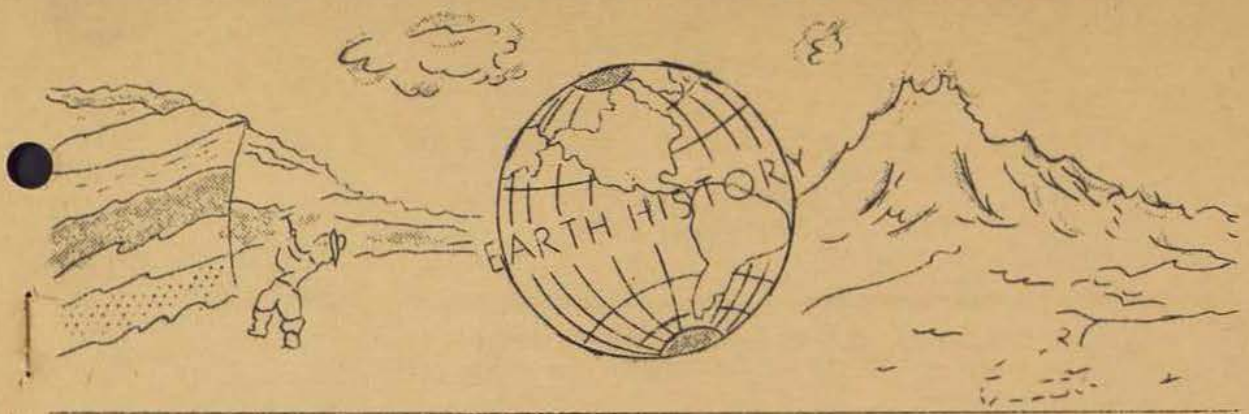

THE MINNESOTA GEOLOGIST

OFFICIAL BULLETIN

OF

THE GEOLOGICAL SOCIETY OF MINNESOTA

VOL. 11 FEBRUARY 1945 NO. 11

CONTENTS

GEOLOGICAL SOCIETY OF MINNESOTA

831 SECOND AVENUE SO.
MINNEAPOLIS 2, MINN.

THE GEOLOGICAL SOCIETY OF MINNESOTA is devoted to the study of GEOLOGY and MINERALOGY for their cultural value.

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Edward P. Burch
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Charles H. Preston

Meetings: 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., from October to May, inclusive. From June until September, inclusive, we have a program of field trips. Visitors are very welcome, always.

Dues: For those residing in Hennepin and Ramsey Counties are $3.00 annually, plus $1.00 additional for your wife, husband, or dependent family members; for those residing elsewhere, dues are $1.00 per person.

* EDITORIAL *

PROGRAM: Perhaps the most important information we have to give you at this time is the announcement of the program for the remaining portion of the lecture season. A copy of this program has already reached most of you, and we are sure that you will find it most attractive. If you have a friend whom you think might be interested in our lectures and work, why not invite them to attend one of these lectures with you.

DIRECTORY: Another important item, which you have also received by this time, is a complete directory of our members, showing the name, occupation, street or office address, and telephone number of each member. There are 191 of them. The compilation of this directory involved a tremendous amount of work. Checking, rechecking, etc., seemed to consume much time. Nevertheless, errors are bound to occur , and if there should be a mistake, please notify us at once, preferably by postal card, so that we can correct it next time it is printed.

FIELD TRIPS: It is not too early to be thinking of a program of field trips for the summer months. If you have any suggestions, please communicate them to one of the officers, or directors.

DR. THIEL'S last lecture in the present course will be given on February 26. To say that this has been a wonderful course of lectures, and that it has been enjoyed by every one of us, is like trying to prove a proposition that is accepted by everyone as already proven. The average attendance at these lectures has been over 90. We can add, however, that it is not only the information that Dr. Thiel gives us, but the inspiration to continue our interest in the subject, which so much appeals to us. Thank you very much, Dr. Thiel!

MINERAL CLASSIFICATION: Included in this issue is a classification of 50 of the more common minerals. If you are able to identify these minerals, you have a good, everyday knowledge of ordinary rocks. This is the classification that is in use at the University of Minnesota, and it gives you the physical characteristics of these minerals, in such a way as to enable you to really tell what they are. We suggest that you start a collection of these minerals, using this classification for identification. You will find it interesting, and not too difficult, especially with a little side reading. Also, if you already have a number of these rocks, you can make an attractive display card from this information. Anyway, we thought enough of it to have it printed for your use.

OPTICAL MINERALOGY: There is still room for one or two more in Dr. Gruner's class on this subject, if you will enroll at once. The class meets at 6:20 P.M. every Thursday night in the Geology Building at the University. The registration fee is $10.00. You can register at the University or at 690 Northwestern Bank Building, Minneapolis, or at 500 Robert Street, St. Paul.

