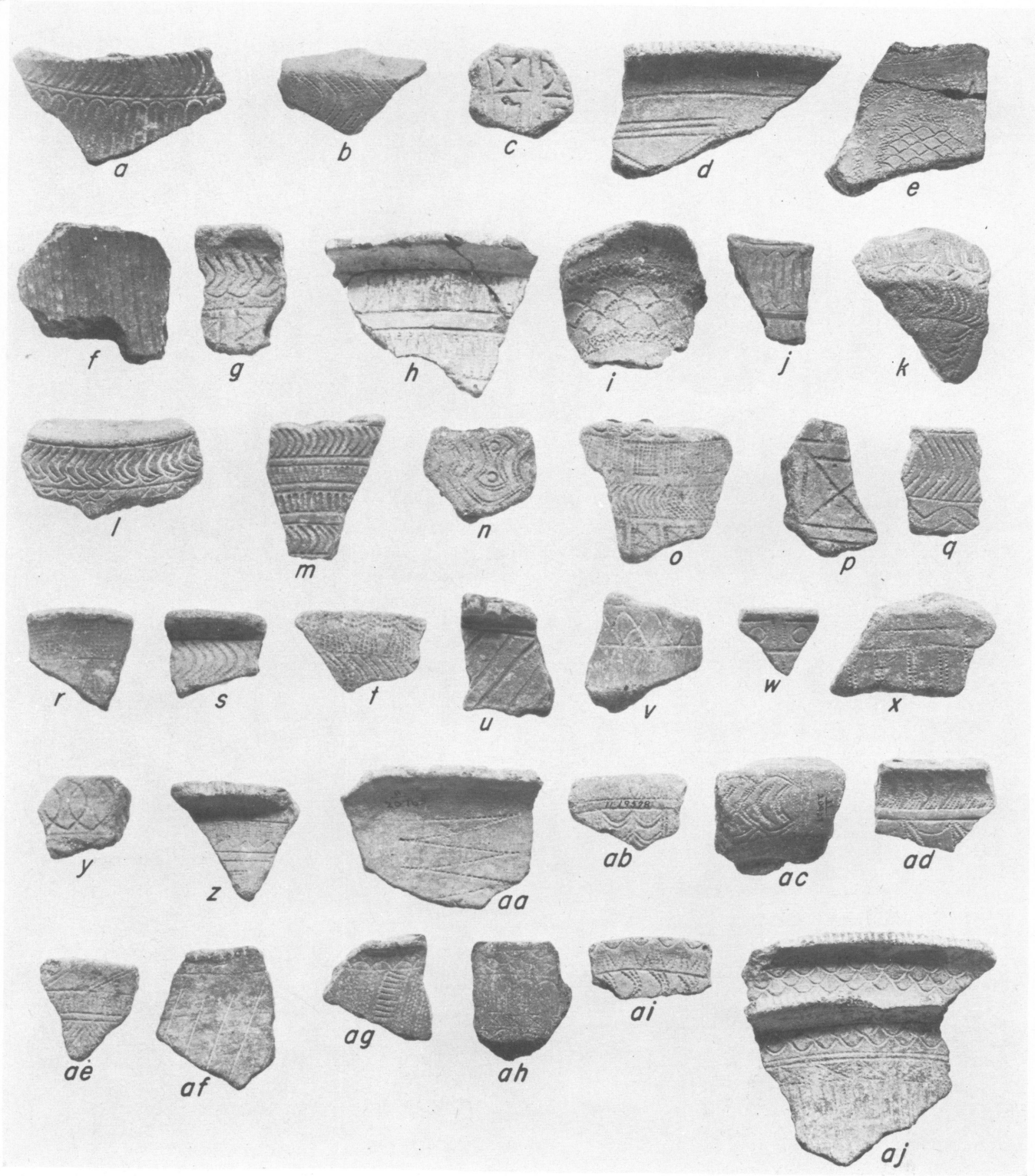


Plate 16. Potsherds