THE MINNESOTA GEOLOGIST

OFFICIAL BULLETIN
OF
THE GEOLOGICAL SOCIETY OF MINNESOTA

VOL III JANUARY 1948 NO 1

contents

GEOLOGICAL SOCIETY OF MINNESOTA

631 SECOND AVENUE SO.
MINNEAPOLIS 2, MINN.

Our Society is devoted to the study of GEOLOGY and MINERALOGY for their cultural value.

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Edward P. Burch

PAST PRESIDENTS

Junior F. Hayden
Alger R. Syme
Charles H. Preston

MEETINGS: OCTOBER to MAY inclusive our Society meets every MONDAY evening, not a holiday, in the large auditorium on the 4th floor of the Public Library at Hennepin Avenue and 10th Street, Minneapolis, Minnesota, at 7:30 o'clock P.M.

JUNE until SEPTEMBER, inclusive, we have a program of field trips. Visitors are very welcome, always.

ANNUAL DUES: Residents of Hennepin and Ramsey Counties $3.00 plus $1.00 additional for your wife, husband, or dependent family members; for students and those residing elsewhere, $1.00.

DINNER MEETING. It seems to be the general opinion that our January 14th dinner meeting was one of the most successful meetings of that kind the Society has ever held. Mr. Zalusky, our President, did a bang-up job of presiding. Mr. McHeathy's memorial to Mr. Burch was skillfully conceived and presented. He fitted pictures, poetry, and personal tribute neatly together into a perfect picture. Practically all of his slides were masterpieces of color. Dr. Mandell was erudite enough to suit the most fastidious. His thought and ideas were thoroughly enjoyed by all. Miss Hinchley eulogized Mr. Burch, and Mrs. Mabel Williams spoke with great credit to themselves. The Society is greatly indebted to the Burch family, Miss. Noernberg Dr. Schwartz, Mr. Zalusky, Geroge Rickert, Charles Preston, Mrs. Freeman, and others for donating many beautiful rock and mineral specimens for the auction, which netted $38.35. The time allotted for the auction expired with many fine specimens left unsold. These will be offered at a later time. The faculty of the Geology Department of the University were our guests and we very much enjoyed having them, as usual. The evening was closed with a showing of several reels of motion pictures on "Petroleum."

THE DEPARTMENT OF GEOLOGY has added two new members to its faculty. Dr. W. C. Bell who will teach Paleontology and Dr. Robert P. Sharp whose specialty is Glaciation. Mrs. Sharp is also a geologist in her own right. We are very glad to welcome both Dr. Bell and Dr. Sharp as honorary members of our Society.

CRYSTALLOGRAPHY. Dr. Gruner has agreed to teach a class in Crystallography during the next semester of the Extension Division provided enough of us can show sufficient interest to take the course. Crystallography is not an easy subject, but some knowledge of it is essential to an understanding of mineral crystals. If you desire information, or if you would be interested in promoting such a class, please communicate immediately with Dr. Gruner or the Editors. Dr. Gruner will teach this class as a personal favor, upon our request, without insisting on the stated minimum number.

ATTENDANCE. The average attendance at our lectures so far this year has been very good and almost equals that of last year. The average has been 82.

MODELS. The committee who dug up and hung on the walls of our lecture room the 60 Burch models, which you have observed, is certainly entitled to the commendation of the Society. These are worthy of a lot of study. To complete the exhibition, however, we now need someone to step forward and write a suitable explanation to accompany each model. That is a real task, but we dare venture the thought that if someone will undertake it, that they will feel well repaid for their effort even though it will undoubtedly take considerable time.

BOOKS. We have sold more than 75 copies of Dr. Willard's book on the "Story of the North Star State." These books are on sale at $2.50 at one of our leading department stores in Minneapolis. We still have a few for sale at $1.50 a copy, or if you prefer to think of it in another way--we will give you a copy of the book if you will donate $1.50 to the expense of printing this Bulletin. We also have a few copies of Dr. Willard's book on the Geological Story of North Dakota as well as Montana. These sell at $2.00 per copy. We will fill your order by mail if you will enclose 10¢ additional for postage.

