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This Bulletin is issued monthly for the purpose of giving information to those interested in the natural history and scientific features of the Grand Canyon National Park. Additional copies of these bulletins may be obtained free of charge by those who can make use of them, by addressing the Superintendent, Grand Canyon National Park, Grand Canyon, Arizona.

M. R. Tillotson, Superintendent Edwin D. McKee, Park Naturalist

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GREENLAND LAKE

By Edwin D. McKee, Park Naturalist.

ON THE North Rim of Grand Canyon and in the adjoining Kaibab Forest, permanent water bodies are conspicuous by their absence. Especially noticeable, therefore, is the small basin, which contains water during a considerable part of the year, located near the road between Point Imperial and Cape Royal. It has been named Greenland Lake.

During the latter part of the past summer, Dr. Russell Gibson of the U. S. Geological Survey and I visited Greenland Lake for the purpose of determining its nature and origin. Knowledge on these two points seemed to be especially desirable since the pond appears to have neither an inlet nor an outlet and so is an object of considerable curiosity to visitors. Fortunately at the season of our visit it was dry, so a detailed examination of its bottom -- everywhere a thick layer of fine mud -- was possible.

It was not difficult to determine that the bowl shape of the depression containing Greenland Lake was similar to a feature common over the plateau surface throughout this region -- wherever the Kaibab limestone forms its cover. This type of depression is known as a "sink hole" and is formed by the dissolving and carrying away of limestone in a particular place by rain and snow water. In the case of Greenland Lake, the sink hole differs from many others nearby in that its bottom or underground outlet has been clogged up with fine silt and other sediment so that it retains water at all times except when evaporation during the dry season leaves it empty. In this respect it is by no means unique on the Kaibab plateau but it is one of the best and most accessible examples of its type.

There is considerable evidence to show that the Kaibab limestone, like many other limestones, is literally "honey-combed" throughout much of its extent with a system of caves and underground water-passages. These drainage channels seem to follow, in general, joints and lines of fracture, and to flow to the southwest with the dip of the stratum. They explain the occurrence of many springs feeding perennial streams on the north side of Grand Canyon, and they are partially accountable for the negligible surface flow on both rims.

The sink hole forming the basin of Greenland Lake was probably at one time an entrance to this great system of underground water courses but it is now cut off and isolated by an impervious layer of sediment to form one of the prettiest places on the Kaibab Plateau.

The HERBARIUM of GRAND CANYON NATIONAL PARK

By Clyde C. Searl, Ranger Naturalist

THE GRAND CANYON region, mainly because of the fact that it embraces life zones from the Lower Sonoran through the Canadian, is extremely rich in flora of many types. Through efforts of the educational force of the National Park Service, an herbarium of all typical plants in the Grand Canyon National Park and surrounding region has been in process of growth for several years. All plants represented in the herbarium have been determined or checked as to name by the National Museum.

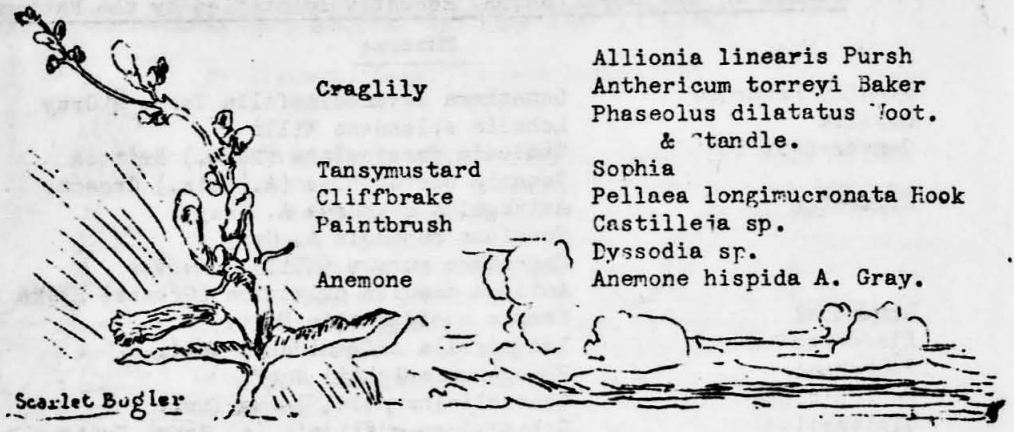
Building up this herbarium will require years of effort since the size of the area it represents constitutes an almost endless field for collection and study. Already however, practically all the more common plants have been gathered and mounted; others are being added continually.