with incised designs from site 13

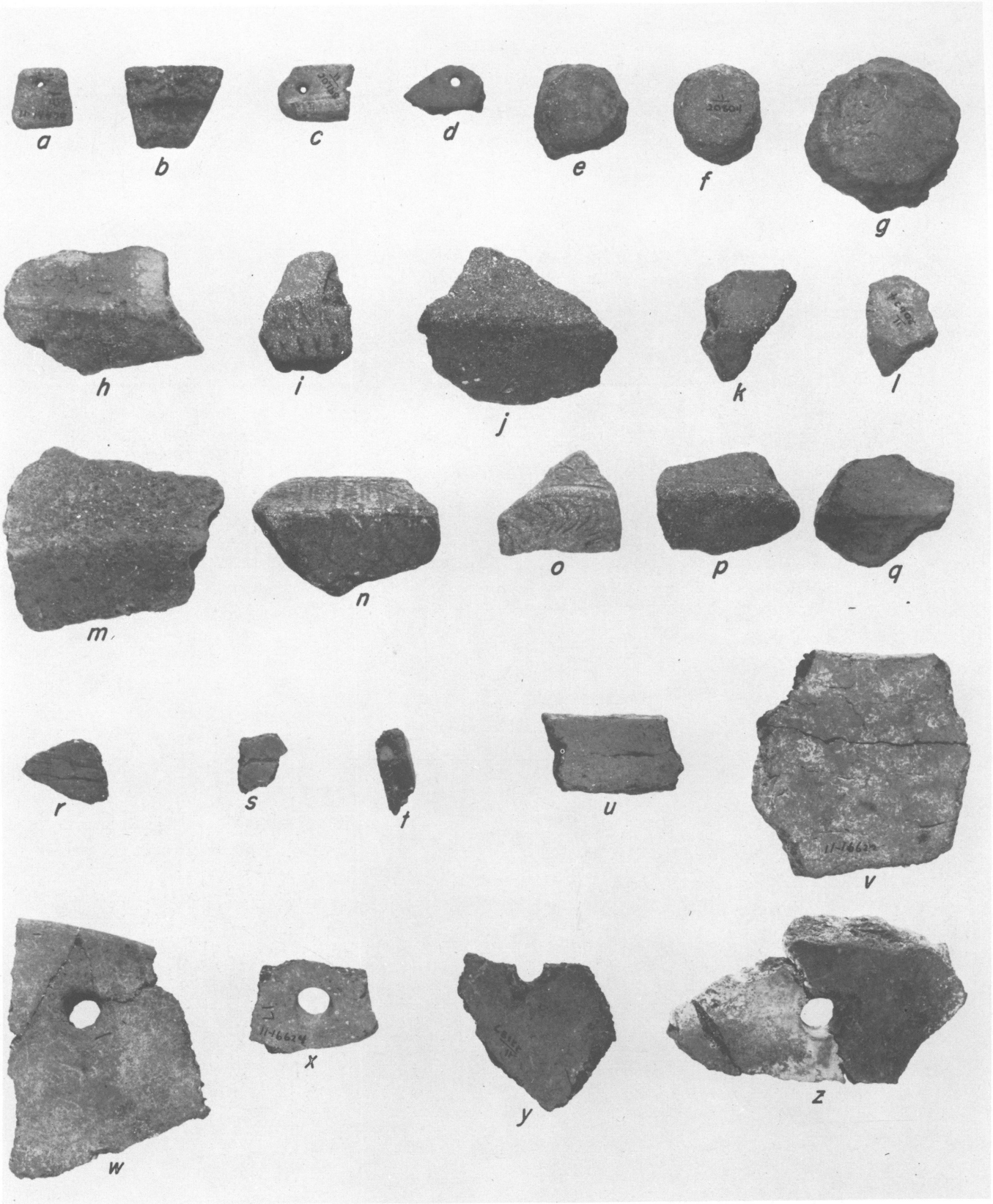


