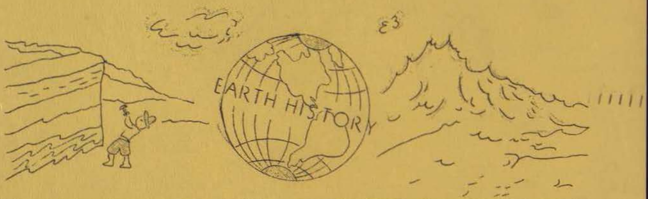

THE MINNESOTA GEOLOGIST

OFFICIAL BULLETIN OF THE GEOLOGICAL SOCIETY OF MINNESOTA

VOL. VII FIRST QUARTER 1950 NO. 1

"EARTH, YOU AND I ARE ACQUAINTED. I FEEL AS IF I HAVE KNOWN YOU FOR A LONG TIME. WE ARE FRIENDS AND ARE GOING TO LIVE TOGETHER IN MUTUAL HARMONY AND UNDERSTANDING FOR THE REST OF MY LIFE."

Dake, Fleener and Wilson,
"Quartz Family Minerals".

GEOLOGICAL SOCIETY OF MINNESOTA

EDITORS
Loretta E. and E. L. Koppen
3376 Brunswick Ave.,
Minneapolis 16 Minn.

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

OFFICERS

MEETINGS : October to May inclusive, 7:45 P. M. every Monday 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.

ANNUAL DUES : Residents of Hennepin and Ramsey counties \$ 3.00 plus \$ 1.00 additional for husband, wife, or dependent family members ; for students and non-residents, \$ 1.00.

MEMBER

MIDWEST FEDERATION OF MINERALOGICAL AND GEOLOGICAL SOCIETIES

* Deceased

BULLETIN BOARD

Feb. 28 --- Dedication and special dinner meeting - Schuneman's River Room.
Speaker : Miss Ruth Stephens.

Mar. 6 ---- Glaciers and Vegetation.
Dr. Wm. S. Cooper, Prof. Botany, University of Minnesota.

Mar. 13 --- Developement of Minnesota Soils and their Distribution.
Prof. Paul R. McMiller, Prof. of Soils, University of Minnesota.

Mar. 20 --- Exploration for Oil in the North Central States.
Prof. F. M. Swain, Associate Prof. of Geology, University of Minn.

Mar. 27 --- East and West Through North.
Dr. John C. Weaver, Prof. of Geography, University of Minnesota.

Apr. 3 ---- Recent Investigations of Tree Ring Analysis.
Dr. W. S. Glock, Prof. and head of Dept. of Geology, Macalester College and lecturer in Botany at the University of Minnesota.

Apr. 10 --- Color Pictures, Grand Canyon, Black Hills, Colorado.

Apr. 17 --- Field Trip Lecture.
Mr. Chas. H. Preston, President of Midwest Federation of Mineralogical and Geological Societies and Past President of Minnesota Geological Society.

Apr. 24 --- Annual Banquet. "Oceanography".
Dean A. F. Spilhaus, Dean and Prof. Institute of Technology University of Minnesota.

SPECIAL NOTICE

Dr. Ben Hur Wilson of Joliet, Ill. will be the speaker of the evening at the annual banquet of the Minnesota Mineral Club on March 11th at 8 o'clock in the Curtis Hotel Solarium. Dr. Wilson is widely known throughout the United States as a mineralogist and is listed in Who's Who in America. He is also co-author of the popular book "Quartz Family Minerals."

The Minnesota Mineral Club extends a cordial invitation to the members of the Geological Society of Minnesota to attend either the banquet or the lecture which will begin at 8 P. M. No charge is made for the lecture. Tickets for the banquet are $ 2.50 and reservations can be made by phoning Mr. H. T. Perry, KE 1309.

NATIONAL CONVENTION JUNE 28-29-30. Plans for the National Convention of the American Federation of Geological and Mineralogical Societies to be held in Milwaukee in June are progressing with alacrity. The Midwest Federation is to be the host of this great convention for the first time. It is our responsibility to make this convention a huge success. One of the greatest displays of minerals and polished stones will be shown. Many noted speakers will address us and some interesting side trips are being arranged.

The Minnesota delegation will combine this convention with a weeks interesting field trip in southern and eastern Wisconsin. Bus fare for the entire nine day trip will be not more than $ 20.00. Many interesting stops will be made.

