

State of Michigan
DEPARTMENT OF CONSERVATION
Gerald E. Eddy, Director
GEOLOGICAL SURVEY DIVISION
William L. Daoust, State Geologist

Publication 50

**AN INDEX
of the
GEOLOGY OF MICHIGAN
1823-1955**



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FOREWORD

To the Director, and Commissioners of the Department
of Conservation:

Gentlemen:

I have the honor and pleasure to transmit herewith
An Index to The Geology of Michigan, prepared and
compiled by Helen M. Martin and Muriel Tara
Straight.

Publication of such an index or survey has become of
paramount importance. It will be of value not only to
students and teachers of geology as a pure science,
but of greater importance to those interested in the
economic development of the mineral resources of
Michigan. It will be of value to industries, now
developing, that not only require a knowledge of the
rocks and their resources that industry needs but also
require a knowledge of rock formations that will aid in
disposal of waste. It will answer numerous requests
for reference material on Michigan's basic resources
received from industrial, educational, agricultural and
even social groups. The maps, the chart, and list of
publications and laws are a brief of the history of the
Geological Survey since 1837. The Index to
Nomenclature and the Author-Subject References to
Michigan Geology review the geological work that
has been done in the State and by their numbers
show the geologic value of our area.

Respectfully submitted,
[Signed] William L Daoust

State Geologist
April 1956

PREFACE

Compilation of various parts of this book was started by both authors before becoming staff members of the Geological Survey Division, to meet our needs as geologists in public and private enterprise and later was put to continuous use as reference material for consultation on the Survey. Compilation of the chart showing the development of the geological nomenclature of Michigan formations was an outgrowth of a request to the senior author by Professor E. C. Case, late of the University of Michigan, to compile such a chart for the Devonian formations. Much of the other material in the book is from notes accumulated for a history of the Survey, for discussions of stratigraphy, for use as lecture material, and in response to requests for information made by students, teachers, and geologists in industry newly come to the State, and geologists employed by the State.

The References to Michigan Geology with a subject index was an indispensable tool of readily obtainable references prepared by the junior author when an undergraduate and later a geologist on the staff of the United States Geological Survey.

We have felt that compilation of all this material was needed by other members of the Survey staff, by students of geology and especially by professional geologists in industry. We are happy to share our accumulated data hoping our sins of omission are not too many.

Such a sharing would not be possible without the encouragement of four State Geologists: R. A. Smith, Gerald E. Eddy, Franklin G. Pardee, and William L. Daoust. Nor would it be possible if we had not had the devoted assistance of Mrs. Norma Guyer in preparation of the junior author's manuscript, and of Mrs. Joyce D'Valentine who not only typed but edited the manuscript of the senior author, discovered and corrected elisions, errors in dates, spelling, locations, and made numerous suggestions which will make this book of value to others than geologists. James Campbell has painstakingly drafted the maps and Robert Kelley compiled the section of laws relating to the Survey. To all of these we express our appreciation and thanks.

[Signed] Helen M. Martin

[Signed] Muriel Tara Straight

AN INDEX OF MICHIGAN GEOLOGY

by
HELEN M. MARTIN
and
MURIEL TARA STRAIGHT

PUBLICATIONS of the **MICHIGAN GEOLOGICAL SURVEY** **1838-1921** and of the **GEOLOGICAL SURVEY DIVISION** **MICHIGAN DEPARTMENT OF** **CONSERVATION** **1921-1955**

DOUGLASS HOUGHTON, State Geologist **1838-1846.**

The first reports of the Michigan Geological Survey under the direction of Douglass Houghton were made directly to the legislature and were issued as twenty-six legislative documents in the House and Senate Journals of the Michigan Legislature of 1838 through 1846.

Note: S. D. means Senate Document; H. D., House Document; J. D., Joint Document. State Geologist is abbreviated S. G., and State Geological Survey, S. G. S.

1838.

1. Report of a select committee of the Board of Regents of the University on the collection of the S. G.: H. D. Vol. I, p. 1-2; S. D. No. 1, p. 1. H. D. No. 55 is duplicate of S. D. No. 1.

2. Statement of the expenditures on account of the S. G. S. for the year 1837: H. D. No. 8, pp. 115-118; S. D. No. 21. (First annual account of the S. G.), pp. 315-318.

3. Report of the S. G. (first annual): H. D. No. 24, pp. 276-317, separately, No. 14, pp. 1-39.

4. Communication from the S. G.: H. D. No. 46, pp. 457-460.

1839.

1. Report of the S. G., in relation to the improvement of State salt springs: H. D. No. 2, pp. 39-45; S. D. No. 1, pp. 1-7.

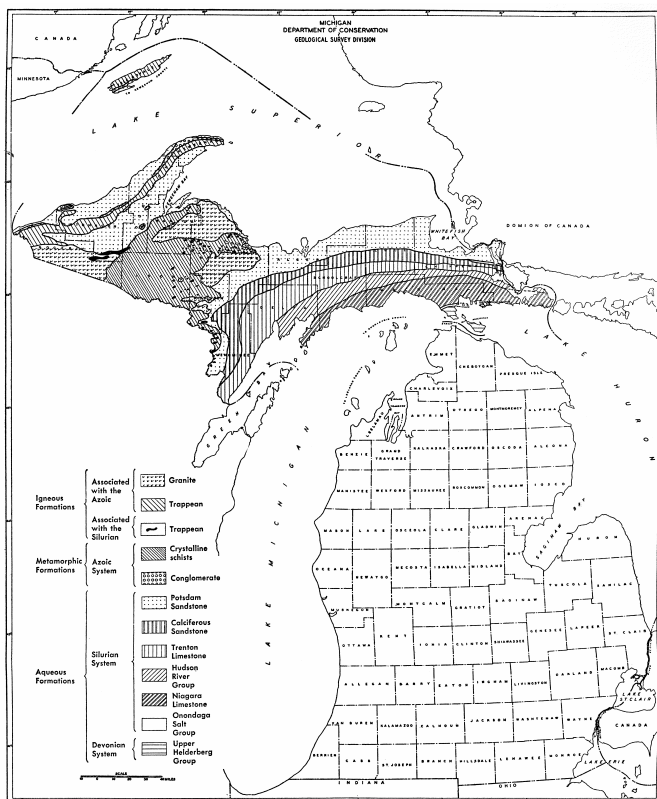
2. Report of the committee on the S. G.'s report in relation to the improvement of the State salt springs: H. D. No. 4, p. 123.

3. Report of the S. G. in relation to the iron ore, etc., on the school section in town five south, range seven west, in Branch County: H. D. No. 21, pp. 342-344.

4. Second annual report of the S. G.: H. D. No. 23, pp. 380-507; S. D. No. 12, pp. 264-391.

5. Report of the Committee of the Senate on Manufacturers, to whom was referred the communication of the S. G. relative to salt springs and the salines of the State: S. D. No. 3, pp. 85-86 (Parallel to H. D. No. 4).

6. Communication from the S. G. relative to the S. G. S.: S. D. No. 25, pp. 463-466.

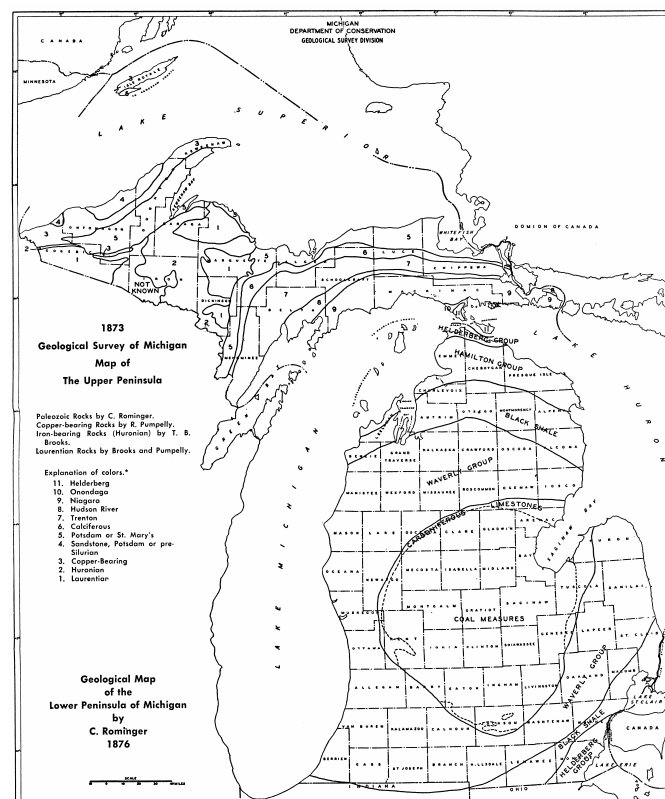


Map 2. After: "Geological Map of the Lake Superior Land District. Prepared pursuant to an Act of Congress approved March 1st 1847 entitled "An Act to Establish a New Land District and to provide for the sale of Mineral Lands in the State of Michigan".

J. W. Foster, J. D. Whitney U. S. Geologists"

This map is a part of the Foster and Whitney report on the geology of the Lake Superior Land District, Michigan, published as Ex. Doc. 69 House of Representatives 31st Congress, 1st Session.

