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THE MINNESOTA GEOLOGIST

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OFFICIAL BULLETIN

OF

THE GEOLOGICAL SOCIETY OF MINNESOTA

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FIRST

1964

QUARTER

A given result may be equally achieved by a great force acting very quickly, or by a small force acting through a long period of time. It is the triumph of Geology, as a science, to have demonstrated that we do not need to refer to vast, unknown, and terrible causes the relief features of the earth, but that the known agencies at work today are competent to produce them, provided they have enough time.

Pirsson and Schuchert  
Introductory Geology

GEOLOGICAL SOCIETY OF MINNESOTA

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MEETINGS: October to May inclusive, 6:45 P.M. every 2nd and 4th Monday not a holiday, in Ford Hall, University of Minnesota, 17th Avenue S. E. and Washington Avenue. Visitors welcome.

FIELD TRIPS: May until October inclusive.

ANNUAL DUES: residents in a 50 mile radius of the Twin Cities \$ 5.00 plus \$ 2.00 additional for husband, wife, or dependent family members. For students and non-residents, \$ 2.00.

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and

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\* Deceased

For those of us who missed the Isle Royale trip of 1963, we have obtained the notes of Dr. George M. Schwartz who was the trip leader.

NOTES ON THE GEOLOGY OF ISLE ROYALE

By: George M. Schwartz

Editor's Note:

Dr. Schwartz, for many years a Geology Professor on the staff of the University of Minnesota, graduated from the University of Wisconsin in 1915. His major was Geology. Dr. Schwartz, after taking his master's degree in 1916, went to work for the Copper Range Company on the Keweenaw Peninsula. He served in the First world War and came to the University of Minnesota as an Instructor in 1919, where he received his Doctor's degree in 1923. Dr. Schwartz was Director of the Minnesota Geological Survey from 1941 to 1961 when he retired.

Geologically, Isle Royale is more closely related to the Minnesota coast of Lake Superior than to Michigan, of which it is politically a part; or to Canada which is closest geographically. Isle Royale National Park consists of the main island, some two hundred smaller islands and many small rocks and reefs. In a sense, the small islands are merely large reefs lined up with the main island as determined by the geologic structure.

Isle Royale is about forty-five miles long and eight miles at its greatest width. One of the interesting and picturesque features are about seventy long, narrow lakes.

The topography is rugged with general northeast trending ridges and valleys. The maximum altitude is about 1400 feet above sea level or 800 feet above Lake Superior. The "backbone" of the island is known as Greenstone Ridge named from the thick lava flow which has resisted erosion more than thinner flows and other rocks. At each end of the main island where the ridge disappears beneath the waters of Lake Superior it reappears to form Passage Island and Gull Island on the northeast and Grace and Washington Islands on the southwest.

The lava flows, conglomerates and sandstones dip (incline) gently to the southeast at right angles to the trend of the island. As a consequence the ridges usually have a gentle slope to the southeast and break off abruptly to the northwest giving a so-called "saw-tooth" topography.

It has been noted above that Isle Royale is geologically related to the Minnesota coast, so this requires explanation. Lake Superior occupies a great downfold or syncline in the ancient rocks of the region. Thus, in a general way, the layers of rocks on the north shore dip southerly and on the south shore northerly. Actually in the western part of the lake between Keweenaw Point and the Minnesota and Ontario shore the dips are to the northwest and southeast respectively. Thus, the rocks of the Minnesota coast and Isle Royale are on the north limb and those on Keweenaw Point on the south limb of the downfold. This major structure in turn explains the linear trend of the rock layers on Isle Royale.

The predominant rocks of the archipelago are a series of lava flows with which are interbedded sandstones and conglomerates. In general the lava flows greatly predominate on the northwest side of the island and

sandstones and conglomerates on the northeast side. Lava flows are the prevailing rocks on the Minnesota coast from Duluth to Grand Portage Bay and also occur on Lucille Island south of Pigeon Point. Eastward the lava flows trend under the lake toward Isle Royale. Older rocks occur on Pigeon Point and the Canadian coast.