FEBRUARY'S STONE is the amethyst.

GEOLOGY LESSON: Let us know how many geologic events you were able to find.

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.

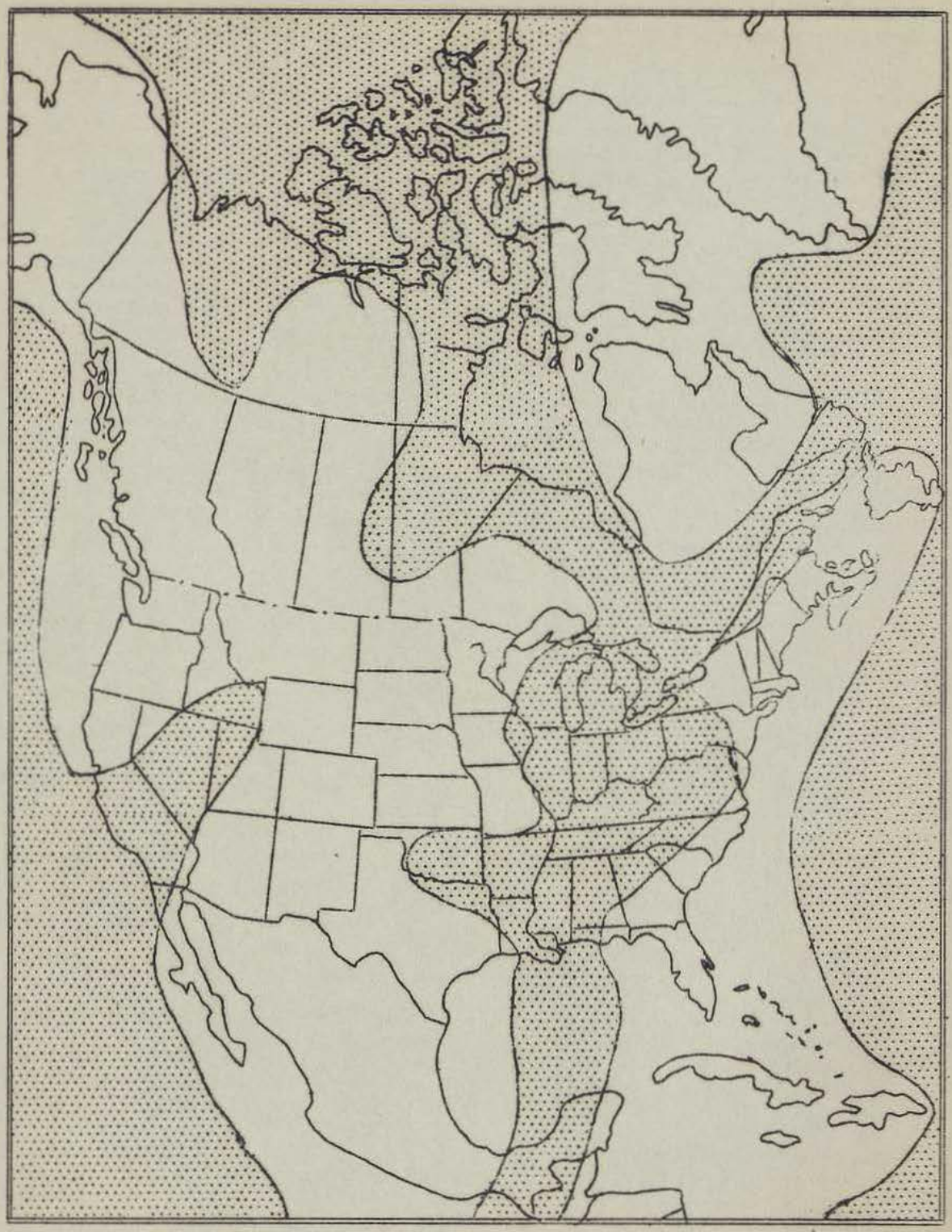
THE SILURIAN PERIOD

The following Paleogeographic Maps show invasions of the sea of this period, as follows: Map No. 9, Lower Silurian, Map No. 10, Middle Silurian, Map No. 11, Upper Silurian, Map No. 12, Europe During Middle Silurian Time. During this period, the continent again stood a little above sea level, with uplands along the margins, only. The probable duration of the period was 40 million years. The climate was uniformly mild, and even over the continent. Life in the sea was very abundant.

During the preceding period, the Ordovician, there occurred a geologic event of the greatest significance, namely, the first signs of vertebrate life. This is evidenced by the finding of fossil remains of broken plates and scales from a primitive fish of a very ancient group, the "Ostracodermi". These primitive vertebrates were the vanguard of a vast group of creatures, which today include all the highest forms of life. The remains found in the Ordovician are so fragmental, that a reconstruction of the species has been impossible, and it remained for the Silurian Period to furnish us with a model of their likeness, for they developed and flourished in the genial climate of the Silurian Age.