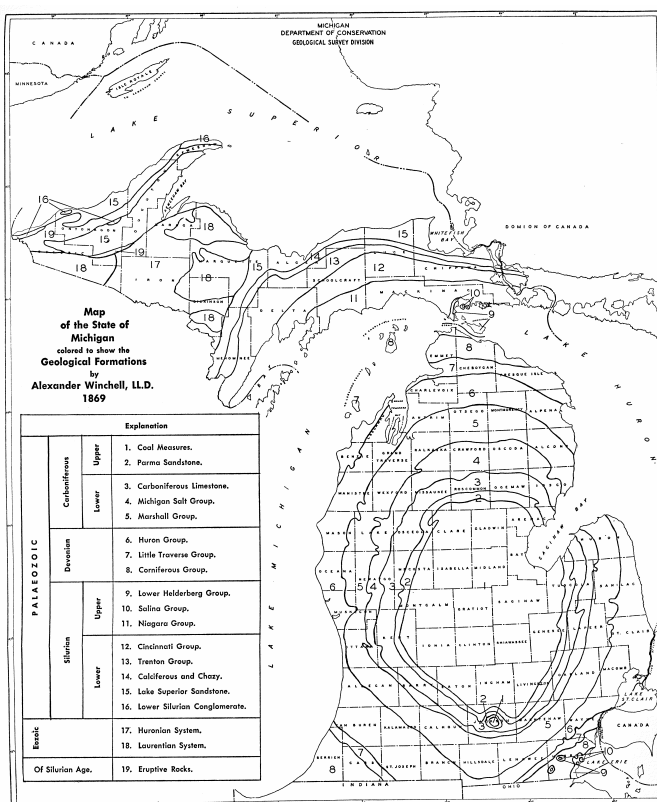
[2. Geologic map of Michigan, Foster and Whitney, 1858]



Map 4. This map is a combination of the Rominger, Pumpelly, Brooks map of the Northern Peninsula published in the Atlas accompanying Vol. I, and of Rominger's map of the Southern Peninsula published in Vol. III. "The map of the Northern Peninsula is in numbered colors and the legend bears the title "Explanation of colors."

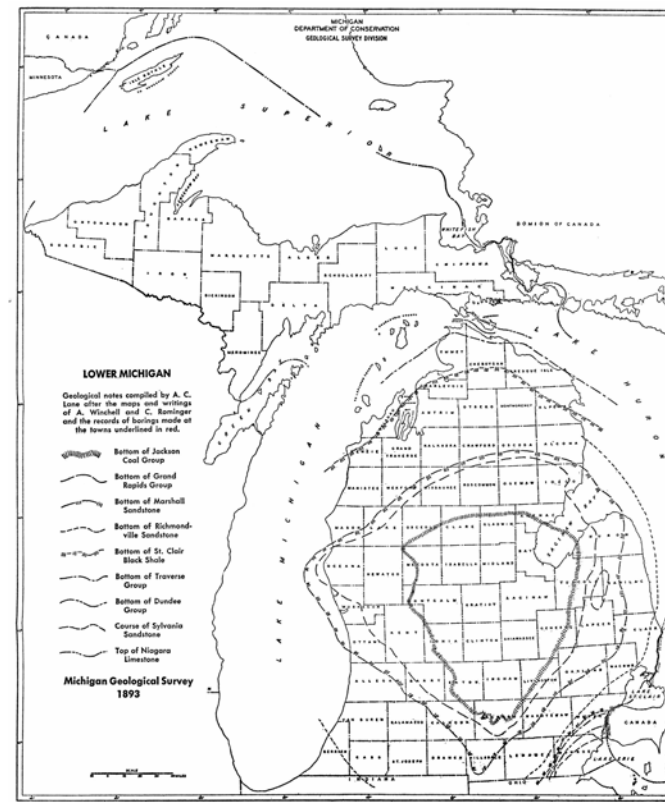
Map of the Southern Peninsula is also published in colors, named in the legend as on this map. 1873. 1876.

[4. Geologic map of Michigan, Rominger, Pumpelly, Brooks, 1876]



Map 3. After "Map of the State of Michigan colored to show the geologic formations. By Alexander Winchell L.L.D." 1869. Published in Atlas of the State of Michigan by H. F. Walling 1873. Known also as Tuckermans Atlas. Colors are numbered in the legend as map indicates.

[3. Geologic map of Michigan, Alexander Winchell, 1873]



Map 5. After a black and white map published in Vol. V, during the administration of L. L. Hubbard, State Geologist, 1893.

[5. Geologic map of Michigan, A. C. Lane, 1893]

ALEXANDER WINCHELL, State Geologist 1859-1863, 1869-1871

Formal reports under the imprimatur of the Michigan Geological Survey and I direction of the State Geologist began with the small volume issued in 1861, First biennial report of the progress of the Geological Survey, Alexander Winchell.

1860.

First biennial report of the progress of the Geological Survey of Michigan embracing observations on the geology, zoology and botany of the Lower Peninsula.

Part I—Geology, pp. 1-210. Contains: Physical structure of the northwest and general sketch of the geology of Michigan.

Part II—Zoology, pp. 211-242. Contains: Catalogue of the mammals, birds, reptiles, and mollusks of Michigan.

Part III—Botany, pp. 243-330. Contains: Catalogue of phaenogamous and acrogenous plants ... of Michigan and the islands at the head of Lake Huron.

1869-1955

Since 1873 printed reports have been issued in three types of format and binding known as: Volumes, Annual Reports, Publications. Summary, Progress, and Technical reports are mimeographed and bound. Reports of the State Geologist were made to the Board of the Geological Survey until 1921. Since 1921 summary reports of the State Geologist and Geological Survey Division are a part of the Biennial Reports of the Department of Conservation.

VOLUMES

Vol. I Upper Peninsula of Michigan, 1869-1873.

Atlas—The Atlas of 23 plates contains geologic maps and cross-sections by T. B. Brooks, R. Pumpelly and C. Rominger.

Part I—Iron-bearing rocks (economic), T. B. Brooks (320 pp., 24 pls., 29 figs.).

Part II—Copper district, Raphael Pumpelly (144 pp.).

Part III—Paleozoic rocks, Carl Rominger (106 pp.).

Part I was also issued as a separate publication.

Vol. II Upper Peninsula, 1869-1873.

Appendices to Pt. I, Vol. I, Iron-bearing rocks (economic), T. B. Brooks (298 pp.).

CARL ROMINGER, State Geologist 1872-1885

Vol. III Lower Peninsula, 1873-1876.

Part I—Geology of Lower Peninsula, Carl Rominger (226 pp., 4 pls., map).

Part II—Palaeontology; fossil corals, Carl Rominger (162 pp., 55 pls.).

Vol. IV Upper Peninsula, 1878-1880 (248 pp., map).

Part I—Marquette iron region, Carl Rominger.

Part II—Menominee iron region, Carl Rominger.

C. E. WRIGHT and M. E. WADSWORTH, State Geologists 1885-1893

Report of the State Board of Geological Survey for 1891 and 1892.

Includes reports of State Geologist Dr. Carl Rominger for 1881 and 1882; of State Geologist C. E. Wright for 1885 to 1888; and of State Geologist M. E. Wadsworth for 1889, 1890, 1891, 1892 and a provisional report by Dr. Wadsworth on the Geology of the Iron, Gold and Copper Districts of Michigan (192 pp.).

L. L. HUBBARD, State Geologist 1893-1899

Vol. V Upper Peninsula, 1881-1884; Lower Peninsula, 1885-1893.

Part I—Geological report on the Upper Peninsula of Michigan, iron and copper regions, Carl Rominger (180 pp., 2 pls., map).

Part II—The geology of Lower Michigan with reference to deep borings, edited by A. C. Lane from notes of C. E. Wright (101 pp. 73 pls., map).

Vol. VI Upper Peninsula, 1893-1897.

Part I—Geological report on Isle Royale, A. C. Lane (282 pp., 16 pls., 29 figs.).

Part II—Keweenaw Point, with particular reference to the felsites and their associated rocks, L. L. Hubbard (pp. 1-156, 10 pls., 11 figs.).

Part II—Appendix. The crystallization of the calcite from the copper mines of Lake Superior, Charles Palache (pp. 157-184, 6 pls.).

A. C. LANE, State Geologist 1899-1909

During Dr. Lane's administration, the activities of the Survey were formally enlarged to include a biological survey. Parts of Volumes VII, VIII, IX were issued also as separate publications.

Vol. VII Lower Peninsula, 1896-1900.

Part I—Geological report on Monroe County, Michigan, W. H. Sherzer (240 pp., 17 pls., 8 figs., incl. 3 maps).

Part II—Geological report on Huron County, Michigan, A. C. Lane (330 pp., 11 pls., 12 figs., incl. 2 maps).

Part III—Geological report on Sanilac County, Michigan, C. H. Gordon (34 pp., 5 pls., 2 figs., incl. map).

Vol. VIII Lower Peninsula, 1900-1903.

Part I—Clays and shales of Michigan, Heinrich Ries (68 pp., 4 pls., 6 figs.).

Part II—Coal of Michigan, A. C. Lane (234 pp., 9 pls., 9 figs., incl. map).

Part III—Marl (bog lime) and its application to the manufacture of Portland cement, D. J. Hale, et al (400 pp., 23 pls., 44 figs.).

Vol. IX 1903-1904.

Part I—The delta of the St. Clair River, L. J. Cole (28 pp., 4 pls., 2 figs., incl. map).

Part II—The gypsum of Michigan and the plaster industry, G. P. Grimsley (248 pp., 29 pls., 49 figs., incl. 6 maps).

ANNUAL REPORTS

Annual Reports by the State Geologist were bound in black cloth. Parts of several of the Annual Reports were also bound and issued as separates.

Annual Report for 1901 (304 pp.).