The following paragraph will be repeated with each set of Paleogeographic Maps. These maps, except those of Europe, were copied from Schuchert, as modified by Miller and other authors, and illustrate various invasions of the sea upon the continent. In past ages, responsive to great forces, the surface of the continents rose, and fell again, many times. When the surface sank below sea level, the sea covered great areas of the land. The processes of erosion continued to wear down the land remaining above sea level, and the resulting material was deposited in the sea, to become sedimentary rock. Thus, large areas of the continent have come, in time, to be covered with great layers of limestone, shale and sandstone. By a study of the area covered by these rocks, geologists have been able to outline, in a general way, the limits of the various invasions by the sea. These seas are known as "Epeiric" and "Epi-Continental" seas. That is, they were seas upon the continent, as distinguished from the abysmal depths of the ocean. They were never very deep, probably not much over 600 feet, yet many thousands of vertical feet of material was collected in many places in these seas, because the weight of the accumulated material caused the floor of the sea to gradually sink, as new material was added. Forty to fifty thousand feet of material was not uncommon, in the great sea troughs.

THE CRETACEOUS PERIOD

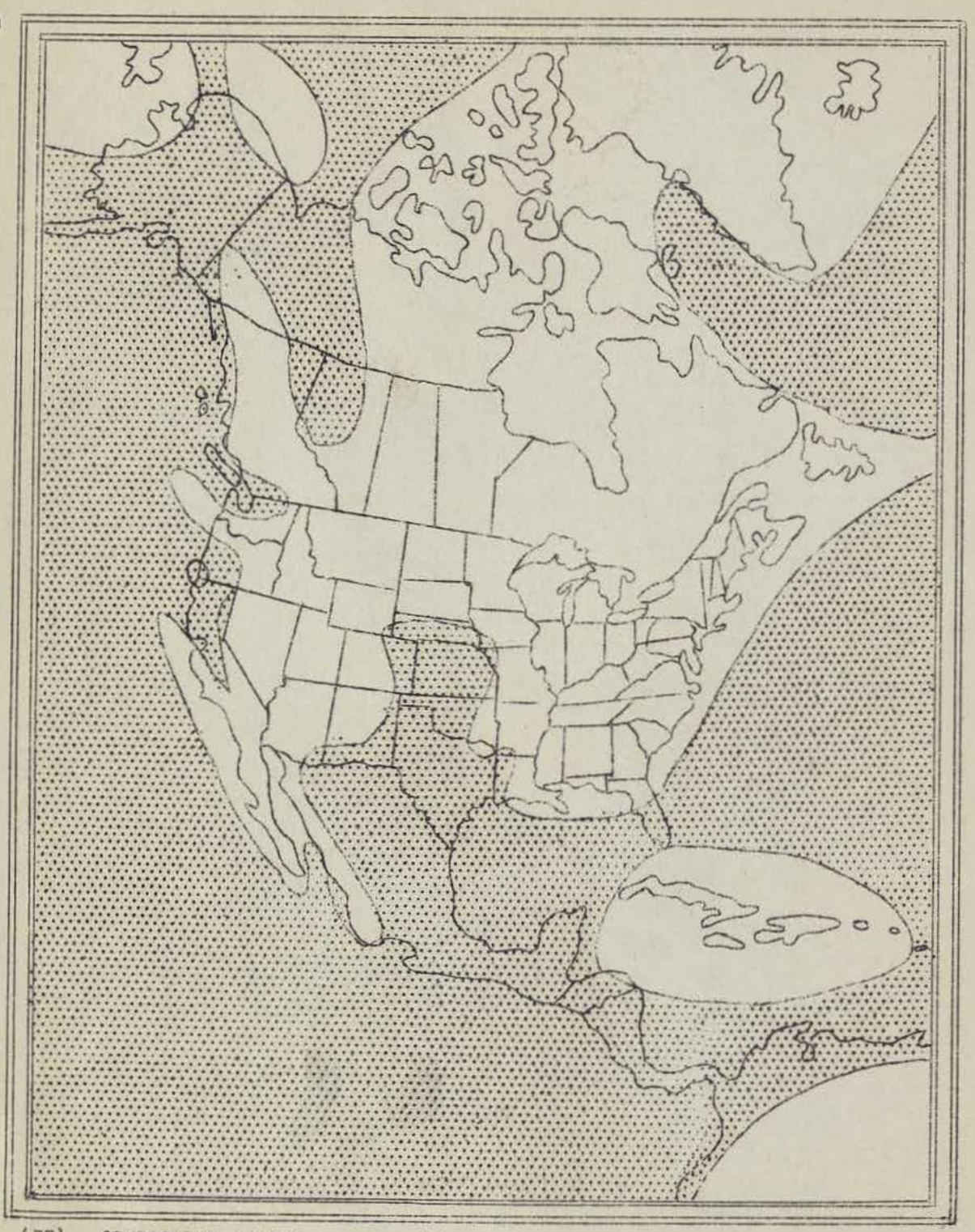
The Cretaceous period is one of the really great periods of all geologic time. If for no other reason, it is entitled to this prominence because it closed the whole Mesozoic Era. The Laramide Revolution at that time gave birth to the Rockies and destroyed, therefore, the great Cordilleran Geosyncline, into which sediments had been washed and deposited through most of prior geologic time. Upper Cretaceous was a period of great flooding and probably the greatest in all geologic history. In North America the seas covered the area from the Arctic to Southern Mexico, and from the Pacific Coast almost to the Mississippi River.