Recently six new families were added to the herbarium. They are Salicaceae or Willow Family - genus Salix; Lobeliaceae or Lobelia Family - genus Lobelia; Orobanchaceae or Broomrape Family - genus Thalesia; Nyctaginaceae or Four-o'clock Family - genus Allionia and Quamoclidion; Crassulaceae or Stonecrop Family - genus Sedum; and Fumariaceae, or Fumitory Family - genus Capnoides.

Inasmuch as the North and South Rims of Grand Canyon must in many ways be administered separately because of the lack of close contact between them, visitors to the North Rim have not in the past enjoyed access to many educational facilities which have had their inception on the South Rim, at or near Park Headquarters, and which, due to lack of funds or other factors, have not yet been broadened sufficiently to affect the North Rim program. However, every possible attention has been paid to the North Rim needs with the result that, among other things, an herbarium has been started out of duplicate material on hand. At the present time this comprises 50 families, 118 genera and 143 species.

Plants of the Grand Canyon, Recently Identified by the National Museum:

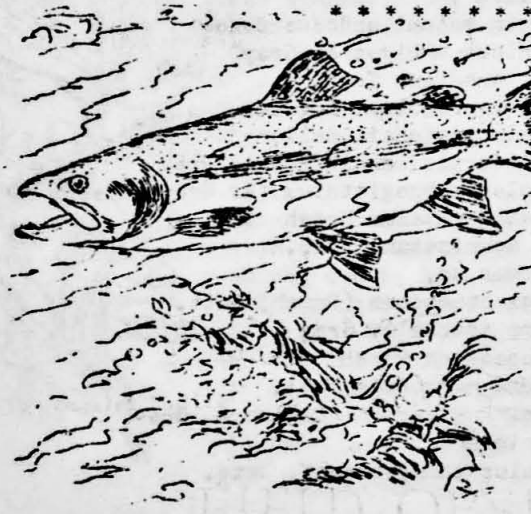
Evening Primrose	Oenothera lavandulaefolia Torr. & Gray
Lobelia	Lobelia splendens Willd
Cancer-root	Thalesia fasciculata (Nutt.) Britton
	Senecio uintahensis (A. Nels.) Greenm.
Milkvetch	Astragalus scaposus A. Gray
	Fendlera rupicola A. Gray
	Capnoides aureum (Willd.) Kuntze
	Actinea acaulis arizonica (Greene) Blake
Groundsel	Crepis occidentalis Nutt.
Bladderpod	Lesquerella Arizonica S. Wats.
Buckwheat	Eriogonum wrightii Torr.
Four O'clock	Quamoclidion multiflorum Torr.
Globemallow	Sphaeralcea cuspidata (A. Gray) Britton
Centaurium	Centaurium exaltatum (Griseb.) W.F.Wight
	Hymenopappus sp.
Aster	Aster hirtifolius Blake
Snake Weed	Euphorbia Schizoloba Engelm.
Shadblow	Amelanchier utahensis Koehne
Desert Gooseberry	Grossularia velutina (Greene) Coville & Britton
	Amelanchier utahensis Koehne
Gremwell	Lithospermum linearifolium Goldie
	Synthyris plantaginea Benth
	Asclepiadora sp.
	Trifolium pinetorum Greene
Cinquefoil	Potentilla ?
Penstemen	Penstemon eatoni undosus Jones
Globemallow	Sphaeralcea ambigua A. Gray
Chickweed	Alsine jamesiana Torr.
	Thalictrum fendleri Engelm.
Bluebells	Mertensia pratensis Heller
Snowberry	Symphoricarpos oreophilus A. Gray
Buttercup	Ranunculus subsagittatus (A. Gray) Greene
Stonecrop	Sedum stenopetalum Pursh
Onion	Allium acuminatum Hook..
Penstemon	Pentstemon sp.
Salt Bush	Atriplex canescens (Pursh) Nutt.
	Menodora scabra A. Gray
Gaura	Gaura coccinea Pursh
Evening Primrose	Oenothera marginata Nutt.
Syringa	Philadelphus serrvllifolius A. Gray
Locoweed	Oxytropis species
Milkvetch	Astragalus thompsonae S. Wats.



Craglily	Allionia linearis Pursh
	Anthericum torreyi Baker
	Phaseolus dilatatus Woot. & Standle.
Tansymustard	Sophia
Cliffbrake	Pellaea longimucronata Hook
Paintbrush	Castilleia sp.
	Dyssodia sp.
Anemone	Anemone hispida A. Gray.

FIELD OBSERVATIONS

HEAVY SNOWS during the past month have forced many deer down into the Canyon. Only about ten out of the herd of sixty that ordinarily come every night to the feeding station at Grand Canyon Village, have appeared there recently. Trail Caretaker Lloyd Davis estimates that between forty and fifty have been staying near Indian Gardens (4,000 feet below the rim) for several weeks.