- (a)—Notes on the progress of work in Tuscola, Saginaw, Bay, Alpena, Kent, Washtenaw, and Muskegon counties.
- (b)—Preliminary report on Arenac County, W. M. Gregory; limestone, gypsum, coal, water supplies, water power and flowing wells, clays and shales.
- (c)—Report on Alcona County: Surface geology, Frank Leverett; subsurface geology, A. C. Lane. Climate, glacial deposits, lake history, economic resources, soils, marl, clay, water power, wells and borings, oil and gas possibilities, salt, water and mineral water, peat, etc., maps of surface and bedrock geology.
- (d)—The distribution of the plant societies of Kent County, Michigan, B. E. Livingston.
- (e)—Surface geology of Lapeer County, Michigan. Map of surface deposits, F. B. Taylor.
- (f)—Economic geology.
- (g)—Limestones: Distribution, character, and analyses of various limestone formations in the state; development of deposits.
- (h)—Stratigraphy of the Traverse group of Michigan, A. W. Grabau.
- (i)—Deep wells and borings for oil and gas in Michigan.
- (j)—Salt.
- (k)—Meteorites.
- (l)—Geothermal gradient.
- (m)—The Port Huron oil field; Wave cutting on west shore of Lake Huron, Sanilac County, Michigan, C. H. Gordon.

Annual Report for 1902 (26 pp., map), published in **Michigan Miner**, Saginaw, 1903.

- (a)—Preliminary report on the gypsum deposits of Michigan, G. P. Grimsley.
- (b)—Field and laboratory tests of Bay County waters.
- (c)—Notes on economic products: Molding sand, peat, limestone, road metal, iron bearing rocks, water power, wells and deep borings, etc.

Annual Report for 1903 (342 pp., 6 pls., 10 figs., soil, vegetation, geologic maps).

- (a)—Progress reports on county geological surveys.
- (b)—Relation of soils to natural vegetation in Roscommon and Crawford counties, B. E. Livingston.
- (c)—Report on progress made in Porcupine Mountains.
- (d)—Water supply of the Lower Peninsula of Michigan, W. F. Cooper.
- (e)—Waters of the Upper Peninsula of Michigan, A. C. Lane.
- (f)—Limestone.
- (g)—Building and road materials.
- (h)—Analyses.
- (i)—Transmission of heat into the earth, A. C. Lane.
- (j)—The theory of copper deposition, A. C. Lane.
- (k)—The Tamarack mine cross-section and the Keweenaw lodes.
- (l)—Deep borings for oil and gas (2 well records).
- (m)—Peat.
- (n)—Topographical survey.
- (o)—Recent shore forms.

Annual Report for 1904 (182 pp., 3 maps).

- (a)—Failure of wells along the lower Huron River, Michigan, in 1904, M. L. Fuller.
- (b)—A geological reconnaissance along the north shores of lakes Huron and Michigan, I. C. Russell.
- (c)—Executive report on some non-metallies.
- (d)—Report of special committee on nomenclature and correlation for the Lake Superior region.
- (e)—Lake Superior gold mining.
- (f)—Black River work.
- (g)—Wells and borings.

Annual Report for 1905 (638 pp.). Parts a, b, c, were bound and issued as separates.

- (a)—An ecological survey in northern Michigan (Porcupine Mountains and Isle Royale), C. C. Adams and others.
- (b)—Geological report on Bay County, W. F. Cooper.
- (c)—An illustrated catalogue of the Mollusca of Michigan, Bryant Walker.
- (d)—Annual report of the State Geologist. Contains notes on the origin of strontium, on wells, artesian and mineral waters, building material, marl, shale, sand lime brick, road metal, gypsum, paint, iron, coal.

Annual Report for 1906 (602 pp., illus., incl. maps). Parts a, b, c, d, were bound and issued as separates.

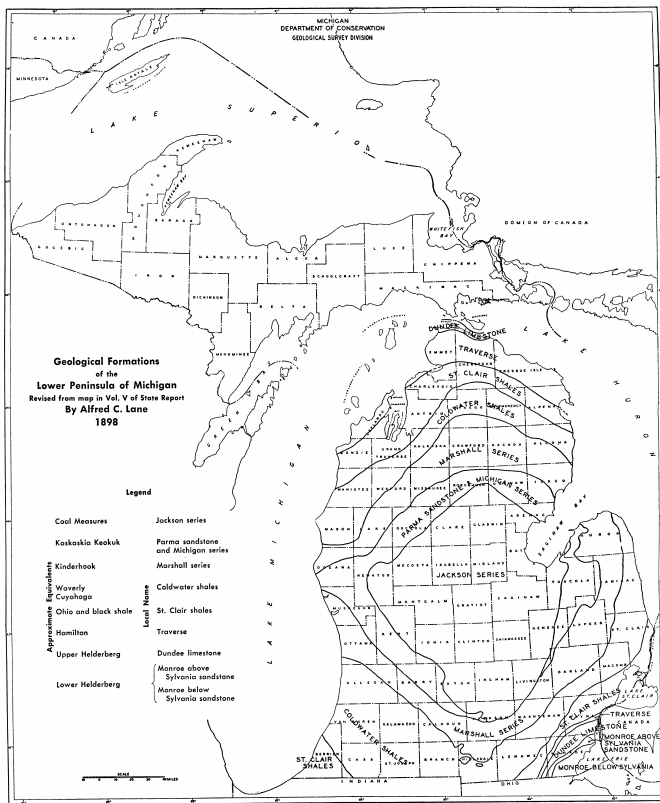
- (a)—The surface geology of portions of Menominee, Dickinson, and Iron counties, Michigan, I. C. Russell.
- (b)—Peat, essays on its origin, uses and distribution in Michigan, C. A. Davis.
- (c)—A geological section from Bessemer down Black River, W. C. Gordon.
- (d)—Crataegus in southern Michigan, C. S. Sargent.
- (e)—Annual report of the State Geologist, containing notes on gold (placer) in Michigan, limestone, earthquakes, molding sand, clay, water and water supplies, coal, oil and gas, sand lime brick, biological and topographic surveys, etc.

Annual Report for 1907 (288 pp., illus., incl. maps). Parts b, c, d, were issued as separates.

- (a)—State Geologist's report containing notes on the topographic survey, on reforestation, leasing of state lands for oil and gas etc. exploration, peat, coal and coal analyses, limestone, cement and lime, tests, and analyses.
- (b)—Foundry sands, Heinrich Ries and J. A. Rosen.
- (c)—Summary of the surface geology of Michigan, A. C. Lane. Map.
- (d)—A biological survey of Walnut Lake (Oakland County), Michigan, T. L. Hankinson, C. A. Davis and J. G. Needham.

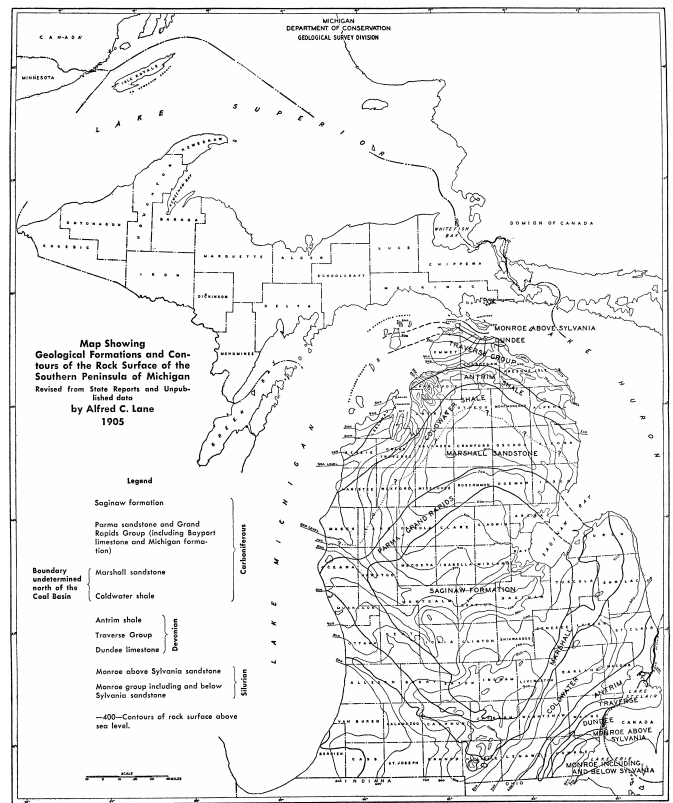
Annual Report for 1908 (402 pp., illus., incl. maps). Parts b, c, d were issued as separates.

- (a)—Annual report of the State Geologist, containing notes on water, sand lime brick, peat, and salt licks.
- (b)—Notes on the geological section of Michigan, A. C. Lane and A. E. Seaman.
- (c)—Report on the geology of Tuscola County, C. A. Davis.
- (d)—The intrusive rocks of Mount Bohemia, Michigan, F. E. Wright. An Ecological Survey of Isle Royale, Lake Superior prepared under the direction of C. C. Adams; published as part of the report of the Board of the Geological Survey for 1908 (468 pp., 63 figs., incl. 5 maps). Contains annotated lists of fauna and flora and contributions from twelve biologists.



Map 6. After a map published in colors in U. S. Geological Survey W.S.P. 31. 1898.

[6. Geologic map of Michigan, A. C. Lane, 1897]



Map 8. After map by A. C. Lane published as Plate VI in the Michigan Annual Report for 1907 and as Plate II in U. S. Geological Survey W.S.P. 183. It is published in colors and patterns with 100-foot bedrock and surface contours by Frank Leverett. This is the first map of Michigan to show surface and bedrock topography by contours.

[8. Geologic map of Michigan, A. C. Lane, 1907]

R. C. ALLEN, State Geologist 1909-1919 A. G. RUTHVEN, Chief Naturalist 1908-1921

PUBLICATIONS

Publication of the Annual Report was discontinued after 1908 and reports were issued as Publications in two series—Geological and Biological. Publications have consecutive numbers followed by series numbers. They are bound in paper and in gray vellum. Parts of the Biological Series were published also as separates.