The rock which makes up the lava flows falls in the general class of basalts. These are dark gray to black, fine-grained and are chemically complex. The principal elements in order of abundance are: oxygen, silicon, aluminum, iron, calcium, magnesium, sodium, potassium, titanium. The principal minerals are feldspar, pyroxene, olivine, magnetite-ilmenite and various minor minerals and alteration products. The most significant feature of the flows is the fact that after the lava poured out, gas bubbles rose to the upper part and were trapped by the chilled surface in contact with the air. Later heated waters seeped through the porous, vesicular rock and deposited minerals in the vesicles. When filled, the vesicles are called amygdules and the rock is properly called amygdaloidal basalt. By custom these rocks are commonly called amygdaloids. A further complication is that as the flows moved the chilled upper portion broke up and became jumbled as movement continued. This broken rock was then cemented by lava or by sediment and the resulting rock is called breccia. Later, the porous and broken zones were the locus of mineralizing solutions which altered the rocks, especially to chlorite, epidote, serpentine and some native copper in favored localities.

The fillings of the amygdaloids and other cavities contain the minerals which attract the attention of collectors. Quartz (including agate) and calcite are most abundant but such minerals as chlorastrolite (greenstone), thomsonite, various zeolites, prehnite, laumontite, are most common and many others occur in a few localities.

Too much detail on the rocks is not desirable for the present purpose but certain features may be observed and raise questions. In general the size of grain of rocks which form a melt is related to the rate of cooling. Rapid cooling results in a fine grain, slow cooling in a coarse grain. Thus, if a lava flow is thick, say many tens or even hundreds of feet, it will be much coarser grained in the center than at the bottom. The fine-grained basalts were called melaphyres by the early geologists.

In some cases the lava, while still at depth, cooled sufficiently so that it became saturated with some mineral, usually feldspar, and large crystals formed and then were embedded in a fine-grained matrix when the flow cooled after extrusion. The resulting rocks are called porphyrites. Some of the rocks near Rock Harbor Lodge doubtless show this texture as does the "Greenstone" flow.

It is desirable to describe the sequence of flows, sandstones, conglomerates etc., in somewhat more detail with particular reference to those exposed at the east end of the island near Rock Harbor Lodge; but first a few more notes about the general situation. About one billion years ago there was a tremendous period of volcanic eruption, apparently centering where Lake Superior is now located. The flows, evidently moved out from a central highland where huge fissures supplied the molten material (lava). These flows are now best exposed on Keweenaw Point, the North Shore in Minnesota and on Isle Royale. Those exposed along the North Shore are the earliest and those on Keweenaw Point

and Isle Royale the later series. On Isle Royale the lower and earlier flows are on the northwest part of the Island and are interbedded with thin sandstones and conglomerates. (Conglomerate is essentially a cemented gravel.) As time went on, the flows were fewer and the mechanical sediments (sand and gravel) more abundant so that the southwest part of the island, that is from Siskowit Bay to Rainbow cove, the rock consists entirely of sandstone and conglomerate.

The total number of flows exposed on Isle Royale has not been accurately determined but a cross-section based on 14 diamond drill holes by the Windigo Copper Company (cited by Lane in the Geological Survey of Michigan, volume VII) shows 169 basalts and amygdaloids and 18 interbedded sandstones and conglomerates. It is probable that some of the amygdaloids cited belong to one of the basalts so that the total flows number is somewhat less than 169, but a few more occur to the southeast beyond the last drill hole.