Plate 17. Miscellaneous potsherds

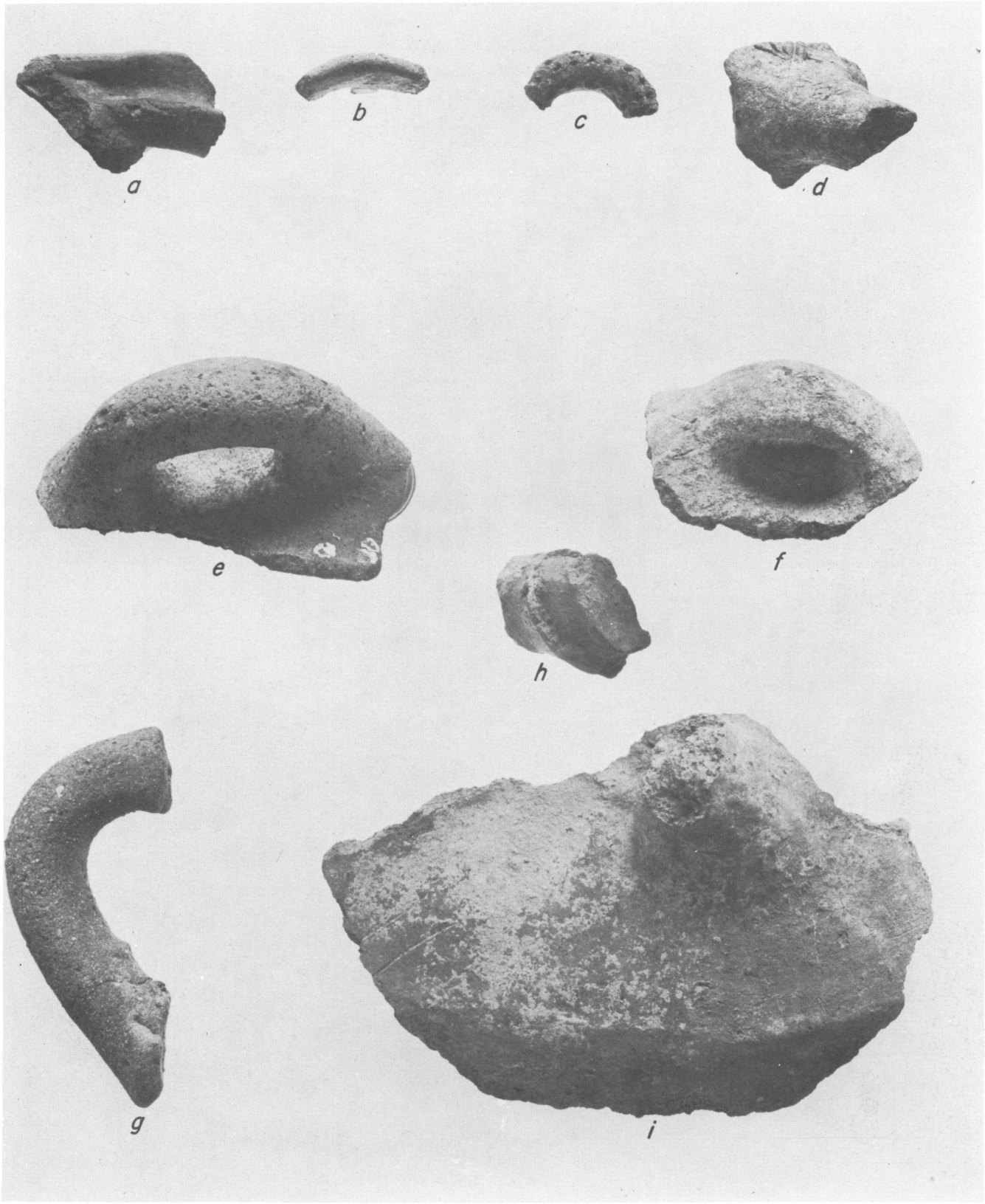
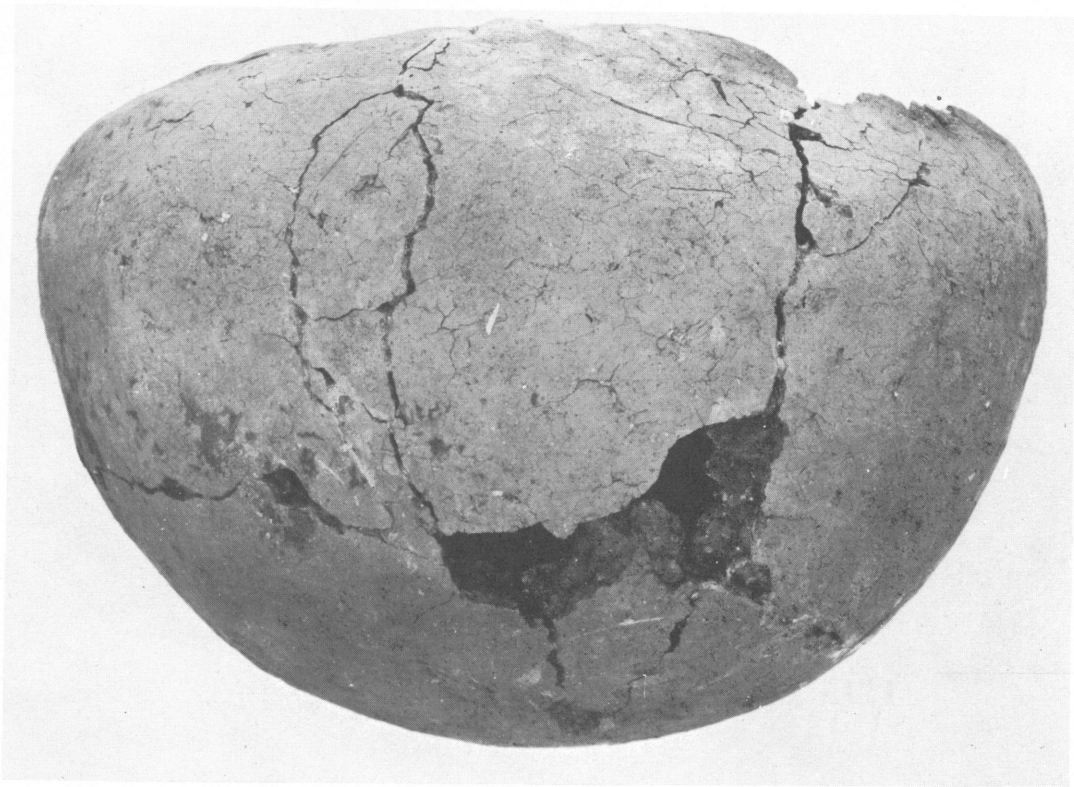