Another great event, for which we are indebted to the Silurian, is the first appearance of land plants. The direct evidence is scarce, and consists of a few broken pieces of stems and leaves. The abundance of land vegetation which developed in the succeeding Devonian Period makes it seem probable, however, that their ancestral forms developed during the Silurian.

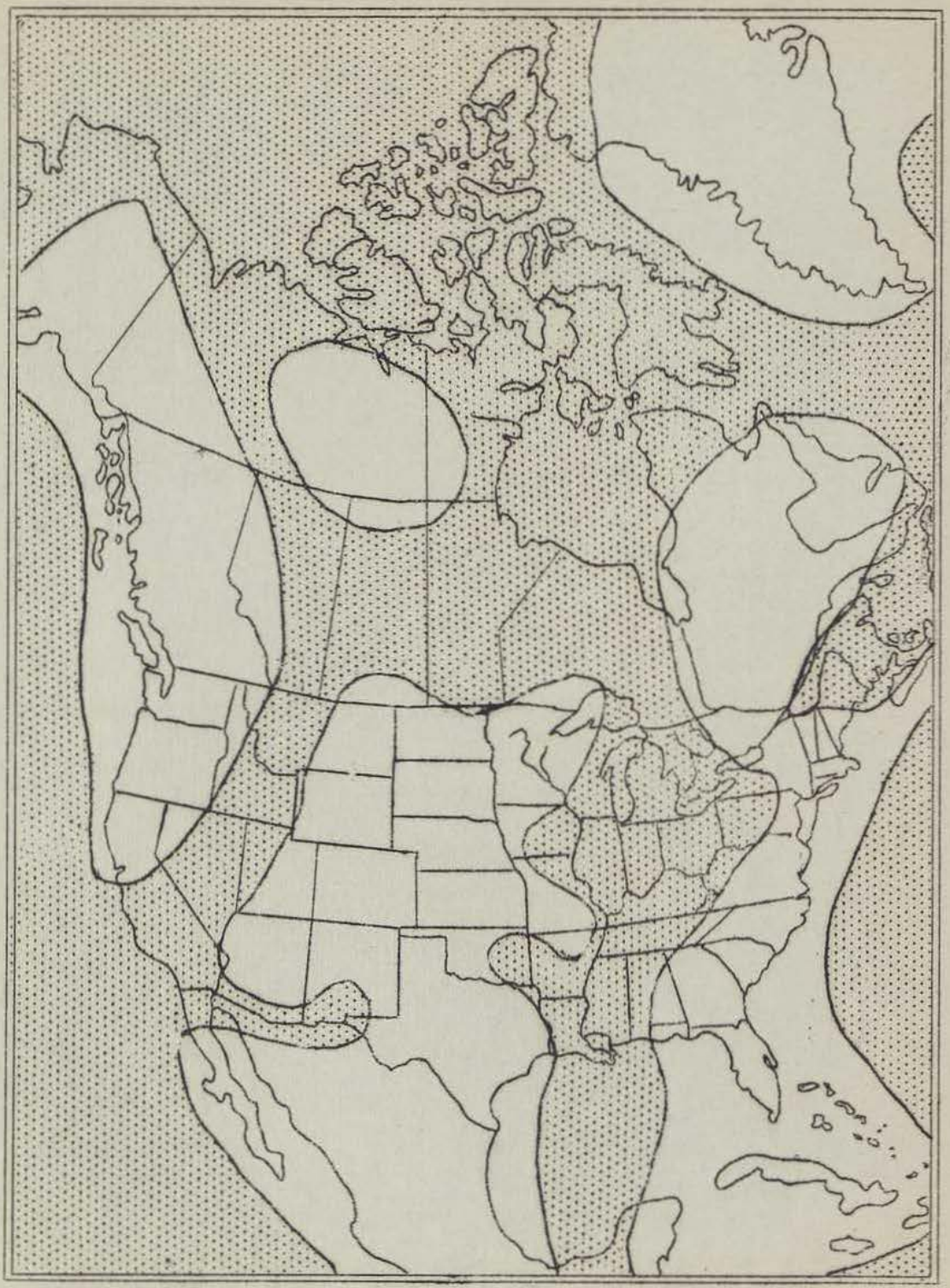
Also, the first air-breathing animals made their appearance in the Silurian, an ancient form of the Scorpion. Life had begun to come out of the sea, and to possess the land. All of these events were portents of a vast plant and animal life, which was to inherit the Earth. How long ago did all this happen? Oh, perhaps 450 million years ago.