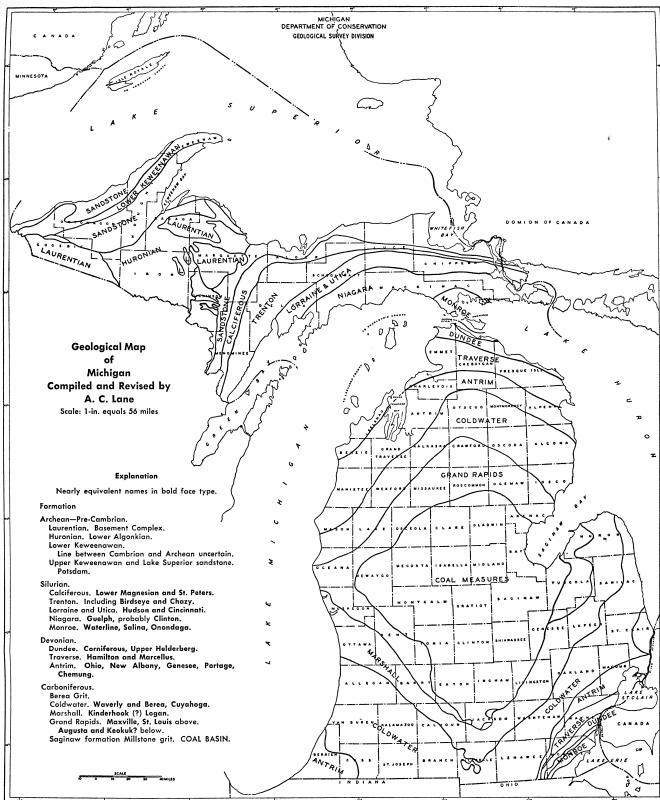
In 1911 the office of Commissioner of Mineral Statistics was abolished and his duties were transferred to the Survey. Statistical data in Publications 21, 24, 27, 29, 32, 33, 34, 35, and 37 were collected in co-operation with the United States Department of the Interior, Bureau of Mines.

Publication 1, Biological Series 1, 1910 (96 pp., 17 pls., incl. map).

- (a)—The crawfishes of Michigan, A. S. Pearse.
- (b)—The insect galls of Michigan, M. T. Cook.
- (c)—The birds of School Girl's Glen region, Ann Arbor, Michigan: A study in local ornithology, A. D. Tinker.
- (d)—Preliminary list of the sites of aboriginal remains in Michigan, H. I. Smith.

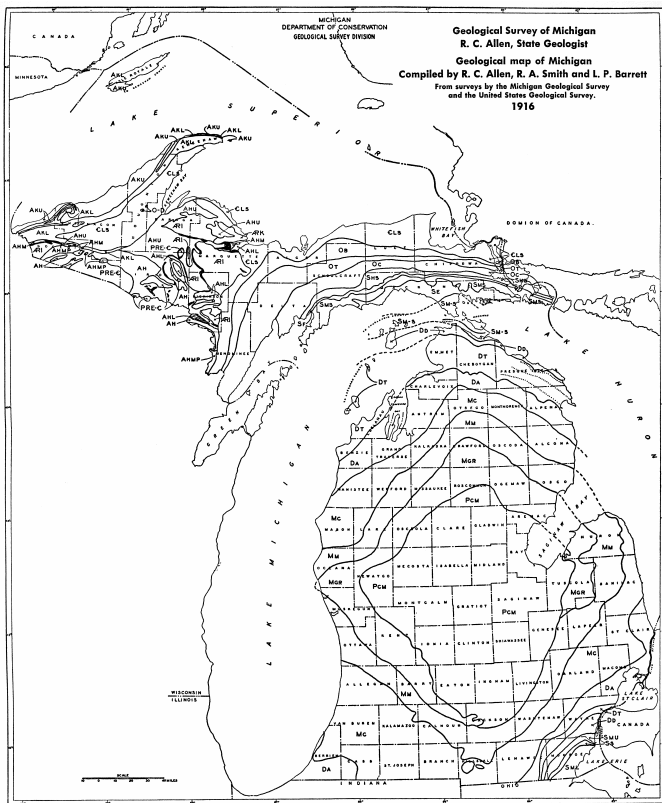
Publication 2, Geological Series 1, 1910 (248 pp., 32 pls., 9 figs.).

The Monroe formation of southern Michigan and adjoining regions, A. W. Grabau and W. H. Sherzer.



Map 7. After the small geologic map (printed in colors and patterns) Lane included in the Annual Reports for 1901 and 1903. The same map is included (Edition 1903) in "Notes on the Rocks and Minerals of Michigan," but the legend differs. Keweenaw is added to Laurentian as the Basement Complex, Cambrian is recognized and includes Upper Keweenaw and Lake Superior sandstone. "The Cambrian includes the Lake Superior sandstone, probably also the Lower Magnesian above and the Keweenaw below." Silurian is divided: Lower Silurian or Ordovician, including Calcareous, Trenton, Lorraine and Utica. (Upper) Silurian including Niagara and Monroe. In Monroe County the course of the Sylvania sandstone is indicated by a full line, and a bed of siltite by a dotted line.

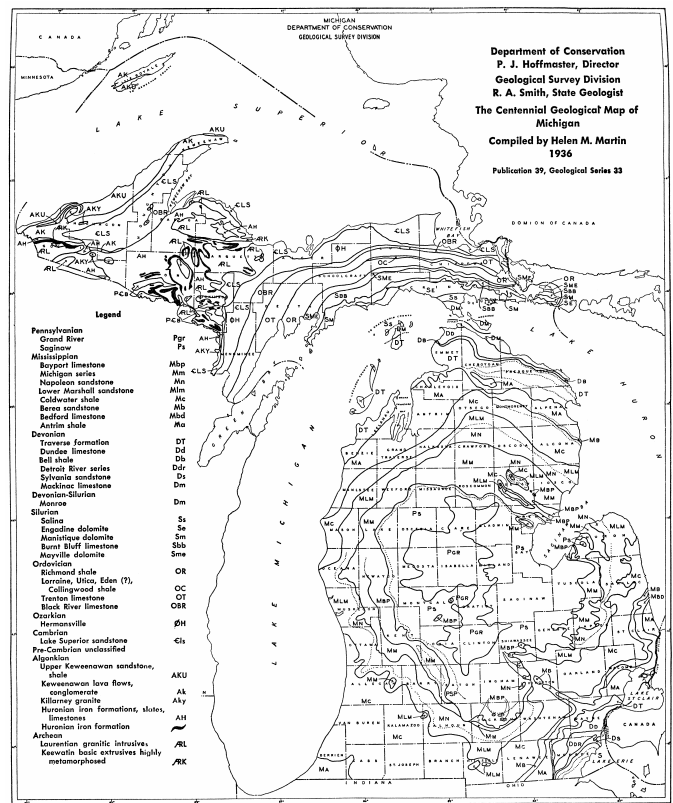
[7. Geologic map of Michigan, A. C. Lane, 1901-1903]



Map 9. After the geological map issued as Publication 23 of the Michigan Geological Survey publications. Printed in color. It is the first map issued by the Survey to have a geologic column and a comprehensive legend dividing the rock formations into system, series, formation, member, with description of the rocks and their economic resources. Magnetic lines are in red overprint. Also the first map issued by Michigan's Survey as a separate publication. The legend printed here is greatly abbreviated.

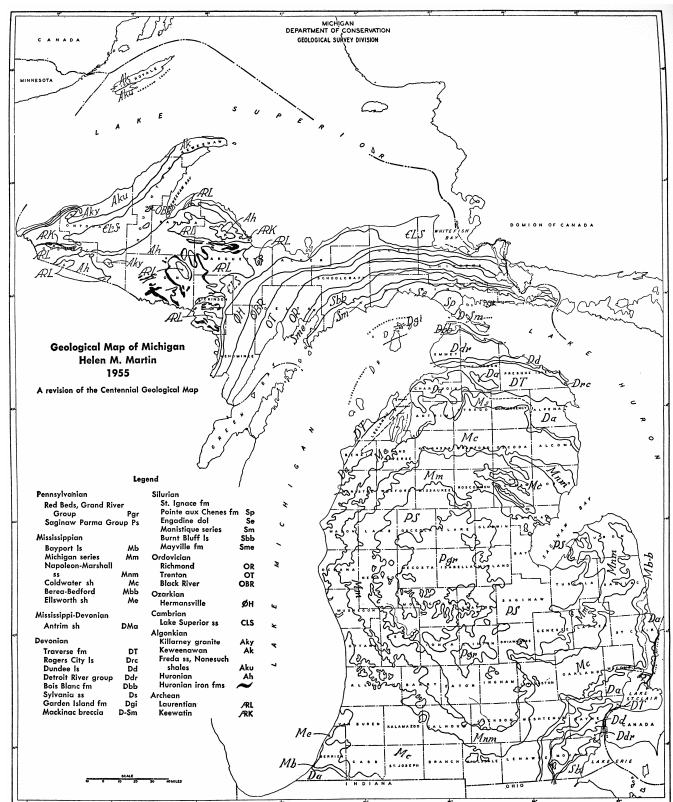
System	Series	Formation, Member	System	Series	Formation, Member
Cenozoic	Quaternary	Recent Deposits	Paleozoic	Ordovician	Richmond shale
		Waukegan drift			Lorraine shale
Paleozoic	Devonian	Waukegan and pre-Waukegan (?) drift		Silurian	Ulster shale
		Waukegan sandstone			Trenton limestone
		Waukegan formation			St. Peter sandstone
		Waukegan member			Beekmantown (Californian) sandstone including
		Waukegan member			Huronville limestone
		Waukegan member		Cambrian	Lake Superior sandstone
		Waukegan member			Waukegan sandstone
		Waukegan member			Frederick shale (may be equivalent to
		Waukegan member			Jacobsville sandstone
		Waukegan member		Keweenaw	Frederick shale
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone
		Waukegan member			Onondaga limestone

[9. Geologic map of Michigan, R. C. Allen, R. A. Smith, L. P. Barrett, 1916]



Map 10. After the "Centennial Map", Publication 39 of the Michigan Geological Survey, commemorating the 100th anniversary of the establishment of the Michigan Geological Survey. The map published in color is in two parts. The Northern Peninsula and the Southern Peninsula. Both maps have appropriate cross sections and comprehensive legends dividing the rock formations into System-Series, Group, Formation-Stage-Member-Sub, with details of nomenclature, and descriptions of the rocks and their economic resources. The Centennial Map was compiled from surveys of the Michigan Geological Survey, from unpublished data supplied by geologists of the University of Michigan and Michigan State College and by the geological departments of several oil companies. The legend of Map 10 is abbreviated from the legend of the Centennial Map to explain the symbols used.

