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"A HOBBY IS SOMETHING TO GO NUTS OVER, TO KEEP
FROM GOING CRAZY OVER THINGS IN GENERAL"

Charles C. Noble,
Syracuse University Dean.

G E O L O G I C A L S O C I E T Y O F M I N N E S O T A

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The Society is devoted to the study of GEOLOGY,
MINERALOGY, and PALEONTOLOGY for their cultural value.

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MEETINGS : October to May inclusive, 7:30 P.M. every Tuesday
not a holiday, auditorium, Minnesota Museum of Natural History
University of Minnesota, 17th Ave., S. E. and University Avenue.
Visitors welcome.

FIELD TRIPS : May until October inclusive.

AFFILIATE MEMBER

MIDWEST FEDERATION OF MINERALOGICAL AND GEOLOGICAL SOCIETIES
and
THE AMERICAN FEDERATION OF MINERALOGICAL SOCIETIES

* Deceased

EDITORIAL

The program committee is planning an excellent program for the fall and winter lecture season. The details however are still in their formative stage. After carefully checking next seasons basketball schedule in addition to the Monday night shopping problem, the committee and board of directors decided to change the meeting night from Monday to Tuesday night for this next season. Let's give it a try.

The annual convention of the Northwest and American Mineralogical Societies will be held Labor Day week-end, September 1st and 2nd at the Masonic Temple, Tacoma Washington. The Tacoma Agate Club will be host to the convention. If you plan to attend please get in touch with the editors so that proper committees can be notified. Society recognition as well as individual recognition will be given to anyone donating a good mineral or cab specimen for the auction.

Let's not forget our "shut-in" members, Mabel Kenrick, Clark D. Schmidt, Mrs. Kolderie and Mrs. Ralph Hollingsworth.

The Glacier Park, Banff and Lake Louise trip is being contemplated with the usual eagerness by those fortunate enough to go. Chas. Freston and his assistants are working hard to complete arrangements.

Our Society can be very proud to count among its members two young high school students, Peter Miller and Wesley Suhr, who have won top honors this spring for their extracurricular work in geology.

Peter, now a senior at Central High school in St. Paul, entered an Invitational Science Congress at St. Cloud Teachers College where he was one of 115 exhibitors who came from 32 different high schools in the state. The problem he chose consisted of a study of the Paleontology of the Decorah shale and Platteville limestone in St. Paul which he exhibited in the form of three charts of representative fossils of each formation. On the basis of his exhibit Peter was one of 20 chosen to give a talk to the Congress. His excellent presentation was judged to merit the first prize offered by the Congress and consists not only of a years scholarship to St. Cloud but also a one-weeks trip to St. Louis to attend the meeting of Science Clubs of America. Peter plans not to accept the scholarship offered to him but to attend the University of Minnesota instead.

Wesley, a student at Monroe High School St. Paul, did research and wrote a pamphlet on the fossil distribution in the Decorah shale and presented his project at the last meeting of the Minnesota Junior Academy of Science. Every year the American Association for the Advancement of Science (AAAS) gives recognition to the student who achieves the most in his particular branch of science. This year this citation went to Wesley. He also plans to attend the University of Minnesota beginning this fall and to make geology his field of concentration.

THE GEOLOGICAL SOCIETY IN CONJUNCTION WITH THE DEPARTMENT OF GEOLOGY AND THE MINNESOTA STATE GEOLOGICAL SURVEY WILL HAVE AN EXHIBIT AT THE MINNESOTA STATE FAIR.

Just before going to press we were informed that Miss Mabel Kenrick, one of our charter members passed away. Miss Kenrick has been in ill health for several years. Our deepest sympathy to her family.