Plate 18. Pottery handles

a



b

Plate 19. Pottery vessels

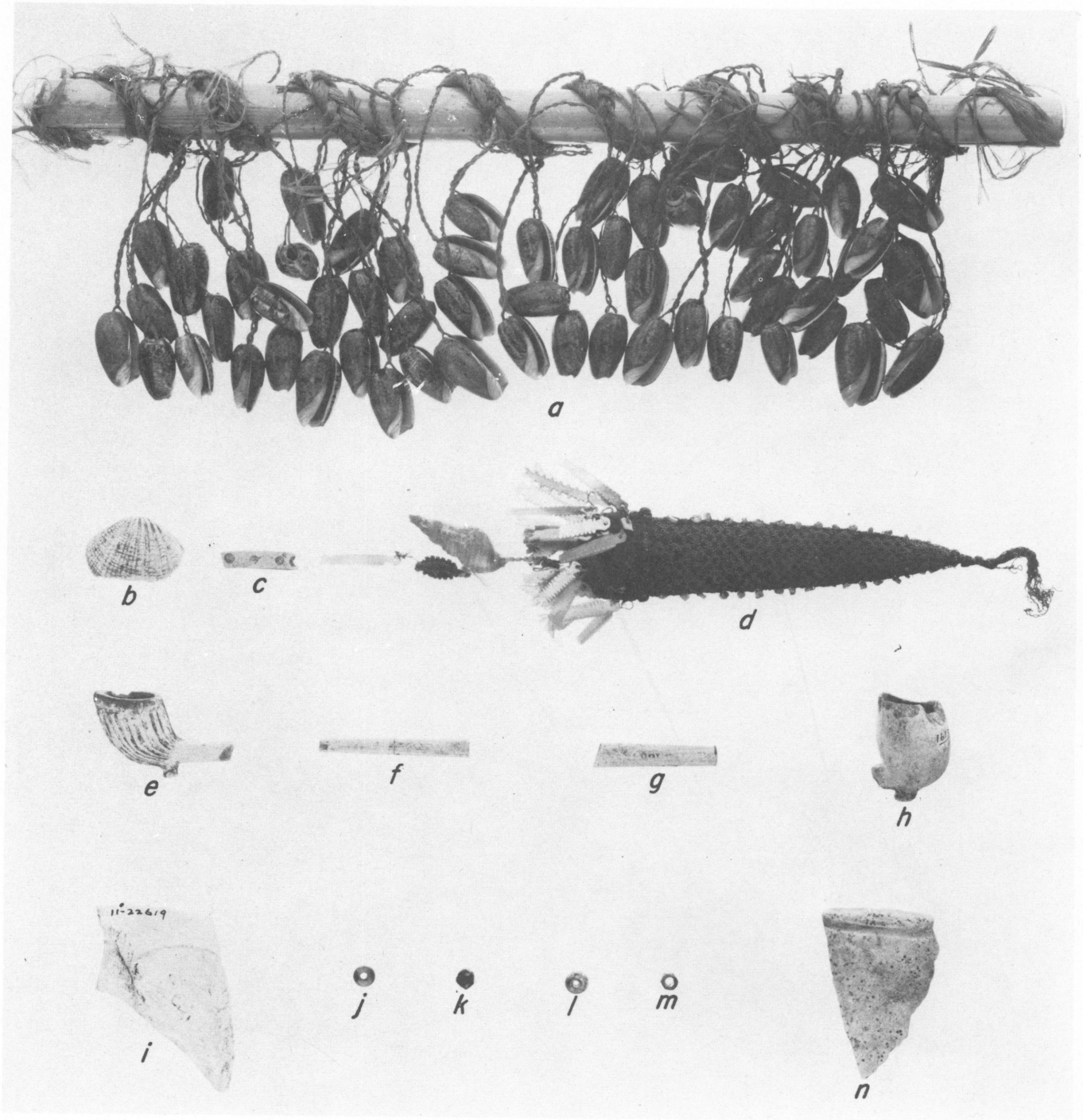
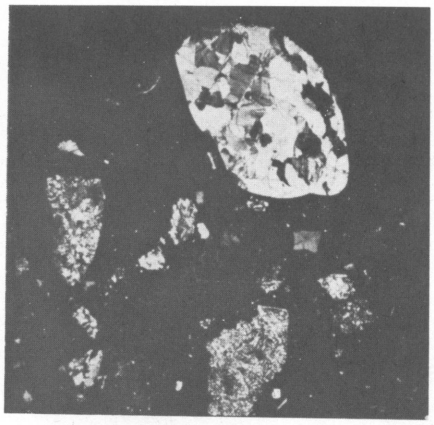
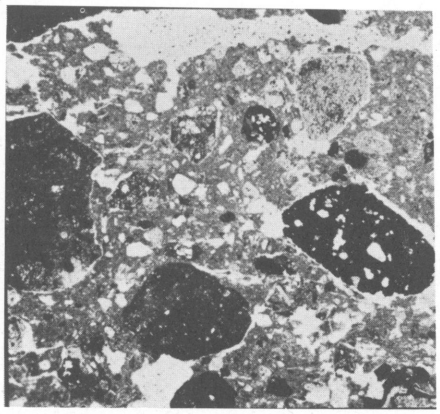