[10. Geologic map of Michigan, H. M. Martin, 1937]



Map 11. After 1955 manuscript revision of the Centennial Map, compiled from data obtained from oil and water well logs, from core testing generously supplied by several oil companies and from the map of the Huronian Series in Publication 44. Only in the St. Ignace area is the Centennial Map of the Northern Peninsula revised.

[11. Geologic map of Michigan, H. M. Martin, 1955]

Publication 3, Geological Series 2, 1910 (152 pp., 18 figs., 17 pls., incl. 2 maps).

The Iron River iron-bearing district of Michigan, R. C. Allen.

Publication 4, Biological Series 2, 1911 (348 pp., 19 pls., map).

A biological survey of the sand dune region on the southern shore of Saginaw Bay, A. G. Ruthven et al.

Publication 5, Geological Series 3, 1911 (96 pp.).

(a)—The late glacial and post-glacial uplift of the Michigan basin (48 figs., 2 pls.).

(b)—Earthquakes in Michigan, W. H. Hobbs (5 figs., 2 pls.).

Publication 6, Geological Series 4, 1911.

The Keweenaw series of Michigan, A. C. Lane.

Vol. I—(pp. 1-499, 15 pls., 47 figs., incl. maps).

Vol. II—(pp. 500-984, 22 figs., incl. maps).

Publication 7, Geological Series 5, 1911 (92 pp., 9 pls., 7 figs., incl. map).

Surface geology of the Northern Peninsula of Michigan, Frank Leverett.

Publication 8, Geological Series 6, 1912 (466 pp., 19 figs., 21 pls., incl. 14 maps).

Mineral resources of Michigan . . . for 1910 and prior years.

(a)—The copper industry, R. E. Hore.

(b)—The iron mining industry, R. C. Allen.

(c)—The pig iron industry, A. E. White.

(d)—The Jones step process, A. E. White.

(e)—Michigan coal, R. A. Smith.

(f)—Gypsum and gypsum products, R. A. Smith.

(g)—The salt industry, C. W. Cook.

(h)—Michigan cement, C. W. Cook.

(i)—Gold in Michigan, R. C. Allen.

(j)—Oil and gas in Michigan, R. A. Smith.

Publication 9, Geological Series 7, 1912 (144 pp., 15 pls., 16 figs., incl. 3 maps).

Surface geology and agricultural conditions of the Southern Peninsula of Michigan, Frank Leverett.

Climate of Michigan, C. F. Schneider.

Publication 10, Biological Series 3, 1912 (190 pp., 55 figs., 20 pls.).

The herpetology of Michigan, A. G. Ruthven, Crystal Thompson and Helen Thompson.

Memoranda towards a bibliography of the archaeology of Michigan, H. I. Smith.

Publication 11, Geological Series 8, 1912 (146 pp., 6 pls., 18 figs.).

Geological report on Arenac County, W. M. Gregory.

Publication 12, Geological Series 9, 1913 (388 pp., 32 pls., 22 figs., incl. maps).

Geological report on Wayne County, W. H. Sherzer.

Publication 13, Geological Series 10, 1913 (256 pp., 8 pls., 1 fig.).

Mineral resources of Michigan . . . for 1912 and prior years.

(a)—The copper industry of Michigan, R. E. Hore.

(b)—Potash.

(c)—Sand and gravel.

(d)—Preliminary statement on limestone.

(e)—Statistical tables.

(f)—Directory of mineral producers of Michigan.

Publication 14, Geological Series 11, 1914 (282 pp., 3 pls., 19 figs., incl. map).

The occurrence of oil and gas in Michigan, R. A. Smith.

Publication 15, Geological Series 12, 1914 (188 pp., 15 pls., 47 figs., incl. maps).

The brine and salt deposits of Michigan, C. W. Cook.

Publication 16, Geological Series 13, 1914 (150 pp.).

Mineral resources of Michigan. . . for 1913 and prior years.

Part I—Copper industry, R. E. Hore.

Iron ore reserves, R. C. Allen.

Part II—Non-metallic minerals, R. A. Smith.

Publication 17, Geological Series 14, 1914 (104 pp., map).

Biennial report of the Director, Michigan Geological and Biological Survey, 1912-1914, R. C. Allen.

Publication 18, Geological Series 15, 1915 (190 pp.).

Part I—Contributions to the pre-Cambrian geology of northern Michigan and Wisconsin, R. C. Allen and L. P. Barrett (12 pls., 11 figs.).

Part II—The geology of Limestone Mountain and Sherman Hill in Houghton County, Michigan, E. C. Case and W. I. Robinson (5 figs.).

Publication 19, Geological Series 16, 1915 (360 pp., 18 pls., 24 figs.).

Mineral resources of Michigan . . . for 1914 and prior years.

Part I—Metallic minerals, R. E. Hore.

Part II—Non-metallic minerals, R. A. Smith.

Publication 20, Biological Series 4, 1916 (180 pp., 28 pls., 3 figs., incl. maps). Miscellaneous papers on the zoology of Michigan.

(a)—Observations on the fishes of Houghton County, T. L. Hankinson.

(b)—An ecological study of the fish fauna of the Douglas Lake region, R. J. Colbert.

(c)—Dragonflies of the Douglas Lake region, A. T. Evans.

(d)—The reptiles and amphibians of Monroe County, Crystal Thompson.

(e)—Results of the Merston expedition to the Charity Islands, Lake Huron: Coleoptera, A. W. Andrews.

(f)—Results of the Shiras expeditions to Whitefish Point: Fishes, T. L. Hankinson.

Publication 21, Geological Series 17, 1916 (402 pp., 8 pls., 15 figs.).

Mineral resources of Michigan . . . for 1915 and prior years.

Part I—Metallic minerals, W. E. Hopper and R. C. Allen.

Part II—Non-metallic minerals, R. A. Smith.

Limestones of Michigan, R. A. Smith

Publication 22, Geological Series 18, 1916 (118 pp., 9 maps).

Biennial report of the Director and report on retracement and permanent monumenting of the Michigan-Ohio boundary line.

Publication 23, Geological Series 19, 1917.

Geological map of Michigan (Scale: 1:750,000), R. C. Allen, R. A. Smith and L. P. Barrett.

Publication 24, Geological Series 20, 1917 (292 pp., 7 figs., incl. maps).
Mineral resources of Michigan . . . for 1916 and prior years.
Part I—Metallic minerals, W. E. Hopper.
Part II—Non-metallic minerals, R. A. Smith.
The Portland cement industry, R. A. Smith.
Part III—Deep borings in Michigan.

Publication 25, Geological Series 21, 1917 (224 pp., 15 pls., 25 figs., incl. maps).
(A revision of publications 7 and 9).
Surface geology and agricultural conditions of Michigan, Frank Leverett.
Chapter on climate, C. F. Schneider.

Publication 26, Biological Series 5, 1918.
The Agaricaceae of Michigan, C. H. Kauffman.
Vol. I—Text (924 pp., 4 figs.).
Vol. II—Plates (172 pls.).

Publication 27, Geological Series 22, 1918 (226 pp., 2 figs.).
Mineral resources of Michigan . . . for 1917 and prior years.
Part I—Metallic minerals, W. E. Hopper.
Part II—Non-metallic minerals, R. A. Smith.

Publication 28, Geological Series 23, 1919 (134 pp., 13 pls., 5 figs., incl. maps).
Drainage in Michigan, D. G. Miller and P. T. Simons.

Publication 29, Geological Series 24, 1920 (214 pp., 4 figs.).
Mineral resources of Michigan . . . for 1918 and prior years.
Part I—Metallic minerals, L. P. Barrett and O. R. Hamilton.
Part II—Non-metallic minerals, H. M. Martin.

R. A. SMITH, State Geologist 1919-1946

Reports were issued as formal Publications and mimeographed progress reports.

Publication 30, Geological Series 25, 1921 (384 pp., 20 pls., 93 figs., incl. maps).
Inland lakes of Michigan, I. D. Scott.

Publication 31, Biological Series 6, 1921 (234 pp., map).
Miscellaneous papers on the botany of Michigan, C. K. Dodge.

In 1921, the Geological Survey became a Division of the Department of Conservation and publications of the biological series were discontinued by the Survey; thus, Publication 31, Biological Series 6 is the final report of the series. Annual and biennial reports of the Geological Survey Division are published in the Biennial Reports of the Department of Conservation.

Publication 32, Geological Series 26, 1922 (146 pp.).
Mineral resources of Michigan . . . for 1920 and prior years.
Part I—Metallic minerals, L. P. Barrett.
Part II—Non-metallic minerals, H. M. Martin.
Oil and gas in Michigan, W. I. Robinson.