BULLETIN BOARD

1951 TENTATIVE FIELD TRIPS

July 2nd to 5th	Houghton Michigan Convention and Field Trips	Midwest Federation
July 8th	Southeast Minnesota	Rochester Society
July 14th to 29th	Glacier Park, Banff, Lake Louise and Jasper Park	Chas. H. Preston
July 22nd	St. Cloud Granites	?
Aug. 5th	Noerenbergs Estate - Picnic Lake Minnetonka	Report on Glacier Park, Banff, Jasper Park Trip
Aug. 19th	Mankato Minn. Local Geology Field Trip Dedication of Geological Plaque	Loretta Koppen
Aug. 30th	Ford Plant St. Paul Inspection of Plant	Elsie Hinchley
Sept. 15th 16th	Chippewa Falls, Elk Mound Barron Hills	Hal E. McWethy
Sept. 29th 30th	Spring Valley Minn.	Dr. W. C. Bell
Oct. 14th	Reads Landing Minn. Dedication of Geological Plaque	?

The annual convention of the Mid-West Federation of Mineralogical Societies will be held this year at the school of Mines at Houghton Michigan July 2nd through July 5th.

This promises to be an outstanding meeting due to the fact that Houghton is located in the heart of the famed copper country of the Keweenaw peninsula. The geology of the country is of intense interest to either a geologist or a mineralogist as there are dozens of different minerals that can be collected from the millions of tons of so called poor rock laying on top of the ground at the various abandoned mines. Professors Snellgrove and Spiroff have turned over the facilities of the School of Mines to the convention and will supervise and conduct the lectures and field trips.

While most members of our society are familiar with the scenic beauties and topography of the North Shore, comparatively few have visited the beautiful copper range country of the Keweenaw peninsula. This neck of land extends about a hundred miles into Lake Superior in a northeasterly direction just south of Isle Royale. It is about 35 miles wide at the base narrowing to about 5 miles at Keweenaw point at the tip of the peninsula. It is a rugged and wooded country similar to the North Shore with elevations up to 1350 feet at various points. About midway up the peninsula there is a winding valley, the remnant of a strait that cut Keweenaw point from the mainland. A canal has been cut through this strait to enable ships to avoid the dangerous trip around Keweenaw Point. Houghton Michigan is located midway in this valley. The town is built on the old lake terraces cut in the trap rock. Directly across the canal is the city of Hancock. It is the deepest copper mine in the world (11,000 feet) and contains pure copper masses too tough to blast.

The famed copper range is a belt from 2 to 5 miles wide running directly west of the Keweenaw fault which extends from Bete Gris Bay on the northern tip of the peninsula to a point near Lake Gogebic some 150 miles in a southwesterly direction. This copper belt west of the fault was uplifted about 1200 feet thus bringing the copper bearing rock to the surface. The rock containing the ore consists mainly of basic lava flows alternating with beds of lava conglomerates of middle Keweenaw age.

It is the consensus of opinion that the copper bearing solutions came up along faults encountering impervious gangue or sandstone beds which caused the solutions to migrate out into the shales and sandstone where the silver and copper were deposited.

East of the fault the peninsula is composed of Jacobsville sandstone (pre-Cambrian). This is a red and brown sandstone with markings and streaks of white and gray. West of the fault and copper ore belt the peninsula is composed of Freda sandstone and conglomerate and the Nonesuch formation, a dark colored shale and sandstone (upper Keweenaw).

Probably the most interesting feature of the convention will be the opportunity it will afford to explore the various mines and enjoy the beautiful scenery. There is also agate Thomsonite and Chlorastrolite along the shores of the bays and inlets. The business and lecture portion of the convention program will be held to a minimum to allow a greater number of field trips. Those that may wish to remain for a day or two longer will find much of interest to occupy their time. It is hoped that a large number of our society will make an effort to attend the convention. It is indeed a refreshing experience to meet and renew acquaintances with members of the other 20 societies which compose our Mid-West Federation.

From the Twin Cities the driving distance is about 360 miles. From Taylors Falls take T. H. 8 to Rhineland Wis. then take No. 17 to Eagle River then T. H. 45 to Rockland then T. H. 26 to Houghton. As this is a vacation country reservations at the hotels and tourist camps should be made well in advance.