Plate 20. Artifacts from Solomon Islands and New Caledonia



a

b



c

d

Plate 21. Thin sections of potsherds

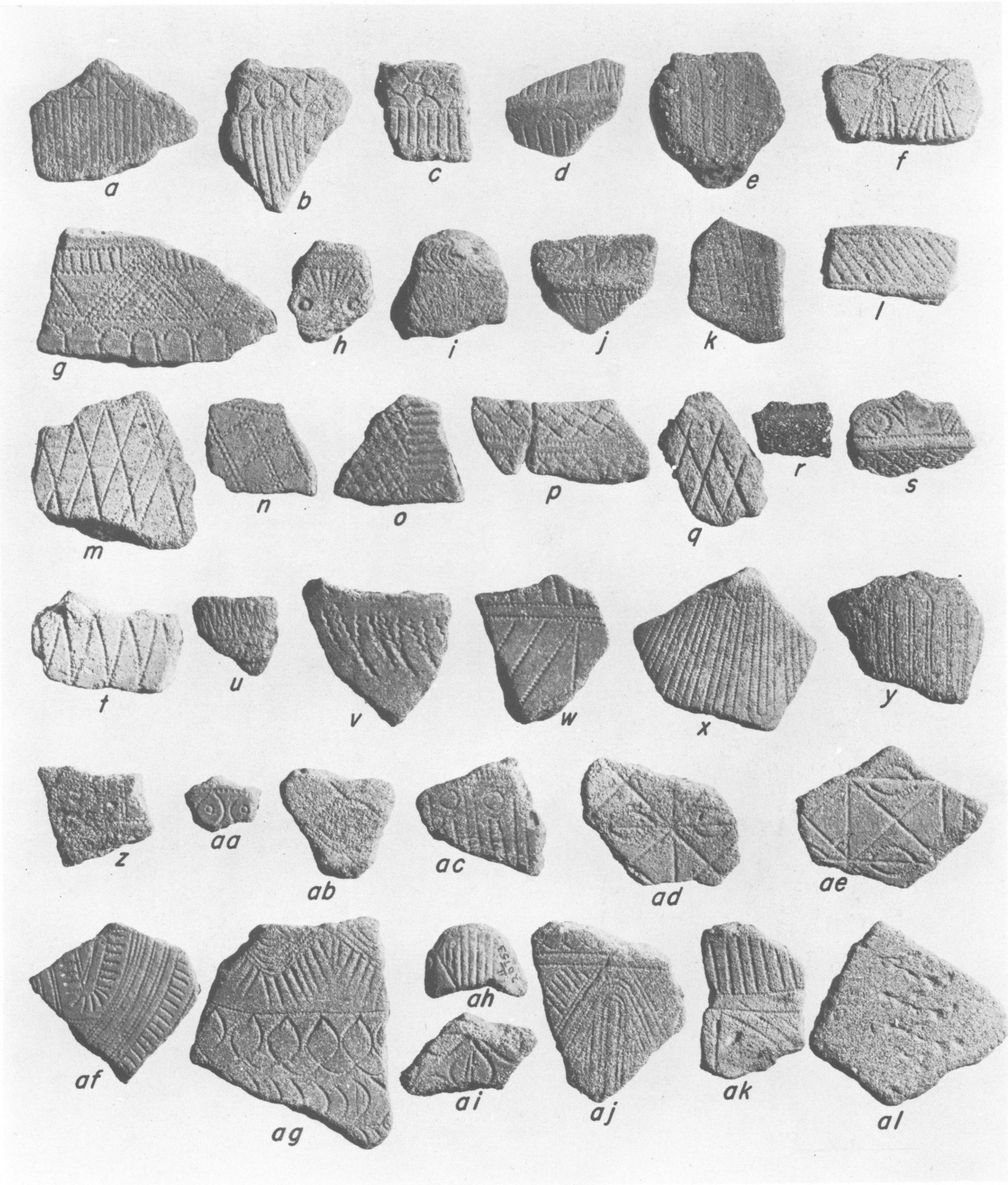