Publication 33, Geological Series 27, 1923 (138 pp.).
Mineral resources of Michigan . . . for 1921 and prior years.
Part I—Metallic minerals.
Part II—Non-metallic minerals, H. M. Martin.

Publication 34, Geological Series 28, 1924 (146 pp.).
Mineral resources of Michigan . . . for 1921 and prior years.
Part I—Metallic minerals, L. P. Barrett.
Part II—Non-metallic minerals.

Publication 35, Geological Series 29, 1925 (116 pp., 2 figs.).
Mineral resources of Michigan . . . for 1923 and prior years.
Part I—Metallic minerals, L. P. Barrett.
Part II—Non-metallic minerals.

Publication 36, Geological Series 30, 1926 (444 pp., 41 pls., 69 figs., incl. maps).
Clays and shales of Michigan and their uses, G. G. Brown.

Publication 37, Geological Series 31, 1928 (322 pp., 10 figs., incl. maps).
Mineral resources of Michigan . . . for 1924, 1925, 1926 and prior years.
Part I—Metallic minerals, F. G. Pardee.
Part II—Non-metallic minerals, O. F. Poindexter and R. B. Newcombe.
Part III—Oil and gas developments in Michigan, R. B. Newcombe.

Publication 38, Geological Series 32, 1933 (294 pp., 10 pls., 41 figs., 23 tables, incl. maps).
Oil and gas fields of Michigan, R. B. Newcombe.
Part I—General geology.
Part II—Economic geology.

Publication 39, Geological Series 33, 1937.
The centennial geological map of Michigan (Scale: 1:500,000), H. M. Martin.
Part I—Northern Peninsula.
Part II—Southern Peninsula.

Publication 40, Geological Series 34, 1936 (260 pp., 16 figs., 27 pls., incl. maps).
Occasional papers on the geology of Michigan.
Part I—The Pleistocene history of the Tahquamenon and Manistique drainage region of the Northern Peninsula, S. G. Bergquist.
Part II—The Pennsylvanian system in Michigan, W. A. Kelly.
Part III—The Trenton and Black River rocks of Michigan, R. C. Hussey.

Publication 41, Geological Series 35, 1936 (262 pp., 34 figs., 42 tabs., 2 maps).
Molding sands of Michigan and their uses, G. G. Brown.
Part I—Chemical and physical properties of, and cause of bond in sands.
Part II—Tests of Michigan sands.

Publication 42, 1939.
Rocks and minerals of Michigan, O. F. Poindexter, H. M. Martin and S. G. Bergquist (81 pp., 10 figs., incl. fossils, mineral crystals and map).
Third edition, revised 1951, Helen M. Martin. Second printing 1953 (124 pp., 21 pls., 5 figs.).

Publication 43, Geological Series 36, 1945 (74 pp., 31 figs., map).
Pre-historic Mackinac Island, G. M. Stanley.

Publication 44, Geological Series 37, 1945 (204 pp., 14 pls., incl. maps).

Geology of the Mackinac Straits region, K. K. Landes, G. M. Ehlers and G. M. Stanley.

G. E. EDDY, State Geologist 1946-1951

Reports were issued as Publications, Progress Reports, Technical Reports and Research Publications. Many of these reports were in co-operation with various federal, state and educational agencies.

Publication 45, Geological Series 38, 1948.

Occasional papers on the geology of Michigan for 1946.

Part I—The post-glacial geology of the Grand Marais embayment in Berrien County, Michigan, G. C. Tague (82 pp., 27 pls., 6 figs., incl. maps).

Part II—The glacial and post-glacial history of the Platte and Crystal lake depressions, Benzie County, Michigan, J. L. Calver (70 pp., 16 pls., 9 figs., map).

F. G. PARDEE, State Geologist 1951-1952

Publication 46, Geological Series 39, 1952 (90 pp., 10 pls., 11 figs.).

The Middle and Upper Ordovician rocks of Michigan, R. C. Hussey.

W. L. DAOUST, Acting State Geologist 1952-1954 State Geologist 1954—

In 1953, use of the term "Geological Series" was discontinued and only publication numbers retained.

Publication 47, 1954.

Oil and gas conservation in Michigan, L. S. Miller.

Publication 48, 1955.

Occasional papers on the geology of Michigan for 1954.

Part I—The glacial geology and groundwater resources of Van Buren County, Michigan, F. W. Terwilliger.

Part II—A survey of the groundwater resources in Oakland County, Michigan, A. J. Mozola.

Publication 49, 1955.

Map of the surface formations of the Southern Peninsula of Michigan (Scale: 1:500,000), H. M. Martin.

Publication 50, 1956.

A survey of Michigan geology, 1821 to 1955, H. M. Martin and M. T. Straight.

PROGRESS REPORTS

Progress reports have been issued during the administration of State Geologists Smith, Eddy, Pardee, and Daoust. They are mimeographed and bound. Editions have been small as it is the intent of the Geological Survey to combine them eventually in several monographic reports.

Progress Report No. 1, 1936.

Geology of the Crystal oil field, Montcalm County, G. E. Eddy.

Progress Report No. 2, 1937.

Geology of Ogemaw County and the West Branch oil field, E. A. Newman.

Progress Report No. 3, 1937.

Geology of Arenac County, G. H. Pringle.

Progress Report No. 4, 1938.

Geology of Allegan County, C. H. Riggs.

Progress Report No. 5, 1939.

Geology of the Menominee Range, Dickinson County, C. E. Dutton and C. A. Lamey.

Progress Report No. 6, 1941.

Geology of the Menominee Range, vicinity of Iron Mountain, C. A. Lamey and C. E. Dutton.

Progress Report No. 7, 1941.

Dip-needle survey of the Wyandotte-Winona area, Houghton County, and Cherokee area, Ontonagon County, Kiril Spiroff.

Progress Report No. 8, 1942.

Geology of the Menominee Range, Norway to Waucedah, C. A. Lamey and C. E. Dutton.

Progress Report No. 9, 1942.

Economic geology of a part of the Menominee Range, C. E. Dutton.

Progress Report No. 10, 1944.

Strategic mineral investigations in Marquette and Baraga counties, 1943, A. K. Snelgrove, W. A. Seaman and V. L. Ayres.

(In co-operation with the Michigan College of Mining and Technology)

Progress Report No. 11, 1945.

Geology of the Spruce River and Peshekee River areas, Marquette and Baraga counties, W. A. Seaman.

(In co-operation with the Michigan College of Mining and Technology)

Progress Report No. 12, 1945.

Ground water resources of the Benton Harbor area, W. T. Stuart and R. W. Stallman.

(In co-operation with the U. S. Dept. of Interior, Geological Survey)

Progress Report No. 13, 1945.

Ground water resources of the Lansing area, Michigan, W. T. Stuart.

(In co-operation with the U. S. Dept. of Interior, Geological Survey)

Progress Report No. 14, 1951.

Ground-water resources of the glacial deposits in the Bessemer area, Michigan, E. A. Brown and W. T. Stuart.

(In co-operation with the U. S. Dept. of Interior, Geological Survey)

Progress Report No. 15, 1952.

The Richfield challenge, G. H. Hautau.

Progress Report No. 16, 1954.

Ground-water resources of southeastern Oakland County, J. G. Ferris, E. M. Burt, G. J. Stramel and E. G. Crosthwaite. (In co-operation with the U. S. Dept. of Interior, Geological Survey)

TECHNICAL REPORTS

The first technical report was published in March 1948 in co-operation with the United States Department of the Interior, Geological Survey. These reports are mimeographed and bound. Editions are limited.

Technical Report No. 1, 1948.

Ground water hydraulics as a geophysical aid, J. G. Ferris.

Technical Report No. 2, 1948.

Ground-water problems of the Iron River district, W. T. Stuart, C. V. Theis and G. M. Stanley.

Technical Report No. 3, 1954.

Ground water investigations of the Marquette iron-mining district, W. T. Stuart, E. A. Brown and E. C. Rhodehamel.

RESEARCH PUBLICATIONS

Research publications are published by the University of Michigan, Engineering Research Institute, Lake Hydraulics Laboratory as part of a co-operative project with the Michigan Department of Conservation, Geological Survey Division.

Research Publication No. 1, 1950.

Bibliography on beach erosion and related subjects.

Research Publication No. 2, 1950.

Beach erosion in Michigan, E. F. Brater.

Research Publication No. 3, 1952.

Low cost shore protection for the Great Lakes.

(In co-operation with Michigan Water Resources Commission)

MISCELLANEOUS PUBLICATIONS

Mines and mineral statistics.

Annual reports of the Commissioners of mineral statistics, 1877 and previous years to 1909.

You never miss the water, 1952, J. L. Slaughter and J. M. Campbell.

Statistics covering costs and production of Michigan iron mines. Published annually since 1927.

Summary of operations, oil and gas fields. Published annually since 1946.

Logs of water wells, oil and gas wells, other borings, drillers, company and sample logs. Filed and issued as requested.

General regulations governing oil and gas operations in the state of Michigan, June 9, 1949.

General regulations governing the spacing, drilling, deepening and plugging of wells for natural dry gas, June 9, 1949.

ACT NO. 61, PUBLIC ACTS 1939 as amended.

This Act provides for a Supervisor of wells.

ACT NO. 194, PUBLIC ACTS 1939 as amended by Acts 121 and 194, Public Acts 1954. (Inland lake levels).

ACT NO. 326, PUBLIC ACTS 1937 as amended.

This Act provides for a Supervisor of natural dry gas wells.

Price list of oil and gas and geologic maps available from Geological Survey Division.

Index maps to topographic quadrangles in Michigan.

A guide to uranium prospectors in Michigan, 1949, B. E. Kennedy.

Lake gazetteer, Gogebic County, Michigan, compiled by Michigan Committee on Geographic Names, June 1952, revised July 1954.