In India and Arabia, during Upper Cretaceous time, occured the most colossal eruptions known to geologists, covering over 200,000 square miles.

The climate, though cooler than some periods, was not cold but fairly mild. There were vast areas of swamps which later formed great quantities of coal. On the whole the climate was quite temperate.

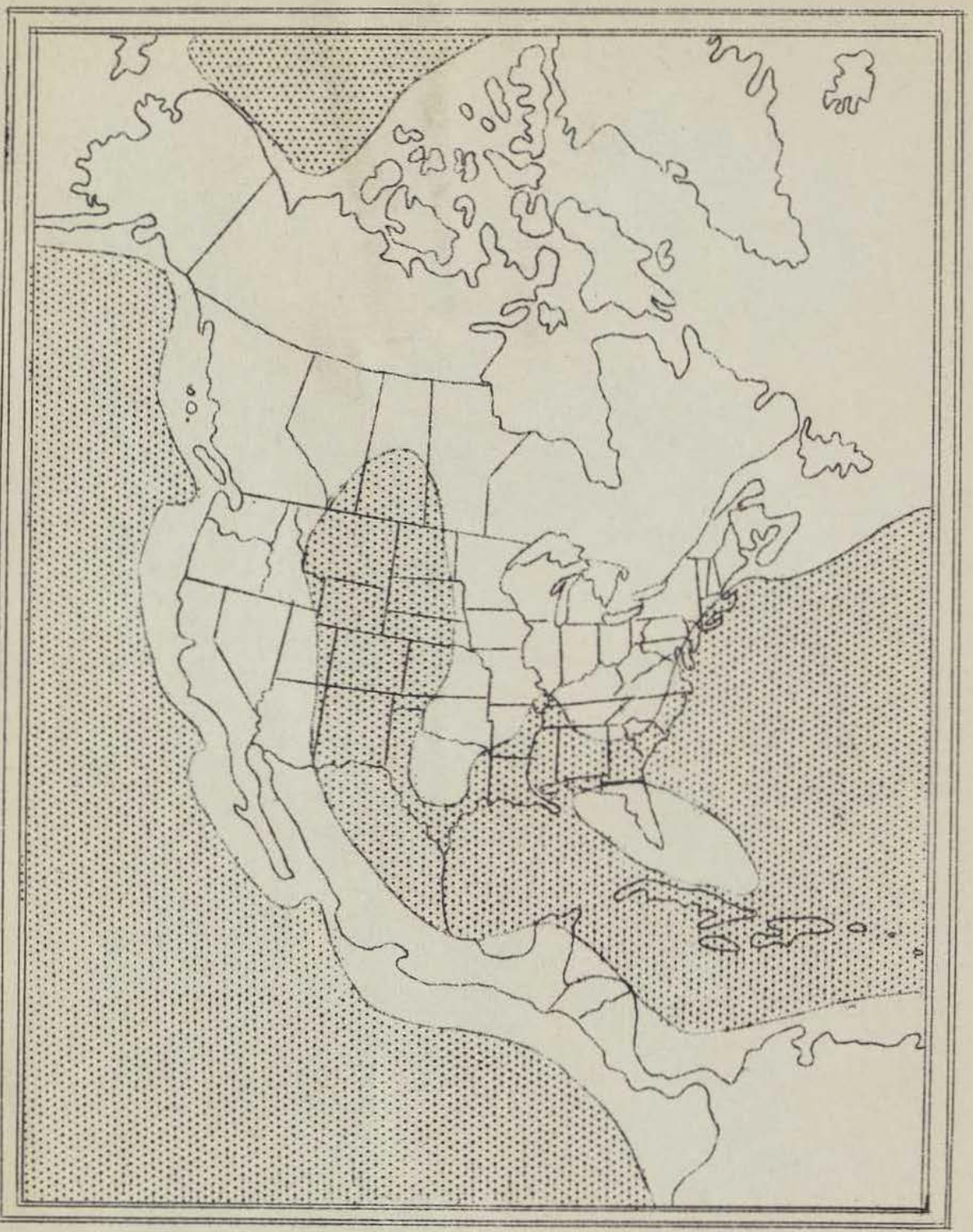
There were great events recorded in both animal and plant history. The dinosaurs completely died out during this period, reptiles however continued to dominate both land and sea during most of the period. Scaled reptiles appeared. The flying reptiles reached their climax. At the very close of the period, the modern mammals began to appear including the five genera of primates, the stock from which man was ultimately to rise.