ANNUAL CONVENTION
MIDWEST FEDERATION OF MINERALOGICAL SOCIETIES
Michigan College of Mining and Technology
Houghton, Michigan
July 2, 3, and 4, 1951

Monday, July 2

- 9:00 AM Registration at A. E. Seaman Mineralogical Museum
12-2 PM Luncheon at Denton House
2:00 Welcoming Address by President Grover C. Dillman and
and Dr. A. K. Snelgrove, Head, Department of
Geological Engineering
East Engineering Building, Room 202
2-3 Address on General Geology of the Keweenaw Peninsula
by Professor K. Spiroff
3-4 Address on Milling and Refining of Copper
by Professor G. P. Schubert, East Engineering
Building, Room 202
4:00 Address on Michigan Copper Deposits, by Dr. H. R. Cornwall, U.S.G.S.
Room 202, East Engineering Building
4:30 Address on Measurement of Lapping Hardness of Diamond with
Respect to Crystallographic Direction by Prof. Spiroff
7:00 Tour of Laboratories at Michigan Tech and Movies of
Geological Interest.

Tuesday, July 3

- 9:00 AM Field Trip to Various Quarries, Rock Piles
Conducted by Professor K. Spiroff. Party leaves Michigan Tech.
Campus (East Engineering Building) 9:00 AM sharp.
12-2 PM Luncheon at Denton House.
2:00 Modern Lapidary Methods by Mr. Wm. J. Bingham, St. Paul
East Engineering Building, Room 202
3-3:30 Modern Mining Display Methods by Mr. John Mihelcic, Detroit
East Engineering Building, Room 202
3:30 Talk on Prehistoric Copper Mining in Michigan
by Dr. Roy W. Drier, Mich. College Mining & Tech.
East Engineering Building, Room 202
4:00 Midwest Business Federation Meeting
East Engineering Building, Room 202
6:30 Banquet at Hotel Douglas
Speaker, Dr. A. K. Miller, Department of Geology,
State University of Iowa, "Geology of Alaskan Highway"

Wednesday, July 4

- 8:30 AM All day Field Trip. Party leaves from East Engineering Bldg.
SHARP

A circle field trip of the Peninsula, stopping at
Allouez to inspect the conglomerate outcrop, Ahmeek, Old
Mining dumps, Phoenix to Eagle River, Sand Dune Drive to
Eagle Harbor, Brockway Mountain Drive to Fort Wilkins.

Cornish Pasty Luncheon to be served enroute.

Thursday, July 5

Optional field trips will be arranged for those desiring
to stay after July 4 in the Arcadian Copper Mine, Quincy
Reclamation Plant, Calumet and Hecla Smelter.

REGISTRATION FEE WILL BE \$ 1.00 PER PERSON

RATES AND RESERVATIONS.

The following is information regarding accommodations at Houghton Mich. for the meeting of the Mid-West Federation to be held the first week of July. Each member planning to attend will please make his reservation directly with the hotel of his choice.

The Douglas House, Houghton Mich.

Single rooms without bath -----	\$ 2.50
Double rooms without bath -----	4.25
Twin beds without bath -----	4.50
Single rooms with bath -----	\$ 3.50, 3.75, 4.00
Double rooms with bath -----	5.50, 5.75, 6.00
Rooms with two beds for four people	8.75, 9.00, 9.50

Scott Hotel, Houghton Mich.

Single rooms without bath -----	\$ 2.00 and 2.25
Double rooms without bath -----	3.50 and 4.00
Twin beds without bath -----	4.50
Single rooms with bath -----	3.00, 3.25, 3.50
Double rooms with bath -----	5.50 and 6.00
Twin beds with bath -----	7.00

Tourist Cabins

These may be had, - last years rates for double occupancy \$ 4.50, 5.00 and 6.00.

Mary Lupient,
Chairman of Reservations.

THE GEOLOGY
OF
BUFFALO RIVER STATE PARK.

J. Merle Harris.

(Reprinted from the "Conservation Volunteer",
with permission of the author)

Buffalo River State Park, established in 1937, consists of about 242 acres of bottom land along the Buffalo River about 12 $\frac{1}{2}$ miles east and one mile south of Moorhead in Clay County. The park is situated on the edge of a large area in northeastern Minnesota which contains very few lakes. There are two other, smaller areas in the state which are also lacking in natural lakes. These are the southeastern and southwestern counties.