A quantitative method for determining ground water characteristics for drainage design, J. G. Ferris.

List of publications Geological Survey Division, with prices.

CO-OPERATIVE REPORTS

In co-operation with
United States Department of Interior
Bureau of Mines

Publications 21, 24, 27, 29, 32, 33, 34, 35, and 37.

Statistical data on mineral resources.

Summary Report No. 1, 1933.

Production and value of minerals and mineral products in Michigan, 1927 to 1931 and prior years, Wayland Osgood and O. F. Poindexter.

Summary Report No. 2, 1936.

Production and value of minerals and mineral products in Michigan, 1930 to 1934 and prior years, Wayland Osgood and O. F. Poindexter.

Mineral industries of Michigan, 1934 to 1938 and prior years, O. F. Poindexter.

Michigan's mineral industries 1946, 1948 (includes summary statistics for 1947), 1949, 1951, and 1952.

Michigan's mineral industries 1953, H. O. Sorensen and E. T. Carlson.

U. S. Bureau of Mines Report of Investigations 3313, 1936.

Extent and availability of natural gas reserves in Michigan "Stray" sandstone horizon of central Michigan, E. L. Rawlins and M. A. Schellhardt.

In co-operation with
United States Department of Interior
Geological Survey

U. S. Geological Survey Circular 26, 1948.

Magnetic survey and geology of the eastern and southeastern parts of the Iron River district, Iron County, Michigan, H. L. James and K. L. Wier.

U. S. Geological Survey Circular 43, 1949.

Geology of the central part of the Iron River district, Iron County, Michigan, C. E. Dutton.

U. S. Geological Survey Circular 55, 1949.

Magnetic survey and geology of the Stager area, Iron County, Michigan, S. E. Good and F. J. Pettijohn.

U. S. Geological Survey Circular 77, 1950.

Coal resources of Michigan, G. V. Cohee et al. (In co-operation with the University of Michigan).

U. S. Geological Survey Circular 84, 1950.

Progress of geologic work in Iron and Dickinson counties, Michigan, C. E. Dutton.

U. S. Geological Survey Circular 120, 1951.

Geology of the northern part of the Iron River district, Iron County, Michigan, H. L. James and C. E. Dutton.

U. S. Geological Survey Circular 133, 1951.

Detroit River group in the Michigan basin, K. K. Landes.

U. S. Geological Survey Circular 153, 1952.

Geology of the northern Crystal Falls area, Iron County, Michigan, F. J. Pettijohn.

U. S. Geological Survey Circular 183, 1952.

Water resources of the Detroit area, Michigan, C. O. Wisler, G. J. Stramel and L. B. Laird.

U. S. Geological Survey Circular 323, 1954.

Water resources of the Grand Rapids area, Michigan, G. J. Stramel, C. O. Wisler and L. B. Laird.
U. S. Geological Survey Preliminary Report, 1945.
General character and succession of tentative divisions in the stratigraphy of Mineral Hills district, Iron River, Iron County, Michigan, C. E. Dutton, C. F. Park, Jr., and J. R. Balsley, Jr.
U. S. Geological Survey Strategic Minerals Investigations Preliminary Map 3-181, 1946.
Geology of the Crystal Falls-Alpha iron-bearing district, Iron County, Michigan, F. J. Pettijohn.
U. S. Geological Survey Strategic Minerals Investigations Preliminary Map 3-213, 1947.
Magnetic survey and geology of the Ice Lake-Chicagon Creek area, Iron County, Michigan, H. L. James, L. B. Clark and L. E. Smith.
U. S. Geological Survey Geophysical Investigations, 1949.
Aeromagnetic survey of parts of Baraga, Iron and Houghton counties, Michigan, with preliminary geologic interpretation, J. R. Balsley, H. L. James and K. L. Wier.
An airborne radioactivity survey of parts of Marquette, Bickinson and Baraga counties, Michigan, 1950, J. R. Balsley, F. W. Stead, F. J. Bavis, R. A. Nelson and P. W. Reinhardt.
(In co-operation with U. S. Atomic Energy Commission).
U. S. Geological Survey Geophysical Investigations 115, 1953.
Aeromagnetic survey of part of Bickinson County, Michigan, with preliminary geologic interpretation, K. L. Wier, J. R. Balsley and W. P. Pratt.

In co-operation with
United States Department of Interior, Geological Survey
and
Department of Geology, University of Michigan

Map No. 11, 1944.
Geology and oil and gas possibilities of south-central Michigan, G. V. Cohee.
Map No. 17, 1944.
Map and sections of the Berea sandstone of eastern Michigan, G. V. Cohee and L. B. Underwood.
Map No. 28, 1945.
Geology and oil and gas possibilities of Sylvania and Bois Blanc formations of Michigan, K. K. Landes.
Map No. 38, 1945.
Lithology and thickness of the Dundee formation and the Rogers City limestone in the Michigan basin, G. V. Cohee and L. B. Underwood.
Map No. 40, 1945.
The Salina and Bass Island rocks in the Michigan basin, K. K. Landes.
Chart No. 4, 1944.
Thickness and character of the Traverse group and Dundee formation in southwestern Michigan, G. V. Cohee.
Chart No. 9, 1945.
Sections and maps of Lower Ordovician and Cambrian rocks in the Michigan basin, Michigan and adjoining areas, G. V. Cohee.
Chart No. 11, 1945.
Geology and oil and gas possibilities of Trenton and Black River limestones of the Michigan basin, Michigan and adjacent areas, G. V. Cohee.
Chart No. 28, 1947.
Lithology and thickness of the Traverse group in the Michigan basin, G. V. Cohee.
Chart No. 33, 1948.
Thickness and lithology of Upper Ordovician, and Lower and Middle Silurian rocks in the Michigan basin, G. V. Cohee (2 sheets).

Chart No. 41, 1951.

Thickness and lithology of Upper Devonian and Carboniferous rocks in Michigan, G. V. Cohee, Carol Mocha, and Marjorie Holk (5 sheets).

FIELD EXCURSION GUIDEBOOKS

In co-operation with the Geology Section
Michigan Academy of Science, Arts and Letters
and the Michigan Geological Society

1931. First Annual Excursion, Michigan Academy of Science. Field Excursion to Saginaw Bay Region.
1932. Section Geology and Geography, Michigan Academy of Science.
Pleistocene of southwestern Southern Peninsula.
1933. Michigan Academy of Science Field Excursion.
Pennsylvanian in Grand Ledge area.
1934. Michigan Academy of Science Geological Field Trip.
Pleistocene of the Thumb area of Michigan.
1935. Guide to Fifth Annual Field Trip, Section Geology and Mineralogy, Michigan Academy of Science.
A study of the Lucas County, Ohio—Monroe County, Michigan Monocline and stratigraphy of northwestern Ohio and southeastern Michigan.
1936. Guide to Sixth Annual Field Trip, Section Geology and Mineralogy, Michigan Academy of Science.
A study of the Fort Wayne Outlet of the Early Glacial Lakes and Niagaran Strata of Northern Indiana.
1937. Seventh Annual Field Excursion of the Michigan Academy of Science, Arts and Letters, Section Geology and Geography.
Devonian of Alpena and Presque Isle counties (celebrating the Centennial of the Michigan Geological Survey).
1938. Eighth Annual Field Excursion of the Michigan Academy of Science, Arts and Letters, Section Geology and Geography.
Devonian of Antrim, Charlevoix and Emmet counties.
1939. Ninth Annual Field Excursion of the Michigan Academy of Science, Arts and Letters, Section Geology and Geography.
Marquette and Menominee Districts.
1940. Tenth Annual Geological Excursion, Michigan Academy of Science, Arts and Letters.
To Afton-Onaway District, Devonian.
1941. Eleventh Annual Geological Excursion, Michigan Academy of Science, Arts and Letters.
St. Ignace and Mackinac Island.
1944. Mackinac Straits Field Conference, Michigan Geological Society.
1945. Field Trip Northwestern Ohio. No Guidebook prepared.
1946. Michigan Geological Society, Ontario Field Trip.
1947. Annual Field Trip, Michigan Academy of Science, Arts and Letters and Michigan Geological Society.
Michigan Copper Country.

1948. Annual Geological Excursion, Michigan Academy of Science, Arts and Letters and the Michigan Geological Society.
Pleistocene and Early Paleozoic of the eastern part of the Northern Peninsula of Michigan.
1949. Annual Geological Excursion, Michigan Geological Society.
The Traverse Group of the northern part of the Southern Peninsula.
1950. Annual Geological Excursion, Michigan Geological Society.
The Ordovician Rocks of the Escanaba-Stonington area.
1951. Annual Geological Excursion, Michigan Geological Society.
Devonian and Silurian rocks of Ontario, Canada and Western New York.
1952. Annual Geological Excursion, Michigan Geological Society.
Stratigraphy and Structure of the Devonian Rocks in southeastern Michigan and northwestern Ohio. (This was also the guidebook for the stratigraphic field trip of the Geological Society of America, November 1951).
1953. Annual Geological Excursion, Michigan Geological Society.
The Ordovician Stratigraphy of the Cincinnati, Ohio and Richmond, Indiana areas.
1954. Annual Geological Excursion, Michigan Geological Society.
Stratigraphy of Manitoulin Island, Ontario.
1955. Michigan Geological Society, Annual Field Trip.
Niagara Escarpment of Peninsular Ontario.

OPEN FILE REPORTS

Open file reports are available for study at the office of the Michigan Geological Survey, Lansing 26, Michigan; United States Geological Survey, Iron Mountain, Michigan; United States Geological Survey, University of Wisconsin, Madison, Wisconsin.

Graphite deposits of the Taylor mine area, 1942, Justin Zinn (12 pp., map).