This was the period also in which the flowering plants began to appear, the anziosperm flora often called an event as important in the plant world as that of man in the animal world. Fruits, grasses, and cereals were at hand, as was also great hardwood forests. Nature was beginning to prepare the earth for man. It marked the beginnings of modern life in both the plant and animal kingdoms.

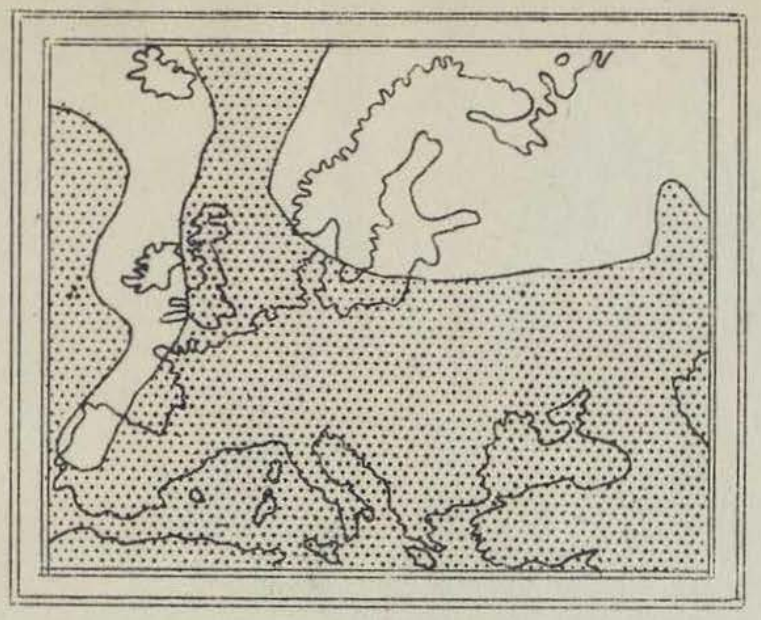


(37) CRETACEOUS- EARLY (SCHUCHERT, MODIFIED; STIPPLED AREA IS SEA)

(38) CRETACEOUS- MIDDLE (SCHUCHERT, MODIFIED; STIPPLED AREA IS SEA)



(39) CRETACEOUS- LATE (SCHUCHERT, MODIFIED; STIPPLED AREA IS SEA)



(40) EUROPEAN- CRETACEOUS (MILLER AFTER SCHAFFER)

"OUT-OF-TOWN" MEMBERSHIP

If you reside outside of Ramsey and Hennepin Counties, Minnesota, you may become a member of our society by payment of the annual membership fee of $1.00.