Mr. Perry of our Society and Mr. Bingham of the Minnesota Mineral Club are working on the arrangements for displays. Displays will be brought in from all over the country. Remember these dates, June 28, 29 and 30 and the field trip in connection. Plan now to attend.

Chas. H. Preston,
President Midwest Federation.

NOTICE TO AFFILIATE SOCIETIES OF THE MIDWEST FEDERATION - - - We hope that each Society in the Midwest Federation will assume the responsibility of obtaining enough small specimens of their local minerals to be used in grab bags to be given to each registrant at the convention. It is not necessary that these specimens be large or of any great value, but they will, we hope, please our other Federation members. Mr. Montague suggests 1500 to 2000 specimens if possible. He has appointed a committee to arrange and catalogue the specimens for the grab bags.

We also hope to use small crystal and minerals on place cards for the banquet. If your Society can provide colorful minerals or crystals we will appreciate your donation to the specimens. All the materials should be small, as we will try to include materials typical of our entire mid-west on the place cards. We will need about 1000 or 1500 of these specimens.

We will appreciate your cooperation in furthering the interest of other regional Federations in our mid-west minerals. Specimens or correspondence on the material should be sent to Marjorie A. Scanlon, Marquette Geologists Association, 8403 S. Langley Avenue, Chicago 19, Ills.

(Signed) Marjorie Scanlon.
Approved by J. O. Montague,
General Chairman.

AN INSIGNIA CONTEST for lapel buttons, car stickers, etc., has been sponsored by the Midwest Federation to be used at the 3rd National Convention of the American Federation of Mineralogical Societies to be held at Milwaukee, Wis. June 28, 29 and 30, 1950. Design specifications are :

a. Drawn in black ink on 8½ by 11 inch white card, (or on heavy white paper), and mail flat.
b. Design to be simple, in order that it may be readily distinguishable when reduced to lapel button size.
c. Design to incorporate the initials A. F. M. S.
d. Overall size of design to be 5 by 5 inches and centered on the 8½ by 11 inch card.

Send all entries to MR. RICHARD M. PEARL, Colorado College, Colorado Springs, Colo. Mail entries before midnight, April 30, 1950. Be sure your name and address and "COLORADO MINERAL SOCIETY" are printed clearly on the back. Winners will be announced and awards made for first and second place at the Convention in Milwaukee.

In all scientific investigations, one factor always crops up which defies analysis. That factor is time. What is time ? What is its composition, if it has composition ? What is its motion or speed, if it has motion or speed ? Where is it ? Whither does it go and whence does it come ? Can it change tempo or direction ? These and other questions about time elude scientific answer.

Man, the scientist, in his insatiable urge to fathom life's mysteries, has constantly sought to reduce the universe to its elementals. He tries to discover and explain the nature of the forces about him. He seeks after truth ; and truth, to him, is an understanding of the natural and universal laws. He studies the substance of the universe and tries to reduce it to its simplest terms and to measure the qualities that give each its individuality. He must know what forces they create and what force acts upon or within all things. To do this, science is ever alert to devise finer instruments of measurement, probes for peering deeper and newer and more complex mathematical formula to to explain what he already has learned and to chart the course to knowledge not yet learned. In all of the scientist's investigation, either in the laboratory or in his mathematical deliberations, all things are accepted as objectively real - having existence outside himself. He becomes aware of these things through perceptive sensations from without. This is true of everything but time. Man has no sense organ to feel time. He only knows it exists by some inner awareness. He cannot prove its existence but his consciousness makes him certain; and our scientist insists therefore it must exist. Not only is he certain of its being but all his reason gives it motion and direction - not in space to be sure but in time. Here we come to our first peculiarity of time, that it moves within itself with apparently no reference to any other frame of observation. This much we seem to get from some inner revelations.

Why can we not investigate time objectively ? We can see and feel a stone ; we can weigh it in a balance ; we can determine its mass ; we can analyze its chemical components. We can determine where it lies or its relative position in space. We can throw it and measure its velocity, its direction, its acceleration and deceleration, and even explain its gravitational fall to earth. If it were made of iron we can calculate the electricity generated as it passed through the earth's magnetic field for we know that the atom iron possesses properties of magnetism and we have learned many of the laws that govern this force.