So well established is the idea that Minnesota is the "Land of 10,000 Lakes" that mention of any large area which has none, or only a few of them, probably will raise doubts as to the truth of the statement. A glance at almost any map of the state will verify the assertion, however. There remains the question, why, or "how come"? The answer to this, different for each of the areas named above, is packed with the geological history of the state. Indeed, the answer to this question for the northwestern corner of the state gives us the reason for the existence of Buffalo River State Park.

The area which interests us here is somewhat the shape of a funnel split down the middle with its pointed end at the southern tip of Lake Traverse and its top flaring outward toward the northeast. More specifically, the pointed part of our funnel is about the width of one row of counties along the west edge of the state. Its eastern margin runs roughly from south to north as far as Maple Lake, near Mentor, southeast of Crookston. Here the flaring top of the funnel begins and swings sharply to the east and, passing just south of Lower Red Lake, continues east by northeast and crosses into Canada at a point almost directly north of Duluth. In the entire area west and north of this line, some 15,000 square miles, there are very few lakes. Why?

The most casual observer who travels in this part of the state cannot fail to notice how extremely level the land appears. He may also notice the scarcity of rocks and boulders, except along certain rather well defined ridges. In the vicinity of Buffalo River State Park these ridges trend in a generally north-south direction. There is usually a long sweeping slope from the west up to one of these ridges and a comparatively level bench or terrace to the east for some distance. In the roadside ditches, if freshly cut, one sees that a fairly thin layer of black top-soil rests on a fine-grained, often laminated, light gray soil beneath. This represents quite a contrast to the soil profile commonly observed over most of the state.

All these unusual features are well explained by the existence of a large lake which covered, at its highest stage, some 6,500 square miles in North Dakota and 65,000 more in Canada in addition to that in Minnesota, outlined above. This was Glacial Lake Agassiz which came into existence at the close of the last glacial period and disappeared perhaps 10,000 years ago. It was approximately the size of all five of the present Great Lakes combined. The water for Lake Agassiz was largely furnished by the melting of a tongue of ice lingered somewhat longer in that area than in most of the rest of the state. The lake was apparently quite small at first, occupying a pointed area in the immediate vicinity of present Lake Traverse. It was outlined on the west, south and east by the natural basin and on the north by the ice-wall of the

melting glacier. Melting of the glacier caused this north wall to recede gradually toward the north. Since the glacier was doubtless several times thicker than the depth of the natural basin, much more water resulted than could possibly be contained in it. Lake Agassiz overflowed at Lake Traverse into what is now Big Stone Lake and the Minnesota River just as a pan overflows first at the lowest dent in its rim. Finally enough melting took place to open still other, probably lower, outlets to the north and/or east. This tended to cause the lake to abandon the Traverse-Big Stone outlet. This finally occurred, of course, but it would have occurred much sooner had it not been for the intervention of an unusual series of geologic events.

Although continued melting of the ice in the northern regions opened new outlets, it also unburdened the earth's crust of the huge load of ice under which it had been sagging. Upon relief of pressure the earth's crust rose and in doing so tilted the Lake Agassiz basin toward the Traverse-Big Stone outlet again. At first it would seem impossible to know this - events which occurred so long ago. However, our evidence comes from a study of the rocky ridges mentioned earlier. These ridges represent the beach lines which were formed when the lake was at that level. Careful study of these beaches reveals much interesting information. It is found that there are two principal series of beaches, an upper series and a lower series representing different lake levels. The upper series consists of five beaches named for towns they pass through or near. They are, beginning with the highest, the Harman, Norcross, Tintah, Campbell and McCauleyville beaches. They have been traced for hundreds of miles in Minnesota, North Dakota and Canada. In doing so a strange fact comes to light. As one of these beaches is traced northward it is found to get higher and higher. This alone would be sufficient proof of the tilting mentioned above, since there can be no doubt that these beach lines were level, when formed, just as are those being formed today. However, from this alone we would not know when the tilting occurred. A comparison of all the beaches reveals that they all rise to the north but not by the same amount. Their divergence is greater the farther north they go. This convinces us that the tilting took place by stages, some of it between the formation of each of the beaches and the next one lower. All the beaches mentioned above point, both geographically and in slope, toward Lake Traverse. This is taken as evidence that the southern outlet remained open most if not all of the time during the formation of these five beaches. If our understanding of the process described above is not clear let us try an analogy. Think of a small boat loaded with bricks with most of them at one end. The boat will sink most where it is loaded most, and as it is unloaded a few bricks at a time, will rise most where there is the greatest relief from pressure.