THE RAINBOW TROUT which were planted in Havasu Creek just one year ago (See Nature Notes Vol. 5, Nos. 5 & 6) now average a foot in length. This exceptionally rapid growth is probably due both to the abundance of food and to the warmth of the water (64 -70). Such water temperatures, although ordinarily not favorable for the development of this species, seem to have helped in this case since the stream is swift and without very great fluctuation, and contains an abundance of deep pools.

-- Chief Ranger J. P. Brooks --

DURING THE STORM of January 19 to 21, snow covered the ground and remained even in the bottom of Grand Canyon. It was estimated that between two and three inches of snow fell in the vicinity of Phantom Ranch -- an event heretofore unheard of, at least within recent years.

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IN JANUARY 26 a flock of about eight Western Evening Grosbeaks was seen near the Bright Angel Trail about 1,000 feet below the South Rim of Grand Canyon. The writer can find no previous winter records of this bird either from Grand Canyon National Park or from the San Francisco Mountain area to the south.

-- E. D. McKee --

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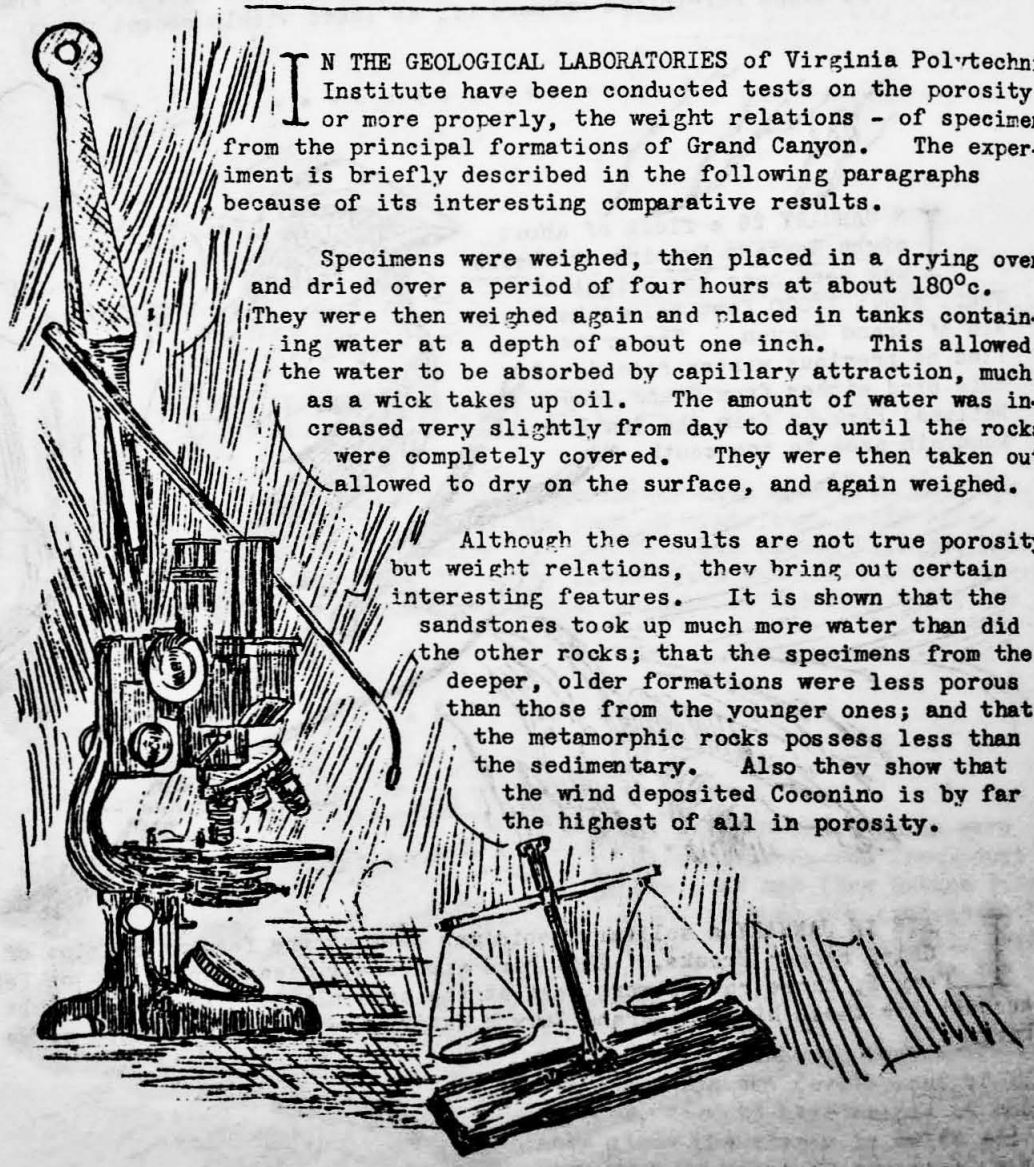
LATE IN JANUARY a solitary robin was seen at the feeding station of Chief Ranger Brooks. This bird apparently disappeared, but on February 5, three robins were seen at the same place. It is difficult to account for these birds at Grand Canyon during such a wintry season as we are having.