You will receive a membership card, all notices of our activities, including meetings, lectures, field trips, etc., and the Bulletin of our Society, The Minnesota Geologist, which is published eight times during the year.

Mail the following application to the Society's office with check or currency for $1.00.

"OUT-OF-TOWN" MEMBERSHIP APPLICATION
GEOLOGICAL SOCIETY OF MINNESOTA
831 Second Ave. South,
Minneapolis 2, Minnesota

I enclose herewith $1.00 and apply for membership in your Society;

Name _____ (Print) Residence _____ (Print) Phone _____

Business _____ Business Address _____ Phone _____

_____ Signature

_____ Address

Graphite	Characterized by low S.G. (2.1, very low for mineral with metallic luster), greasy feel, and ease with which it soils fingers and marks paper. Distinguished from molybdenite by the brownish tinge to its gray-black color. (Molybdenite is blue-gray.) Graphite makes a lead gray streak on glazed porcelain, molybdenite makes a greenish streak.
Sulfur	The low S.G. (2.07), yellow color, lack of cleavage and brittleness are diagnostic.
Arsenic	Tin white color on fresh fracture, tarnishing gray to black. Usually in fine grained masses, with reniform or botryoidal surfaces, which often break into concentric or onion-like layers.
Antimony	Tin white color which does not tarnish readily. Commonly carries a yellow alteration product (antimony oxides). (H - 3 to 3 1/2; S.G. - 6.65; streak - tin white.
Realgar	The red to orange color and orange yellow streak are distinctive. Usually associated with orpiment. Distinguished from cinnabar by its lower S.G. and inferior hardness.
Orpiment	Characterized by its lemon yellow color, perfect cleavage in one direction, yielding flexible laminae, and association with realgar.
Stibnite	Commonly occurs in bladed or columnar aggregates. Characterized by one perfect cleavage parallel to the length of the blades, with a parting normal to the cleavage producing cross striations on the cleavage faces. Lighter in color than jamesonite and enargite. In disseminated grains its brittleness distinguishes from molybdenite.
Bismuthinite	Resembles stibnite closely. May be distinguished from stibnite by the absence of cross striations on the cleavage faces. Otherwise distinguished by blowpipe tests.
Molybdenite	Characterized by bluish lead gray color, greasy feel, foliated structure, and perfect cleavage in one direction yielding flexible, sectile laminae. Distinguished from graphite by much greater S.G., color and streak. (See graphite.)
Galena	Characterized by its high S.G. (7.5), perfect cubic cleavage and bright metallic luster.
Chalcocite	Commonly in compact masses showing conchoidal fracture. No cleavage. Is semi-sectile. Dark lead gray color on fresh surface (with shining metallic luster) tarnishing to dull black on exposure. Enargite has perfect cleavage; tetrahedrite is very brittle.
Sphalerite	Characterized by its highly perfect dodecahedral cleavage and resinous to adamantine luster. The dark varieties are distinguished by their yellow to brown streak on unglazed porcelain, and the reddish brown streak left on the specimen when scratched by a knife or needle
Alabandite	Distinguished by its olive green streak, perfect cubic cleavage and sub-metallic luster. Soluble in dil. HCL with evolution of H_2S. (Mnsh-3 1/2; S.G.-5.6; iron black on fresh surface, brown on weathered surface.)