Rock Harbor Lodge is located on a narrow peninsula between Rock Harbor and Tobin Harbor bays. The peninsula is about 5 miles long and ends at Scovill Point. The rocks on both sides of Tobin Harbor belong to flows which Lane correlated with the "Ashbed" Group of Keweenaw Point. These consist of basalt porphyry and scoriaceous conglomerates. A long series of islands form most of the outer (southeast) boundary of Rock Harbor and, according to Lane's map, these consist of mottled (ophitic) basalts. Not far inland from Tobin Harbor is the great "Greenstone" flow, the thickest flow on Isle Royal and presumably correlated with the "Greenstone" of Keweenaw Point. The geologic structural control to the bays, (harbors), points, islands, ridges, and lakes is a most conspicuous feature of Isle Royale archipelago and can be appreciated only by study of a good map. It should be emphasized again that this pronounced linear structure is a result of a rather regular northeasterly trend of the series of gently, southeasterly dipping, lava flows, sandstone and conglomerates. The dips on Lane's map range from 8 to 32 degrees with those on the northeast side somewhat steeper than on the southeast side. The closest, shown near Rock Harbor Lodge, is 17 degrees on Nott Island.

#### A Poem of Tribute

Now in geological circles the name of Dr. George M. Schwartz  
Is as well known as in the music world the name Horowitz,  
And his often fellow author with his rock not waxy seal  
Is the noted geologist by the name of Dr. George A. Thiel.  
Minnesota's Rocks and Waters they wrote in fifty eight,  
But a quarter century earlier were listed their bulletins of a thirty three date.  
The Geology of the Minneapolis-St. Paul Metropolitan Area by Schwartz in thirty six  
Covers about the same amount of ground today, so how is that for tricks?  
Geology and Underground Waters of Southern Minnesota by Thiel in forty four,  
As co-authors of A Guide to Minerals and Rocks of Minnesota giving descriptions  
by the score.

These are just a few titles of their many publications  
Without even mentioning their many Geological Society banquet orations,  
Which are anticipated and appreciated to no small degree  
By all the members of the Minnesota Geological Society.  
This summer Dr. George M. Schwartz was our trip leader to Isle Royale  
Where we learned much geology on that part of Michigan's soil,  
Through the years the help and leadership of these two wise geologists and friends  
Have benefitted and encouraged us in our geological ends.  
And we wish to say thank you to Dr. George M. Schwartz and Dr. George A. Thiel  
To whom we cannot exactly say how grateful we feel.

"Pat" Summerfield.

ASTROLOGY and GEOLOGY?

How good are you in making geological predictions? A man named Edgar Cayce has made some geological predictions which appear dramatic and catastrophic.

Edgar Cayce who died in 1945 was known as "the sage of Virginia Beach", Virginia. He gave 14,000 "readings" between 1901 and 1945. These "readings" included descriptions of events that he visualized as happening in the past or which were about to happen in the future. They included both world-wide occurrence and small scale events involved with the personal and business lives of people.

Edgar Cayce believed in the lost continent of Atlantis; he thought it was destroyed 7,500 years ago; he believed that the last great flood occurred largely because of its sinking. He had predicted the California and Japanese earthquakes of 1926. He had predicted that the center of the earth would shift with respect to its axis starting in 1936.

Some of his predictions are not very specific in time, but he thinks that the Great Lakes drainage will eventually be into the Gulf of Mexico as the land areas north of the Great Lakes rise in elevation.

Catastrophic events predicted are that New York will be destroyed sometime between 1958 and 1998; the western coast of America will be greatly changed; Japan will go under the sea; northern parts of Europe will change in a very short time. Cayce thinks these changes will take place after some breaking up in the South Pacific, notably Hawaii, and elevation changes in the Mediterranean and Etna areas, together with land risings in the Arctic and Antarctic regions. He sees the changing location of the poles and new land rising along the eastern seaboard and in the Caribbean Sea.

These predictions which were contained in the "readings" by Edgar Cayce were usually not made with the topic of geology or the earth as the subject matter. These predictions came out by way of Cayce, for example being asked by a businessman whether his business offices in New York should be expanded, the reply of Cayce being negative with the prediction of the destruction of New York. During these "readings" Cayce appeared to be in a deep sleep or trance. Edgar Cayce's predictions go as far as the year 2100 A. D. at which time he sees the rebuilding of New York.