Whatever course the investigation of our stone takes, the factor of time must be a part of our calculations ; the time its crystals needed to be formed under a set of circumstances ; the time of its flight when thrown ; the time of its fall. And this time we cannot perceive and can but crudely measure.

Our language is full of references to time. "Time drags." "Time flies." "Time stands still. "Time passes." these are but a few. Where do we get these peculiar notions of time ? The scientist can exert no force to act on time, no chemistry to analyze or syenthesize it. The laws of physics do not effect it ; it is not changed by heat or slowed by cold. It has no mass and bears no relationship to quantity or units. Magnetism and radiation do not affect it

No physicist has dared to propound a wave or mechanical theory of motion to it. All we can say is that time is, is entire and indivisible and must be from the beginning to the end.

Time is used as a measure in many places and under many conditions. But how can we measure time ? Clocks are but crude measurements of the speed of the earth's rotation and calendars but crude measurements of the speed in our orbit around the sun. These are an estimation of time from speed and distance factors. Is time then a coefficient of motion and distance ? Motion and distance are relative factors having reality only in a given plane of reference. Time seems absolute. In our present knowledge, it is to the speed of light that we ascribe an absolute value. Is the speed of light then the measure of time ? Again, radioactive substances disintegrate at a fixed rate albeit that this disintegration is by a series of jerks rather than a smooth even process. The rate of break-down is fixed and constant. It is affected neither by physical or chemical consideration. Time alone is the measure of this break-down rate. May we not use the break-down as a measure of time ? In some fields of scientific investigation, we do just that ; as the modern geologist does in measuring the age of certain rocks. Even in this last sentence we introduced another concept. Is age a quality of time ?

We have spent some time now discussing the measurement of a factor known as time ; but have we come any nearer to an understanding of what it is ? Our consciousness tells us that time passes or moves, but even more that, it has a fixed direction. Yesterday came before today and tomorrow must follow. It is unconceivable that the reverse can be true. Scientific calculations, however, do not give to time a fixed directional flow. All the equations conclude it should be able to go forward or backward. Even this concept, of forward and backward, allows for movement in only one plane. Since we do not know anything of time we really cannot decide whether its movement cannot also exist in two, three or even ten dimensions.

All reason objects to any backward flow of time. The scientist, who is usually a reasonable creature, has injected the time symbol (-1) - the square root of minus one - into all his equations to give to time a constant forward direction. Yet all sciences, except biology, would indicate that time is reversible. This idea is obnoxious to the biologist. Scientists being biological animals have also found an uncertain direction in time, offensive. They arbitrarily give it a positive direction. Albert Einstein, in the evolution of his Theory of Realtivity uses time as a fourth dimension. If time is thus a dimension, then it can have no direction of motion. Planck showed as one of the conclusions of his Quantum Theory, that nature apparently proceeds by a series of jerks. Our impression of time is t at it flows smoothly. It is probable that our perception of time is faulty.

We do not see the continuity in time. We see rather as a series of jerks. We see like a motion picture camera - picking up a series of instantaneous nows. We do not see the past or future. We can get some idea of what vision in time would be like from viewing the streaks over a photographic plate exposed for a long period in view of a moving object. Such a picture, taken at night, of the headlights of moving cars appears as a pattern of white swirling streaks. Thus, if we could view someone in time's fullness, that person would appear as a long undulating worm, small at the birth end, swelling through maturity and shrinking away in death.

Man does not possess such a vision but he can grasp such an idea. In the study of our universe, an all inclusive concept must be hypothocated. Such a vision must be owned by whatever God there be, as part of his powers. I would not be so presumptive as to define or limit these powers. I would not dare to limit Him to my vision or my image. In contemplation of the universe, it is evident that it is still in the making. Dare we relegate that Power to dotage by an implication that He finished His work and purpose, and now sits back, drowsily contemplating this thing already wrought. On the contrary, we must assume that God is still busily engaged in the completion of His experiments.

In the final analysis, time, to us, is the change in the relationships of the various components of the universe in relation to each other. They are ever being more thoroughly mixed, moving to what the physicist calls Entrophy. When all the parts shall be so thoroughly mixed, that any further mixing can no longer change their relationship, time will cease and the experiment be completed, or perhaps have come full circle, to be started anew.