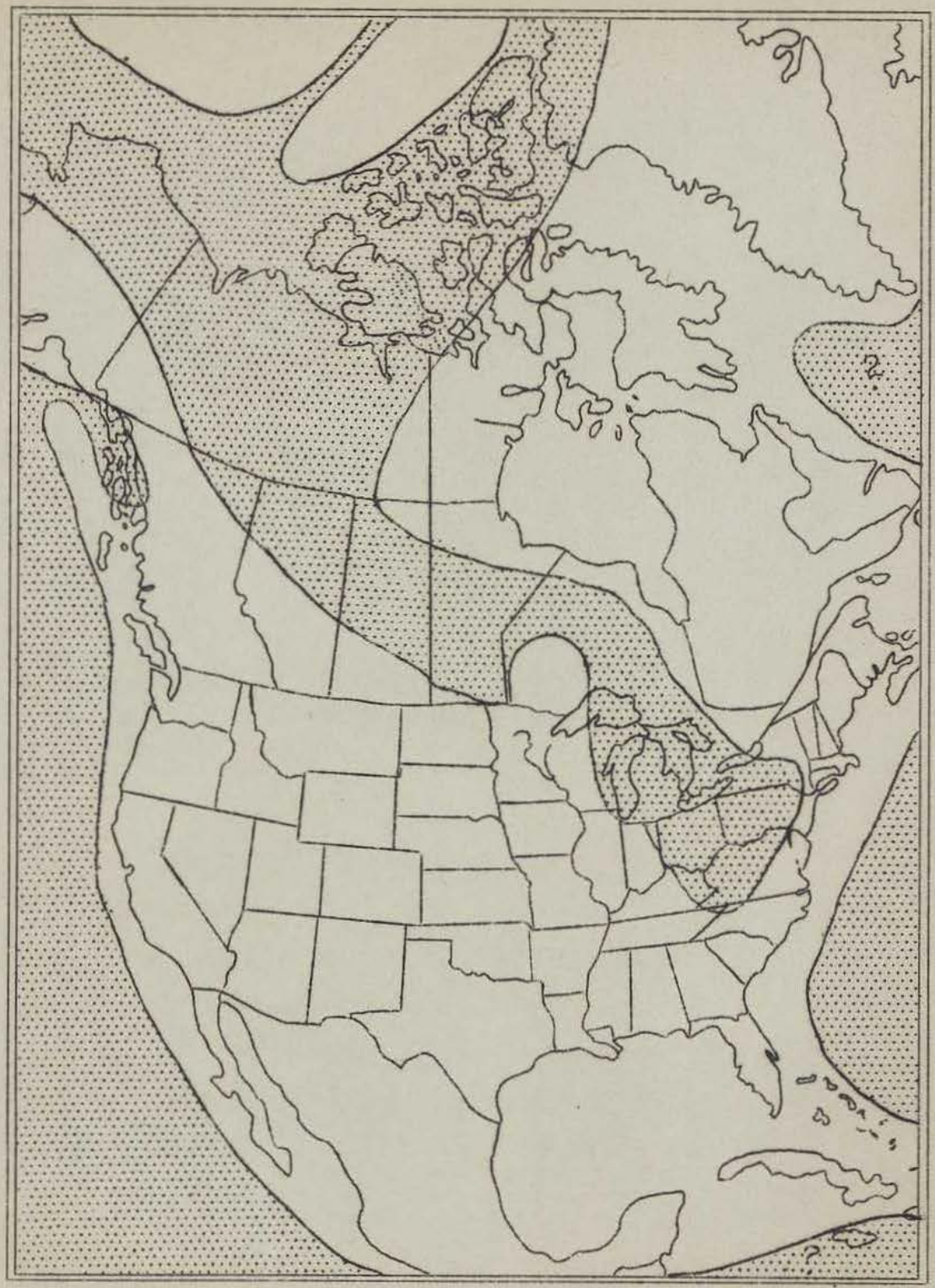
(9) SILURIAN- EARLY.

(SCHUCHERT- MODIFIED)

STIPPLED AREA IS SEA.