MISCELLANEOUS NOTES and NEWS:

"Minnesota Rocks and Waters" is the subject of a slide lecture offered to boy scout troops of the Indianhead Council in the St. Paul area. This lecture is sponsored by the Geological Society of Minnesota. The slides are based on the book "Minnesota Rocks and Waters" by Dr. George A. Thiel and Dr. George M. Schwartz both now retired from the Department of Geology of the University of Minnesota.

The Lawrence Kings celebrated their 50th wedding anniversary New Years Eve. Although this anniversary was kept a secret from their many friends, Mr. & Mrs. King's son and daughter-in-law flew for the occasion from Riverton Wyoming where their son is an Episcopal minister at the Arapahoe Indian Mission.

A close friend Mrs. Dostall personally presented the Kings with a tree decorated with 50 silver dollars. This money is being given to the Arapahoe Indian Mission through their son Ware. CONGRATULATIONS Mr. & Mrs. King !

George Rickert, Martha Peterson, and Ara Rickmire have been on the 1963 sick list, but we hope that they are all well on the road to recovery. George Rickert has been recalling some of his trips last year on one of which he said he found the finest limestone deposit as far as having an even polished level surface of glaciated stone, easily obtained in thicknesses of one to four inches and sizes from two inches to four feet at Valders Wisconsin west of Manitowoc, but it had to be the hottest day of the year, almost. He also selected the following poem from the W. P. A. Review which is entitled:

"Every Man's A Diamond in the Rough"

Mind is the master power that molds and makes,  
And Man is mind and evermore he takes  
The tools of thought and fashions what he wills,  
Brings forth a thousand joys, a thousand ills.  
He thinks in secret and it comes to pass  
Environment is but his looking glass.  
Though man a thinking being is defined,  
Few use the grand prerogative of mind.  
How few think justly of the thinking few !  
How many never think but think they do !

### THE SUBJECT OF MEMBERSHIP

The membership of our group is not increasing and perhaps we should ask ourselves why not and what can we do about it. The attendance and interest shown by most of our members is very good, but it seems we have failed to introduce enough new people to the group and have failed to hold their continued interest. The opinion of one of our members is that more advertising through newspaper and radio channels should be done; we have advertised irregularly and in too few ways.

Other comments have been made that new members could become acquainted faster if name tags were used, and they might be encouraged through the use of introductory reading materials or book lists. After the evening lecture, a short members discussion period which could include displays of pertinent fossils or geological samples might offer new members a chance to ask questions and to get to know other members. These are a few suggestions, it is up to each of us to consider the subject of membership and what we can do to encourage new members.

"Letters to the Editor" on the subject of membership or on any other topic of interest to members would be appreciated.

### BOOKS OF INTEREST

Two recent books which discuss different aspects of geology are A Hole at the Bottom of the Sea by William Bascom (1961) and The Moon, Meteorites and Comets edited by Barbara H. Middlehurst and Gerald P. Kuiper (1963). Both books are available at the Minneapolis Public Library.

A Hole at the Bottom of the Sea gives the history of how the Mohole project was started, descriptions of the equipment that may be used in the rock drilling and of the kind of information that may be obtained. The author discusses many geological questions which the Mohole project hopes to answer. The book is written with the layman in mind and offers much stimulating reading.

The second book The Moon, Meteorites and Comets is a more technical book with almost half of the book written on the subject of meteorites. Especially interesting was a section entitled "Meteorite Distribution on Earth" written by H. H. Nininger, in which he tells of how the difference of the reported meteorite findings in Illinois and Kansas was largely found to be that the farmers of Kansas were alerted by a series of educational campaigns as to what meteorites should look like so that many meteorites were found in Kansas, but in Illinois where there was no educational program, few meteorites were found. Other sections of the book give descriptions of meteorites and meteorite craters.