Seldom does a state park hold within its boundaries sufficient reason for its being, either historically or geologically. More often it simply accentuates or symbolizes a setting which extends far beyond its premises. A better example of this than Buffalo State Park would be hard to find. The foregoing story, covering thousands of years and nearly a hundred thousand square miles, comes to ones mind as he reads the plaque near the park entrance. It marks the Campbell Beach of Old Lake Agassiz 1000 feet above the sea. Even the casual visitor can see, in the ridge there, the rounded pebbles which remind him that wave action once occurred where he is standing.

The Buffalo River arises just outside the margin of the region just discussed, in the morainic lake area of Western Becker County. It flows in a southeasterly direction to a point about 2 miles southwest of Hawley, then west northwest through Buffalo River State Park and finally into the

Red River near Georgetown. Thus the river flows stepwise from one beach level to another until it reaches the low bottoms of the Red River. In the Park advantage has been taken of the rapids at the Campbell Beach and a dam has been built. Here water is impounded and used for various purposes, one being the supply for a swimming pool. A representative view of the Campbell Beach cannot be had adjacent to the river because a notch has been eroded out of it at this point by the river.

Exposed along the river some 50 yards above the dam is a nearly vertical bank 25 or 30 feet high. It is composed of grayish boulder clay with little or no evidence of lake clays above it, though possibly the cover of grass conceals some. This bank is undoubtedly cut in an old moraine which wave action was not successful in completely erasing. A few cases of such moraines are found within the boundary of Lake Agassiz large enough to be mapped. One quite long one is found in Clay County southwest of the Park and paralleling the South Branch of Buffalo River. Most of these moraines were probably deposited in the water by the melting of the glacier. They were undoubtedly lashed hard by the waves when the lake fell to near their level. That this section was successful in erasing most of them and distributing the material into the depressions is shown by the levelness of the land and the scarcity of either lakes or moraines. Those few remaining probably represent the largest or deepest depressions and the largest and strongest moraines.

Along the river within the park a nice stand of timber is found. It consists mostly of elm, cottonwood, box elder, basswood and willow. The higher ground is mostly meadow and grassland. As the visitor to Buffalo River State Park relaxes and reflects upon the geological story which it commemorates he is reminded that the area now described as "river bottom" was once lake bottom. The present swimming pool is just a hint of the big "swimming pool" that once existed there -- though perhaps only polar bears and their kin could enjoy it.

DIRECTORY ADDITIONS

Anderson, Mrs. James L.	Housewife	Manley Iowa
Beshefkin, Mildred	630 Iglehart Ave.	St. Paul DA 4253
Diamond, Winifred	23 So. Albans	St. Paul
Halper, Ida	630 Iglehart Ave.	St. Paul DA 4253
Haugen, Kasper		Kanyon Minn.
Jone, Thelma	Librarian	Wayzata Minn.
Lambert, Mr. & Mrs. E.A.	Ret. Prof.	705 6th St. S. E. Mpls. 14 GL 1405
Miller, Peter L.	Student	1320 Ashland Ave. St. Paul 5
Pica, Ben		718 Oak St. Gr. Forks ND 21131
Rauscher, Katherine		1072 Iglehart Ave. St. Paul EL 0906
Steffenson, Lenora		994 Linwood St. Paul
Dorothy Davis		462 So. Saratoga St. Paul

CORRECTIONS

Frederick P. Bradford office phone GA 7461 residence LA 5310
 Mr. & Mrs. Fred W. Hallberg were listed as Nallberg.
 J. Merle Harris extension number at the University is 6993.

MR. & MRS. HAL E. MCGERTY
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