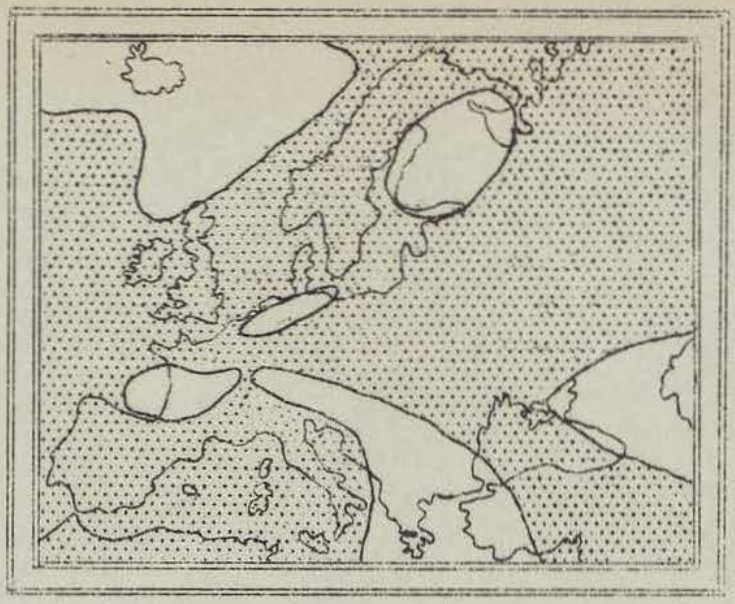


(10) SILURIAN- MIDDLE



(41) SILURIAN- LATE

(SCHUCHERT- MODIFIED) STIPPLED AREA IS SEA.



(12) EUROPEAN-SILURIAN (MILLER-SCHAFFER)

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* THE BULLETIN BOARD *

FEBRUARY 19: GEORGE M. SCHWARTZ, PhD.; "GEOLOGY OF ARIZONA".

FEBRUARY 26: GEORGE A. THIEL, PhD.; "MINERAL RESOURCES OF MINNESOTA".

MARCH 5: E. F. BEAN, PhD.; "GEOLOGY OF WISCONSIN".

MARCH 12: JOHN W. GRUNER, PhD.; "GEOLOGY OF THE BLACK HILLS".

MARCH 19: GRACE L. NUTE; "HISTORY OF LAKE SUPERIOR".

MARCH 26: EDWARD W. HAWLEY; "GEOLOGY OF SOUTH DAKOTA".

APRIL 2: LAWRENCE M. GOULD, PhD.; "GLACIAL GEOLOGY".

APRIL 9: PAST PRESIDENT JUNIOR HAYDEN; "YELLOWSTONE PARK".

APRIL 16: PAST PRESIDENT ALGER R. SYLE; "GEOLOGY OF PETROLEUM".

APRIL 23: PAST PRESIDENT CHARLES H. PRESTON; "GEOLOGY OF GRAND CANYON".

APRIL 30: COUNSELOR, E. P. BURCH; "GEOLOGY OF BOSTON AND VICINITY".
(The last three are tentative, only)

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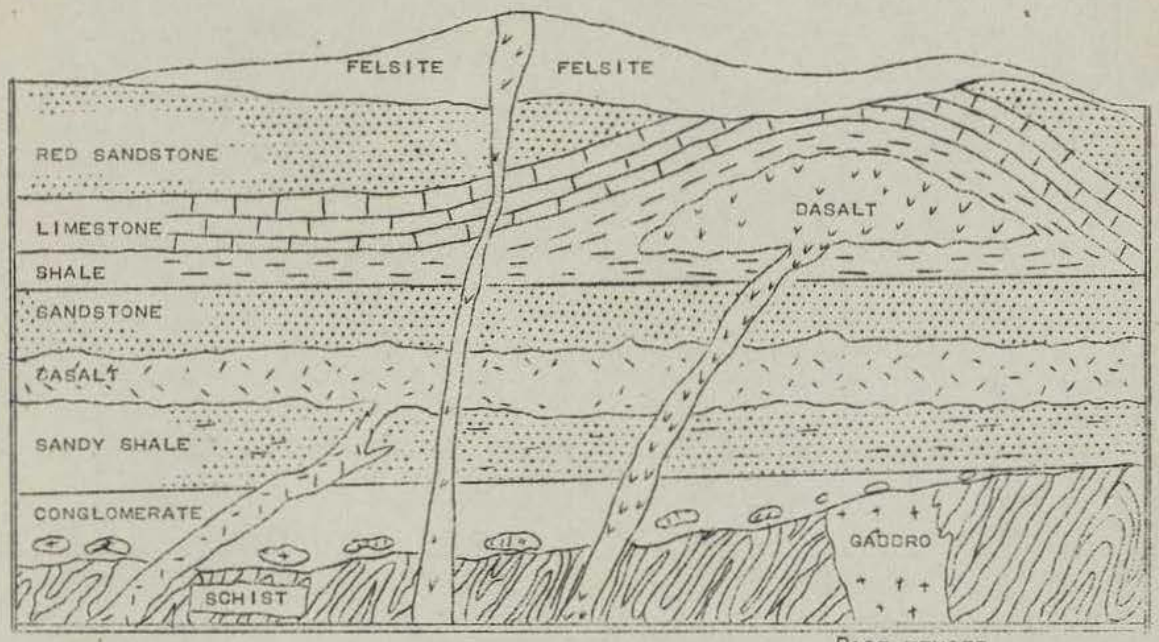
PERSONALS: Our Counselor, Edward P. Burch, is wintering in Cuba.