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TEST YOUR IMAGINATION ON THIS : Let 20,000 years represent one hour on your clock. Now set the clock at 12 noon. Then - The time of the Egyptians would be just 20 minutes ago. Christ was born just 6 minutes ago. The art of printing is 1 1/2 minutes old. Columbus discovered America 1 1/4 minutes ago. The United States is only 30 seconds old. And World War I ended just 4 1/2 seconds.

GEOLOGICAL SOCIETY OF MINNESOTA
Mrs. Mary Lupient, Treasurer,
212 Bedford St. S. E.
Minneapolis 14, Minn.

APPLICATION FOR MEMBERSHIP.

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ADDRESS : ....

PHONE : ....

BUSINESS : ....

I ENCLOSE HEREWITH MEMBERSHIP FEE OF $ ....

THE SEARCH FOR URANIUM

by
W. S. SAVAGE.

Ontario Department of Mines

Part three of a three-part article.

Note : Published by permission of the
Deputy Minister, Ontario Department of Mines.

OTHER CONSIDERATIONS IN PROSPECTING

The first step in planning to prospect for radioactive minerals is to become familiar with the regulations affecting new discoveries and marketing. These regulations are set down in a series of leaflets issued from time to time and published in the press. Permits must be obtained from the Atomic Energy Control Board before proceeding with any development work other than that required for making a discovery. Until March, 1955, the Canadian Government guarantees to purchase acceptable uranium bearing ores or concentrates at a minimum rate of $ 2.75 per pound of contained U3O8 f.o.b. rail. The ores or conenctrates must normally contain a minimum of 10 per cent by weight of U3O8, but under special circumstances consideration may be given to payment of a higher price or to acceptance of concentrates of lower grade.

A prospector should realize that many of the common radioactive minerals do not carry 10 per cent U3O8 even in the pure form, and it is therefore not possible to produce a 10 per cent concentrate. It is also important to bear in mind that the concentrate must be acceptable to the Government, and it is highly improbable that they would accept a complex ore made up of several minerals, which could not be treated by existing methods. Today, however, many of our large gold mines are operating on ore bodies that formerly were not of commercial grade, and it is safe to predict that methods will be developed to mine uranium deposits that are not now regarded as ore.

In prospecting for radioactive minerals, it is necessary to consider future possibilities as well as present conditions. With further advances in the commercial use of atomic power, certain minerals now considerd undesirable might become valuable, and the over-all demand might result in an increased price for concentrates. On the other hand, intensive prospecting for radioactive minerals with the aid of the Geiger counter is in its infancy. It is possible that major discoveries of pitchblende will be made, which could result eventually in lower rather than higher prices for concentrates.

No provision is made at present for purchasing concentrates of thorium bearing minerals. To date it is not possible to release nuclear energy from thorium, and thorium can be obtained at a relatively low price for other purposes from the extensive beach deposits of India, Brazil and Australia.

AREAS FOR PROSPECTING

While it is possible to offer some advice in directing the search for radioactive minerals, it would be unwise to eliminate any areas on the basis of present knowledge. The intensive search for radioactive minerals now being carried out with the assistance of the Geiger counter has already produced results under a wide variety of geological conditions.

Experience to date suggests that uranium deposits are genetically associated with acid igneous rocks. A large variety of radioactive minerals has been found in pegmatite dikes, but they generally occur as disseminated crystals. No ore bodies of commercial grade have been located in pegmatite dikes in Canada.

A. H. Lang points out that the Canadian shield contains the most important uranium deposits so far discovered in Canada and, consequently, appears to offer the most favourable areas for prospecting. The distribution of the known occurrences in the shield is interesting, for practically all of them are near its western and southern margins.

Reference to the geological map of Canada (820A) of the Geological survey of Canada will show that the uranium deposits at Great Bear Lake, the occurrences in the giant quartz vein belt between that lake and Great Slave Lake, and the discoveries at Lake Athabaska and Lac la Ronge are all in the western edge of the shield. Farther east, the pegmatite area of southeastern Manitoba, the Lake Superior region, including the recent pitchblende discovery at Theano point, and the pegmatite belt extending from Georgian bay to the Saguenay region, are all in the southern margin of the shield. Two explanations can be suggested for these geographical relationships, both of which may be valid to some extent. The first explanation is related to accessibility, for there can be little doubt that the proximity of these discoveries to large bodies of water or other aids to transportation has influenced their discovery ; consequently, when the entire shield has been well prospected the pattern of uranium discoveries may be greatly different. On the other hand, it has been fairly clearly established that different metals tend to occur in different parts of the shield, sometimes referred to as metallogenic provinces. Many of the pitchblende deposits occur in late Precambrian rocks that have been folded, and these deposits may be considerably younger than many of the gold and base-metal deposits occurring in the shield. The fact that most of the known belts of folded late Precambrian rocks are near the edges of the shield may, therefore, be partly responsible for the distribution of pitchblende deposits.