Plate 22. Potsherds with incised designs from site 13

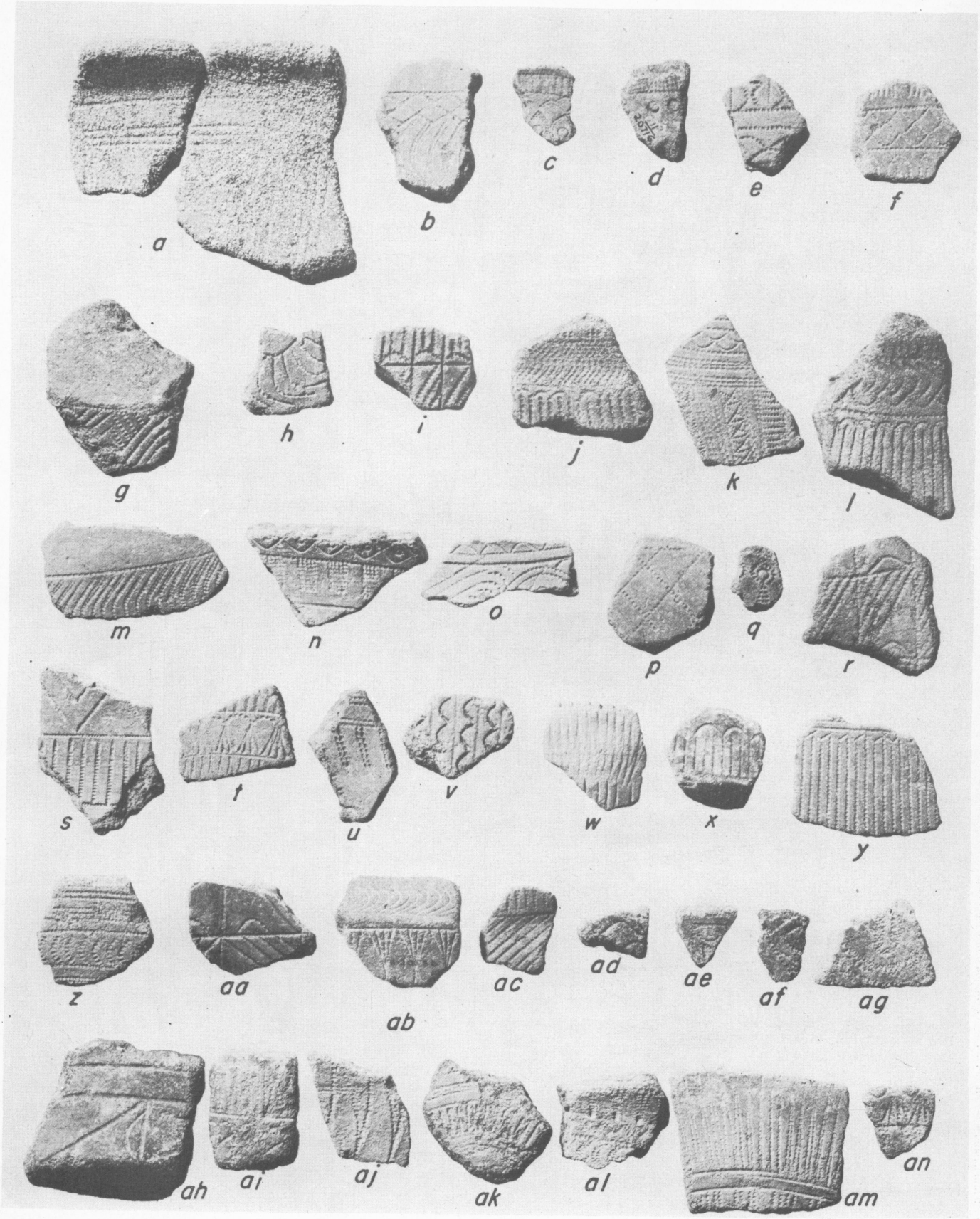


Plate 23. Potsherds with incised designs from site 13