Mr. and Mrs. C. H. Preston and Mr. and Mrs. Reese will go to Mexico City next month. They expect to visit Paricutin, the new Mexican volcano.

OUR GEOLOGY LESSON;



PAGE-KRUGER

LIST BELOW, IN CHRONOLOGICAL ORDER, THE GEOLOGIC EVENTS INDICATED IN THE ABOVE DIAGRAM. CAN YOU FIND AND NAME FIFTEEN EVENTS?

HISTORY OF THE GREAT LAKES SKETCH NO. 4.

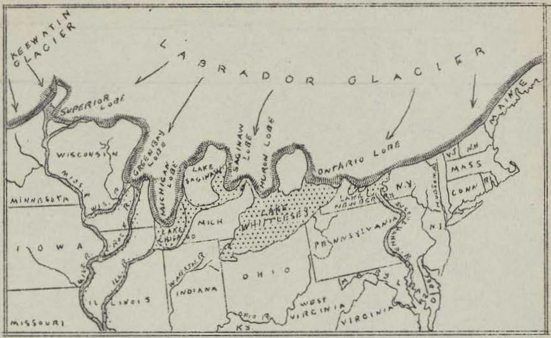
IN OUR LAST ISSUE, WE SHOWED FIRST, THE VERY BEGINNING OF THE ACCUMULATION OF THE MELT WATER IN FRONT OF THE ICE SHEET IN THE GREAT LAKES BASIN, AND SECOND, HOW THE ACCUMULATED WATERS FORCED A PASSAGE ACROSS LOWER MICHIGAN. THE DRAINAGE IN BOTH CASES WAS STILL TO THE WEST AND SOUTH, INTO THE MISSISSIPPI RIVER.

IN THE TWO SKETCHES HEREWITH, WE SHOW HOW LAKE MAUMEE CONTINUED TO GROW, SO AS TO INCLUDE ALL OF LAKE ERIE AND THE FINGER LAKE DISTRICT OF NEW YORK. ALSO, HOW LAKE CHICAGO CONTINUED TO INCREASE, IN SIZE, THE DRAINAGE BEING STILL TO THE WEST AND THE SOUTH, INTO THE MISSISSIPPI RIVER.

THE SECOND SKETCH SHOWS HOW THE WATER HAD ACCUMULATED SUFFICIENTLY, TO FORCE A NEW OUTLET, SOUTHWARD THROUGH THE SUSQUEHANNA RIVER, INTO CHESAPEAKE BAY. BY THIS TIME, SUFFICIENT WATER HAD ACCUMULATED IN LAKE SUPERIOR, TO FORCE AN OUTLET SOUTH THROUGH THE BRULE-KETTLE RIVERS INTO THE ST. CROIX, AND THENCE INTO THE MISSISSIPPI RIVER. AT THIS TIME, THE ICE HAD NOT YET RETREATED BEYOND THE VERY EASTERN TIP OF LAKE ERIE. HENCE, NIAGARA FALLS HAD NOT YET BEEN BORN, SO TO SPEAK.

AS THE ICE CONTINUED TO MELT AND RETREAT NORTHWARD, ACROSS THE BASIN OF THE GREAT LAKES, THE WATERS CONTINUED TO ACCUMULATE FASTER THAN THEY COULD BE DRAINED OFF, EVEN THOUGH ADDITIONAL OUTLETS WERE FORCED FROM TIME TO TIME BY THE GREAT VOLUME OF ACCUMULATED WATERS, IN FRONT OF THE ICE SHEET. THE DEVELOPMENT OF THESE OUTLETS, AS THE NATURAL DRAINAGE SYSTEM OF THE LAND, WAS REVEALED BY THE RETREAT OF THE ICE, IS INDEED MOST INTERESTING.

HISTORY OF THE GREAT LAKES — SKETCH NO. 5.



"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 we publish 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 Avenue 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

Classification of the Common Minerals. Diagnostic qualities are in italics.