At Eldorado (Great Bear Lake), the pitchblende occurs in sheared zones cutting metamorphosed sediments and diabase in the vicinity of a large body of granite. The sheared zones strike northeastward and dip north. A considerable amount of silver accompanies the uranium ores. The principal gangue minerals are quartz, carbonate, and hematite. Pitchblende occurs most commonly as persistent, lenticular veins a few inches wide or as a lacing network of stringers with some coarse dissemination. In some cases the pitchblende was later broken up and brecciated, and the fragments re-cemented by quartz. The ore bodies, as far as tonnage is concerned are generally believed to be the richest known.

The so-called "giant quartz veins," which are a conspicuous feature of the northwestern part of the Canadian shield, are large quartz stockworks consisting of a network of quartz stringers with the interveining rock commonly replaced by silica. In places, these bodies have been reopened by fracturing and mineralized by later quartz, hematite, and pitchblende. In some of these deposits the pitchblende is too sparse or too scattered to be of interest, but others in the area north of Great Slave lake are being developed in the hope that minable ore bodies may be outlined. If these efforts are successful, numerous other "giant quartz veins" that may be prospected will be found indicated on geological maps.

One of the uranium deposits in the Northwest Territories consists of beds of dolomite containing considerable amounts of hematite and some uranium and thorium. Work is being done to test the size and grade of the deposit and the nature of the radioactive minerals and to decide whether these minerals are original constituents of the sedimentary rock or whether they were introduced after the formation of the rock. Until these questions are settled, prospecting for other deposits of this kind cannot be specifically recommended.

The uranium deposits near Wilberforce, Ontario, occur in a band of sedimentary gneiss much invaded by pegmatite dikes. The uraninite occurs as well-formed crystals and as nodular lumps of pitchblende, often coated with various alteration products, including gummite, autunite, and torbernite.

The Cordilleran region in the West ranks next to the Canadian shield in the occurrence of metalliferous deposits in general and of uranium-bearing deposits, but none of the latter has yet been developed to the producing stage. Uranium has been found at several widely scattered localities in British Columbia, the most important discoveries to date being in deposits that had been developed previously because of the occurrence of other metals. The discovery that has attracted greatest attention is at the Gem property in the Bridge River district. The uranium at this property is associated with lenses of an iron-cobalt sulpharsenide mineral in altered granodiorite.

It is unlikely that any commercial deposits of secondary uranium minerals will be found in the Canadian shield. The glaciation that scoured most of the country during the last Ice age removed any accumulations that might have existed prior to that date, and there has not been sufficient time since the Ice age for any sizable bodies to accumulate.

The rich uranium ore in the Belgian Congo is pitchblende accompanied by chalcolite (torbernite), curite, and kasolite. The last two are more or less peculiar to the district. The pitchblende occurs in veins with the torbernite and associated minerals adjacent to the walls. The veins are narrow, branching, and very irregular in strike, dip, and thickness. The country rocks are sedimentaries, which have been highly metamorphosed.

In South Africa, pitchblende has been found to occur in the "banket" or gold bearing conglomerates of the Rand, and it is reported to be associated with graphitic material in the ore.

Uranium is recovered in Sweden from oil shales that carry radioactive minerals in thin beds consisting of coal-like nodules called "kolm". The U3O8 content is low, but when the "kolm" is burnt, the uranium content is considerably higher in the ash.

These few examples, chosen from numerous others throughout the world, serve to demonstrate the varied mode of occurrence of radioactive minerals and show the wide field of possibilities that exists in the search for uranium ores.

REFERENCES :

"Prospectors' Guide for Uranium and Thorium Minerals in Canada," Bureau Mines, Department Mines and Resources, Ottawa.

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