COMPARATIVE POROSITY of ROCK FORMATIONS in GRAND CANYON

By Ranger Naturalist H. H. Waesche



IN THE GEOLOGICAL LABORATORIES of Virginia Polytechnic Institute have been conducted tests on the porosity - or more properly, the weight relations - of specimens from the principal formations of Grand Canyon. The experiment is briefly described in the following paragraphs because of its interesting comparative results.

Specimens were weighed, then placed in a drying oven and dried over a period of four hours at about 180°c. They were then weighed again and placed in tanks containing water at a depth of about one inch. This allowed the water to be absorbed by capillary attraction, much as a wick takes up oil. The amount of water was increased very slightly from day to day until the rocks were completely covered. They were then taken out, allowed to dry on the surface, and again weighed.

Although the results are not true porosity, but weight relations, they bring out certain interesting features. It is shown that the sandstones took up much more water than did the other rocks; that the specimens from the deeper, older formations were less porous than those from the younger ones; and that the metamorphic rocks possess less than the sedimentary. Also they show that the wind deposited Coconino is by far the highest of all in porosity.

The results are as follows:-

Formation	Before Heating	After Heating	Saturated	% Increase
Kaibab Limestone	955 g.	952 g.	961 g.	0.94%
Base of Kaibab (Sandstone)	596	---	605	0.151
Coconino Sandstone	773	773	811	4.91
Hermit Shale	599	599	602	0.50
Supai Formation	1328	1327	1334.5	0.52
Redwall Limestone	1124	1123	1129	0.53
Devonian Limestone	1326	1324	1339	1.13
Muav Limestone	417	417	424	1.67
Bright Angel Shale	1048	1044	1060	1.53
Tapeats Sandstone	642	642	650	1.24
Hakatai Shale	911	---	912	0.11
Bass Limestone	471	471	472.5	0.32
Shinumo Quartzite	622	622	623	0.16
Vishnu Schist	756	755	756	0.13

Tests were also made by blowing air through the specimens with the mouth, before making the water tests. Results are, in relative ease of air passage:-

*Kaibab	Undetected	Muav	Not noticeable
Coconino #1	Barely noticeable	Bright Angel	Same as Devonian
Coconino #2	Easily passed	Tapeats	Fairly easy
Hermit	Easily noticed	Hakatai	Slow but easily noticed
Supai	Slight but noticeable		
Redwall	Not noticeable	Bass	Noticeable but very slight
Devonian	Slightly easier than Tapeats	Shinumo	Undetected.
		Vishnu	With great difficulty.

* Base of Kaibab - very slowly but detected readily.

Of course these do not check readily with the water results, but that is to be expected. Air will go through capillary openings which are not penetrated by water.

The experiment was crude and lacks polish but, I think, is quite interesting and the results turned out as should be expected according to theory.

PERSONNEL NOTES

MANY OF OUR READERS have commented most favorably upon the illustrations, sketches, captions, etc., appearing in Grand Canyon Nature Notes. The artist responsible has always modestly and consistently declined to place even his initials under the drawings but I believe that our readers are entitled to know that we are indebted to the interest and artistic ability of Park Ranger George L. Collins.

-- M. R. Tillotson --

READERS OF "Grand Canyon Nature Notes" will be sorry to learn that two of its greatest supporters - Assistant Superintendent and Mrs. P. P. Patraw - have left this Park. Mr. Patraw rendered constant help in editing and in developing the policies of this publication, and he wrote numerous articles on Canyon expeditions. Mrs. Patraw, formerly Ranger Naturalist Pauline Mead, will be remembered for her many contributions to our knowledge of the region, particularly in the field of botany.

It is very gratifying, however, to know that the reason for the Patraw's departure is the promotion of Mr. Patraw to the position of Superintendent of Zion and Bryce Canyon National Parks, Utah. We wish them much success and happiness in their new location, and extend congratulations.

THE STAFF OF "Grand Canyon Nature Notes" wishes to take this opportunity to welcome Mr. Donald E. McHenry, recently appointed Junior Park Naturalist, to our organization and to this Park. Mr. McHenry comes here from Stillwater, Oklahoma, where he was Assistant Professor of Botany and Plant Pathology at the Oklahoma Agricultural and Mechanical College. He has also had experience in biological and botanical work in Colorado and Wyoming.