	Color	Visible Cleavage	Crystal System	Hardness	Specific Gravity	Texture	Luster	Streak	Chemical Composition	Notes	Names
I. METALLIC MINERALS											
A. Dark Colors											
(i) *Hard*	Blue-black	None	Hexagonal	6.5	5.3	Platy	Brilliant	*Red*	Fe_2O_3		Hematite
	Black	None	Isometric	6.5	5.1		Metallic	*Black*	Fe_3O_4	Magnetic	Magnetite
	Brown-black	None	Amorphous	5.5	4	Fibrous	Shining & dull	*Brown*	$2Fe_2O_3 \cdot 3H_2O$		Limonite
(ii) *Soft*	*Red*	None	Isometric	2.5	8.8	Metal	Shining	*Copper red*	Cu.	*Malleable*	Copper
	Black	None	Amorphous	1-2	2.2	Fibrous	Shining	*Gray*	C	*Greasy feel*	Graphite
										Rarely crystalline	
B. Light Colors	Silver-gray	*3 at rt. angles*	Isometric	3	7.4-7.6		Brilliant	Lead gray	PbS.	Brittle	Galena
	Pale yellow	None	Isometric	6-6.5	5			*Green-black*	FeS_2		Pyrite
	Bronze yellow	None	Tetrahedral	3.5-4	4.2			*Black*	$(CuFe)S_2$	Commonly a *blue tarnish*	Chalcopyrite
	Yellow	None	Isometric	2.5-3	15.6-19.3			*Yellow*	Au.	*Malleable and ductile*	Gold
II. NON-METALLIC MINERALS											
A. Dark Colors											
(i) *Harder than calcite*											
(a) Cleavage	Black	2	Monoclinic	5-6	2.9-3.5		Adamantine	White	$CaO.(FeO,MgO).2SiO_2$	*Good cleavages intersecting at angles of 125*	Hornblende (Amphibole)
	Greenish black	2	Monoclinic	5-6	3		Vitreous	White	$\{CaO.MgO.2SiO_2\}$ $\{CaO.FeO.2SiO_2\}$	*Indefinite cleavages at 87°*	Augite (Pyroxene)
	Black to brown	1	Orthorhombic	7-8	3.75		Dull to resinous	White	$\{2H_2O.6(Fe,Mg)O.12Al_2O_3.12SiO_2\}$	*Cruciform twins*	Staurolite
	Black to yellow	6	Isometric	3.5	4		*Resinous*	White	ZnS.		Sphalerite
	Chocolate brown	2	Hexagonal	3.5-4	3.8		Pearly	White	$FeCO_3$	Effervesces with hot HCl.	Siderite
	Red brown to green	2(imperfect)	Hexagonal	5	3.2		*Vitreous*	White	$\{3(3CaO.P_2O_5).CaF_2\}$ $\{3(3CaO.P_2O_5).CaCl_2\}$		Apatite
	Green	2	Monoclinic	5-6	3	*Fibrous*	*Adamantine*	White	$CaO.3(Mg,Fe)O.4SiO_2$		Actinolite
	Yellow green	1	Monoclinic	6-7	3.3-3.5		Vitreous	White	Hydrous ortho silicate of Al. Fe. Ca.		Epidote
	Gray	2	Triclinic	6-7	2.6-2.7		Vitreous	White	$\{Na_2O.Al_2O_3.6SiO_2\}$ $\{CaO.Al_2O_3.2SiO_2\}$	*Striated faces.* Also pale colors	Plagioclase (Feldspar)
	Smoky gray	1 (apparent)	Hexagonal	9	4		*Greasy-vitreous*	White	Al_2O_3	Parting plane looks like cleavage	Corundum
(b) No cleavage	Black	None	Amorphous	10	3.5		Greasy	White	C	*Striated, triangular prisms,* cross-section	Bort
	Black to green	None	Hexagonal	7-7.5	3.1-3.2		Vitreous	White	Silicate of B. Al etc.		Tourmaline
	Black to red	*None*	Isometric	6.5-7.5	4		Resinous-*vitreous*	White	$R_4R_3(SiO_4)_3$		Garnet
	Smoky gray	*None*	Hexagonal	9	4		Greasy-vitreous	White	Al_2O_3	Parting plane looks like cleavage	Corundum
	Smoky gray	*None*	Hexagonal	7	2.6		Vitreous	White	SiO_2	Also amorphous forms called flint	Quartz
(ii) *Soft as calcite*											
(a) Cleavage	Black to brown	1 perfect	Monoclinic	2.2-3	2.5-3	Platy	Adamantine	White	$(H_2K_2)O.(MgFe)O.Al_2O_3.3SiO_2$	*Elastic*	Biotite
	Dark green	1 perfect	Monoclinic	2-2.5	2.7	Platy	*Pearly*	White	$4H_2O.5(MgFe)O.Al_2O_3.3SiO_2$		Chlorite
	Green	Prismatic	Mono. or Ortho.?	2.5-4	2.3-2.5	*Fibrous*	*Silky*	White	$2H_2O.3MgO.2SiO_2$	Also in massive form	Asbestos(Serpentine)