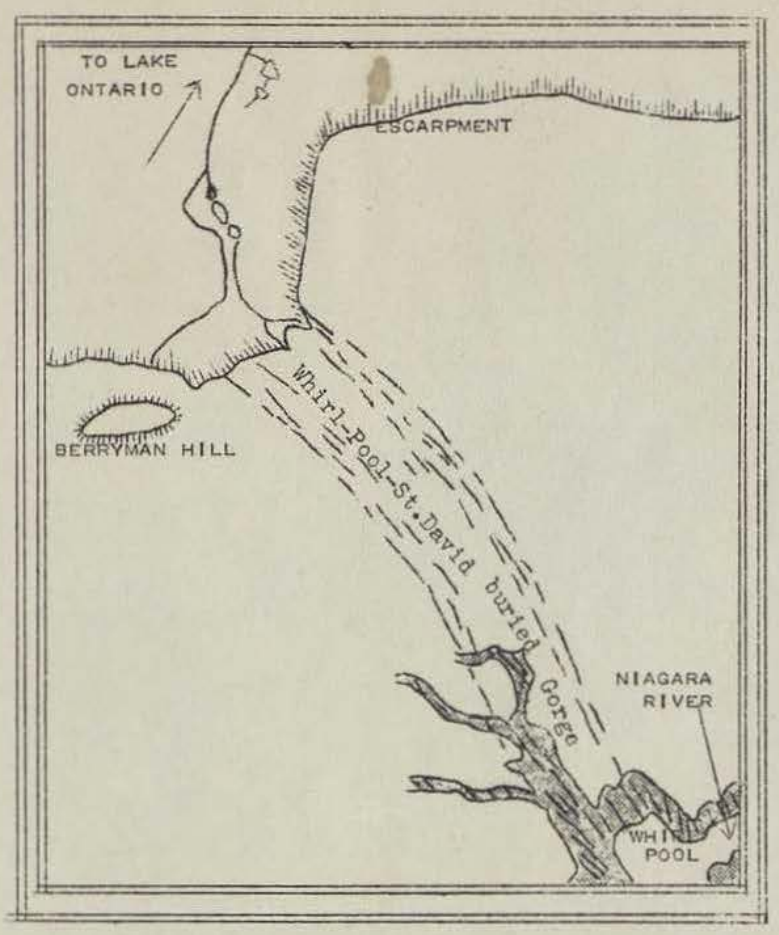
Cinnabar	Characterized by its scarlet to brownish red color, vermillion streak, high S.G. (8.10) and perfect cleavage.
Covelli Covellite	Characterized by its deep indigo-blue color, which becomes purple when moistened with water. Perfect cleavage in one direction. (Compare bornite.) (CuS; H - 1 1/2 to 2; S.G. - 4.68)
Millerite	Characterized by its pale brass yellow color, usually tinged with green, and its inferior hardness (3 1/2). Its fibrous structure is characteristic but not diagnostic since pyrite and marcasite may be fibrous. The latter are harder than a knife blade, however. (NiS; S.G. - 5.6)
Niccolite	Distinguished by its pale copper red color and high S.G. (7.3 - 7.5)
Phyrrhotite	Brownish bronze color and magnetic nature of its powder are characteristic. Pyrrhotite is softer than a knife blade (H-4), pyrite is harder than knife or glass.
Bornite	Characterized by its color which is between reddish bronze and copper red. Tarnishes very quickly to variegated purples and blues (peacock colors) and finally to almost black, so color must be observed on a fresh surface. No cleavage. (Compare covellite.)
Chalcopyrite	Distinguished from pyrite by its deep brass to golden yellow color and inferior hardness. (3 1/2) May be tarnished bronze or iridescent, therefore a fresh surface should be observed.
Pyrite	Crystals are commonly striated cubes, or pyritohedrons, less often octahedrons. Color is pale brass yellow, but may be tarnished to brass yellow or irisdescent (spectrum colors). Distinguished from chalcopyrite, pyrrhotite and millerite by its greater hardness (6-6.5, harder than knife blade or glass.)
Marcasite	Often in twinned crystals resembling cock's combs or spear heads. Its color is paler than that of pyrite and has a greenish tinge. It often has a fibrous structure, and may be in small tufted or rosette-like groups. Marcasite alters more readily than pyrite and commonly carries a friable white or greenish white alteration product, (melanterite), $FeSo_4 \cdot 7H_2O$) which has a disagreeable metallic taste.
Smaltite	When massive, smaltite resembles arsenopyrite very closely. Smaltite, however, has a bluish tinge to its tin white color, while arsenopyrite is commonly tarnished to a yellowish white.
Arsenopyrite	Sometimes in disseminated diamond shaped crystals, striated parallel to the short diagonal of the diamond. For distinguishing features of massive arsenopyrite see smaltite. Arsenopyrite is much more common than smaltite.
Jamesonite	Resembles stibnite somewhat but is distinguished by its fibrous rather than bladed structure, by its lack of distinct cleavage parallel to elongation, by its darker gray color and higher S.G. (5.7) ($4PbS \cdot FeS \cdot 3Sb_2S_3$; H - 2 - 2 1/2; color lead gray)
Tetrahedrite	Color ranges from flint gray to iron black. No cleavage (Enargite has perfect cleavage.) Fracture is very uneven, often giving the massive mineral a superficial resemblance to finely cellular coke. Streak is commonly black, but it may be reddish brown or even cherry red. Sometimes resembles chalcocite, from which it can be readily distinguished by its extreme brittleness (chalcocite is semi-sectile.)