#### 1964 FIELD TRIP

Now is the time to start "boning up" on the geology areas that you will want to visit this summer with the Geological Society of Minnesota under the leadership of Mr. Clark Pettengill in the western states of Wyoming, Idaho, Colorado, South Dakota and Nebraska. The bus trip is scheduled for June 13-27.

Areas to be seen include escarpments at Chadron Park, Nebraska, dinosaur fossils at Dinosaur National Monument; Great Salt Lake with its salt flats; an open pit copper mine in Bingham Canyon; lava beds near Idaho Falls and lava beds at Craters of the Moon; Grand Teton National Park; Wind River Canyon, the Big Horn Mountains; the Black Hills; Badlands National Monument.

Hot springs, raging rivers, crystal caves, fossils from trilobites to dinosaur bones, ghost towns, buffalo herds, elk - these are a few other attractions that may be seen. The mountain and plateau areas that we are going to cross contain a wealth of mineral deposits - gold, silver, copper, iron, lead, zinc, uranium, salt, coal, asphalt, oil, bauxite, and many gem minerals.

From the Niobrara plains to the shores of ancient Lake Bonneville with some of the most picturesque of the Rocky Mountain scenery in between, this is a field trip that offers just about everything.

The included schedule gives the route numbers of the roads to be taken with the mileage given between large towns and totaled for each day. The trip will cover approximately 3400 miles.

FIELD TRIP  
GEOLOGICAL SOCIETY OF MINNESOTA  
June 13 thru 27, 1964

St. Paul to Mpls.		10		
US 169	Mankato	85		
Minn. 60	Worthington	97		
Id. 33 - US 75	Sioux City Ia.	91		
US 20	O'Neill, Nebr.	125	408	Sat. nite June 13
US 20	Valentine	111		
US 20	Chadron	139		
US 20	Lusk, Wyo.	79	329	Sunday, June 14
US 20	Douglas	62		
US 20 - 87	Casper	43		
Wyo. 220	Muddy Gap	73		
US 287	Jawlin	45	223	Monday, June 15
US 30 Wyo. 789	Craig Colo.	117		
US 40	Jensen, Utah	106		
Utah 149	Dinosaur Nat'l. Mon.	10		
US 40	Vernal	23	256	Tuesday, June 16
US 40	Heber	129		
US 189	Provo	27		
US 89	Salt Lake City	50	206	Wednesday, June 17
Utah 48	Bingham Canyon	25		
Utah 111	Saltair	25		
US 40	Salt Lake City	50	100	Thursday, June 18
	Salt Lake City			Friday, June 19
US 89	Ogden	36		
US 89 f	Brigham City	20		
US 89	Logan	26		
91-191-30N	Pocatello, Ida.	96		
US 91	Idaho Falls	50	228	Saturday, June 20
US 20-26	Craters of Moon	86		
	return	86	172	Sunday, June 21
US 191	Ashton	54		
Idaho 32-33	Victor	45		
Idaho 31	Swan Valley	37		
US 26	Jackson, Wyo.	62	198	Monday, June 22
	Teton Park	40		
	Return to Jackson	40	80	Tuesday, June 23
US 89	Moran	30		
US 26-287	Riverton	135		
US 26	Shoshoni	23		
US 20	Thermopolis	34		
Wyo. 789	Worland	34	256	Wednesday, June 24
US 16	Buffalo	96		
US 90	Gillette	67		
US 16	Custer	116		
US 16 SD 79	Rapid City	48	327	Thursday, June 25
US 16	Badlands Nat'l Mon.	93		
US 14	Kadoka	19		
US 16 - 281	Huron	222	334	Friday, June 26
US 14	Lake Benton	104		
Minn 23	Marshall	33		
Minn 19 - 5	Twin Cities	142	279	Saturday, June 27



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