(b) No cleavage	Green	None	Mono. or Ortho.?	2.5-4	2.5-2.6	Massive	*Waxy*	White	$2H_2O.3MgO.2SiO_2$		Serpentine
B. Light Colors											
(i) *Harder than calcite*											
(a) Cleavage	Colorless	1 perfect	Isometric	10	3.5		*Adamantine*	None	C	Also pale colors	Diamond
	Colorless	1 perfect	Orthorhombic	8	3.5		*Vitreous*	None	$Al_2O_3.SiO_2.2F$	Also pale colors	Topaz
	Colorless	4	Isometric	4	3.5-4.5		*Vitreous*	White	CaF_2	Also pale colors	Fluorite
	Colorless-gray	2 (good)	Triclinic	6	2.6-2.7		Vitreous-pearly	White	$\{Na_2O.Al_2O_3.6SiO_2\}$ $\{CaO.Al_2O_3.2SiO_2\}$	*Striated faces,* also dark gray	Plagioclase (Feldspar)
	White-flesh color	2 (good)	Monoclinic	6	2.5		*Porcelainic*	White	$K_2O.Al_2O_3.6SiO_2$	*Cleavages at rt. angles*	Orthoclase (Feldspar)
	White	3	Hexagonal	3.5-4	2.8-2.9		Pearly	White	$(Ca.Mg)O.CO_2$	Effervesces at hot HCl. *Curved crystal faces*	Dolomite
	White-gray	1 perfect	Monoclinic	5-6	2.9-3.1	*Bladed and Fibrous*	Bright	White	$CaO.3MgO.3SiO_2$	White amphibole When fibrous called	Tremolite Asbestos
	White, pink, green	1 perfect	Orthorhombic	5	2.3	*Radiating*	Dull	White	$(CaNa_2)O.2Al_2O_3.4SiO_2.5H_2O$		Thomsonite
	Olive-green	1 fair	Orthorhombic	6.5-7	3.3-3.5	*Granular*	*Vitreous*	Yellow white	$2(MgFe)O.SiO_2$		Olivine
	Pale brown	3	Hexagonal	3.5-4	3.8		*Pearly*	White	$FeO.CO_2$	Also dark brown	Siderite
	Brown	1 (apparent)	Hexagonal	9	4		Greasy	White	Al_2O_3	Also dark colors	Corundum
(b) No cleavage	Colorless	*None*	Hexagonal	7	2.6		*Vitreous*	White	SiO_2	Also pale colors and amorphous	Quartz
	Yellow	*None*	Amorphous	5	3.8	*Earthy*	Dull	*Yellow*	$2Fe_2O_3.3H_2O$	Also dark shades	Limonite
	Red	*None*	Amorphous	5-6	4.2	*Earthy*	Dull	*Red*	Fe_2O_3	Also dark shades	Hematite
	Pale colors	*None*	Amorphous	7	2.6	*Dense*	Dull	Light	SiO_2	Colorless	Chalcedony
										Gray concretions	Flint
										Pale concretions	Chert
										Red	Jasper
										Hydrous, opalescent	Opal
(ii) *Soft as calcite*											
(a) Cleavage	Colorless	3	Hexagonal	3	2.7		Vitreous-pearly	White	$CaO.CO_2$	*Effervesces with cold HCl. Doubly refracting*	Calcite
	Pale colors	*3 at rt. angles*	Isometric	2.5	2.1-2.6		Vitreous-greasy	White	Na Cl.	*Salty taste*	Halite
	Colorless	*1 perfect*	Monoclinic	2	2.3	Crystalline	Vitreous	White	$CaO.SO_3.2H_2O$	Cleavage sheets brittle	Gypsum (Selenite)
	Colorless	1 perfect	Monoclinic	2-2.5	2.7-3	Platy	Shining-pearly	White	$2H_2O.K_2O.3Al_2O_3.6SiO_2$	Sheets *flexible and elastic*	Muscovite
	Pale colors	1 perfect	Mono. or Ortho.?	1	2.7-2.8	Platy	Pearly	White	$H_2O.3MgO.4SiO_2$	Sheets *flexible, soapy feel*	Talc
(b) No cleavage	Pale green	None	Cryptocrystalline	1	2.5-2.8	*Fibrous-Compact*	Dull	White	$H_2O.3MgO.4SiO_2$	*Soapy feel*	Talc-(Soapstone)
	White	None	Cryptocrystalline	2	2.3	*Fibrous*	*Silky*	White	$CaO.SO_3.2H_2O$	Also crystalline	Satin-spar } Gypsum
	White	None	Cryptocrystalline	2	2.3	Massive	Dull	White	$CaO.SO_3.2H_2O$	When pure called	Alabaster }
	White and pale colors	None	*Amorphous*	2-2.5	2.6	*Earthy*	Dull	White	$2H_2O.Al_2O_3.2SiO_2$	*Earthy smell, plastic when wet*	Kaolinite