Enargite	Commonly in columnar or granular masses. Characterized by its structure, perfect cleavage in two directions at 82°, and by its dark gray to black color. Its darker color, prismatic cleavage, absence of striations on cleavage faces distinguish enargite from stibnite. Black streak distinguishes from the dark varities of sphalerite. Cleavage distinuishes from chalcocite and tetrahedrite.
Talc	Perfect basal cleavage yielding flexible but inelastic laminae. When in compact masses the individual grains are usually so small that no cleavage can be seen. Characterized by its very soapy feel.
Gypsum	Cleavage in 3 directions yielding rhombic cleavage fragments with plane angles of 66° and 114°. Cleavage pieces are somewhat flexible. Characterized by cleavage, softness, low S.G. (2.32).
Calcite	Perfect rhombohedral cleavage (with plane angles of about 78° and 102°)
Fluorite	Characterized by its octahedral cleavage, yielding triangular cleavage fragments (60° plane angles). Specific gravity (3.18) is somewhat above the average for minerals with non-metallic luster. The optical properties of fluorite produce a luster which is very distinctive; compare fluorite with such minerals as calcite and quartz to become familiar with this luster.
Apatite	Scratched by a knife with difficulty. Color often uneven; often variegated green and brown. Crystal edges and faces often have a rounded and fused appearance. Imperfect cleavage (which may or may not be in evidence.) Greasy to sub-resinous luster.
Orthoclase	Two cleavages at right angles. Cleavage faces often traversed by narrow bands or veinlets of plagioclase (striated) feldspar.
Quartz	Prism faces of hexagonal crystals are usually striated horizontally. No cleavage. Conchoidal fracture. Vitreous luster.
Topaz	Perfect basal cleavage. High specific gravity (3.5)
Corundum	Characterized by its barrel shaped hexagonal crystals, unusually high specific gravity (4.0); basal and rhombohedral parting. The parting surfaces commonly carry two (sometimes three) sets of striations.

NOTE

From time to time we have published brief descriptions of various minerals and crystals. These descriptions are more or less "thumb nail" but many of them are in use in university class rooms and they have a very great practical value for amateur mineralogists if you use them. By matching the specimens with the description of the various minerals or crystals, you will soon acquire a considerable ability to identify the more common ones. Information such as is given above should be preserved for future use by anyone interested in acquiring some skill in identifying mineral and rock specimens.

The Editor



ST. DAVID'S GORGE

Well drillings show a great gorge once extended from the whirl pool rapids, northwestward to the Niagara escarpment. It was completely obliterated by the glaciers, causing the Niagara River to flow in a course to the northeast and to begin cutting a new gorge from Lewiston to its present location.

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