The Adventure mining property, 1942, Justin Zinn.

Geology of an area southwest of Randville, Dickinson County, Michigan, 1946, C. A. Lamey (8 pp., 2 pls.). (U. S. Geological Survey in co-operation with Michigan Geological Survey).

Geology of an area near Randville, Michigan, 1947, C. A. Lamey (17 pp., 2 pls., 1 fig.). (U. S. Geological Survey in co-operation with Michigan Geological Survey).

Geology of the Lake Michigamme area, Baraga and Marquette counties, 1947, W. A. Seaman (119 pp., 7 pls., 5 tables). (Michigan Geological Survey in co-operation with Michigan College of Mining and Technology).

Geology of the Ishpeming gold range, 1948, R. M. Denning (17 pp., 3 pls.).

(Michigan Geological Survey in co-operation with Michigan College of Mining and Technology).

Geology of a part of the Felch Mountain iron range, Michigan, 1949, C. A. Lamey (19 pp., 2 pls.). (United States Geological Survey).

Detailed geologic maps of recently active copper mines, Houghton and Keweenaw counties, Michigan, 1949, H. R. Cornwall, J. J. Runner, A. A. Stromquist, R. W. Swanson and W. A. White (43 pp., 24 pls.). (United States Geological Survey).

Salt deposits of the United States: Incomplete compilation from published sources, 1950, Resources Group, U. S. Geological Survey (2 pp., map).

Geologic and magnetic data of the Sholdeis-Doane and Red Rock explorations, Iron County, Michigan, 1951, K. L. Wier and B. E. Kennedy (19 pp., 5 pls., 1 fig.). (U. S. Geological Survey in co-operation with Michigan Geological Survey).

Geology and magnetic anomalies of T 42 N, R 30 W, Dickinson County, Michigan, 1951, F. J. Pettijohn (30 pp., 3 pls., 1 fig.). (U. S. Geological Survey in co-operation with Michigan Geological Survey).

Stratigraphic sections in the vicinity of the White Pine copper mine, Ontonagon County, Michigan, 1953, W. S. White and J. C. Wright (1 p., 1 fig., 2 explanation sheets, 15 sees.). (United States Geological Survey).

Pre-Cambrian geology of the Norway Lake area, Dickinson County, Michigan, 1953, L. D. Clark (63 pp., 14 pls., 2 figs., 4 tables). (U. S. Geological Survey in co-operation with Michigan Geological Survey).

Progress report on ground-water conditions at the Cayia mine near Crystal Falls, Mich., 1953, W. T. Stuart (26 pp., 10 figs.). (United States Geological Survey).

Ground-water resources of the Holland area, Ottawa County, Michigan, 1953, J. G. Ferris (29 pp., 3 figs.). (U. S. Geological Survey in co-operation with Michigan Department of Conservation, Michigan Water Resources Commission, and the Holland Department of Public Works).

The following open file report is available for study at the office of the United States Department of the Interior, Geological Survey, Lansing 13, Michigan:

Interpretation of the pre-Pleistocene geomorphology of a portion of the Saginaw Lowland, 1954, E. C. Rhodehamel (163 pp., 11 pls., 8 figs.).

Many informal reports are available for study, i.e., statistical material, map and list of glacial striae and others.

INDEX OF THE PUBLICATIONS OF THE MICHIGAN GEOLOGICAL SURVEY 1838-1955

By
HELEN M. MARTIN

Two reports not published by the Survey are briefly indexed; (1) Report of the C. T. Jackson Survey, Lake Superior Mineral Lands; (2) Report of the Geology and Topography of the Lake Superior Land District, Part I, Copper Lands and Geology of the Lake Superior Land District; Part II, Iron Lands, by J. W. Foster and J. D. Whitney. These reports were published as United States Congressional Documents. The Jackson report is Part III of the message of the President of the United States to the 31st Congress, Senate Document No. 1, 1849, House of Representatives Executive Document No. 5. The Foster and Whitney Reports were a part of the President's message to the Special Session of the United States 31st Congress and were published for the House of Representatives as Executive Document No. 69, 1850.

These documents are included in this index inasmuch as the surveys they report were continuations of the plans and surveys of Douglass Houghton. Work of the surveys was done by men associated with Houghton and trained by him; and the reports embody maps and reports of work started under Houghton and continued after his death by such men as Bela Hubbard, C. C. Douglass, S. W. Hill, Jacob Houghton, Judge Burt, James Hall, S. W. Higgins, William Ives, and other members of the original Survey staff.

The Jackson Report is abbreviated C.T.J.

The Foster and Whitney reports are abbreviated F. and W. pt. 1, and F. and W. pt. 2.

Survey reports have been published as:

1. Michigan Legislative documents. Abbreviated S.D., Senate Document; H.D., House Document; J.D., Joint Document; Houghton.
2. First Biennial Report. Abbreviated Winchell.
3. Volumes I through IX. Abbreviated Vol. I-IX.
4. Annual Reports 1901 through 1908. Abbreviated Ann. Rept. 1901-1908.
5. Publications 1 through 50. Abbreviated Pub. 1-50.
6. Progress Reports 1 through 16. Abbreviated P.R. 1-16.
7. Technical Reports 1 through 3. Abbreviated T.R. 1-3.
8. Open file and miscellaneous. Abbreviated Misc., includes Land Economic Survey open file, abbreviated L.E.S. See list of publications.
9. Research Publications. Abbreviated R.P. 1-3.
10. Summary Reports 1 and 2. Abbreviated S.R. 1-2.

The field notes of Douglass Houghton, Bela Hubbard, A. Winchell, N. H. Winchell, Carl Rominger and Frank Leverett have been transcribed, indexed, and are in open file in the Survey library.

For reference to stratigraphy see Index to Nomenclature of Michigan Geologic Formations.

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29, 1889 to authorize incorporation of pipe line companies: Pub. 47.

107, 1905 to regulate use of and waste of water from artesian wells: Ann. Rept. 1905.

250, 1905 provides for a Biological Survey: Ann. Rept. 1905; Pub. 17.

251, 1905 provides for topographic mapping: Ann. Rept. 1905.

7, 1911 provides for collection of mineral statistics: Pub. 17.

84, 1915 appropriates fund for remarking Ohio-Michigan boundary line: Pub. 22.

65, 1927 creates office of Supervisor of Wells, designates director of Conservation as Supervisor: Pub. 47.

9, 1929 "the pipe line law": Pub. 38, 47.

15, 1929 designating Supervisor of Wells and certain duties: Pub. 47.

16, 1929 crude oil carriers controlled by Public Utilities Commission: Pub. 47.

185, 1931 requires a performance bond: Pub. 47.

326, 1937 relates to prevention of waste of gas.

61, 1939 provides for supervisor of wells and advisory board.

190, 1951 relates to plugging of oil wells: Pub. 47.

216, 1951 relates to plugging of gas wells: Pub. 47.

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- Algonquin beach: Vol. VII pt. 2, IX; Ann. Rept. 1901, 1906; Pub. 40 pt. 1, 43, 44, 45 pts. 1 and 2, 49. See Index to Nomenclature.
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calcium chloride	natural gas
celestite	novaculite
cement	oil
chalco-pyrite	orthoclase
chlorite	peat
clay	petroleum
coal	potash
copper	pottery
dolomite	pyrite
epidote	pyrolusite
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glass sand	silver
gold	slate
gothite	sphalerite
granite	staurolite
graphite	strontianite
grindstones	talc
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compiled by
HELEN M. MARTIN

Derivation of name, introduction in Michigan, and significant usage in Michigan Geological Survey publications. For usage elsewhere, consult U.S.G.S. Bull. 769, 896 and later bibliographies, and the list of References in Part II of this volume.

ABBREVIATIONS

A.A.A.S. Proc.—American Association for the Advancement of Science Proceedings.
A.A.P.G. Bull.—American Association of Petroleum Geologists Bulletin.
Acad. Nat. Sci. Philadelphia Proc.—Academy of Natural Sciences Philadelphia Proceedings.
Am. Comm. Rept. Internat. Geol. Cong.—American Committee Report International Geologic Congress.
Am. Geol.—American Geologist.
Am. Inst. Min. Eng. Trans.—American Institute of Mining and Metallurgical Engineers Transactions.
Am. Jour. Sci. 3d ser.—American Journal of Science, 3d series.
Am. Jour. Sci. ser. 4.—American Journal of Science, series 4.
Am. Jour. Sci. ns.—American Journal of Science, new series.
Am. Philos. Soc. Proc.—American Philosophical Society Proceedings.
Annales sci. nat.—Annales des sciences naturelles.
Ann. Rept.—Annual Report.
Canada Geol. Surv. Prog. Rept.—Canada Geological Survey Progress Report.
Canada Geol. Surv. M.—Canada Geological Survey Memoir.
Canada Geol. and Nat. Hist. Surv. ns.—Canada Geological and Natural History Survey, new series.
Chi. Acad. Sci. and Nat. Hist. Surv.—Chicago Academy of Science and Natural History Survey.
Chi. Geol. and Nat. Hist. Surv.—Chicago Geological and Natural History Survey.
Co.—County.
Edinburgh New Philos. Jour.—Edinburgh New Philosophical Journal.
Eng. and Min. Jour.—Engineering and Mining Journal.
Geol. Mag. London ns.—Geological Magazine of London, new series.
G.S.A. Bull.—Geological Society of America Bulletin.
Geol. Sec.—Geology Section.
Indiana Acad. Sci. Proc.—Indiana Academy of Science Proceedings.
Jour. Geol.—Journal of Geology.
Lake Superior Min. Inst. Proc.—Lake Superior Mining Institute Proceedings.
London and Edinburgh Philos. Mag. and Jour.—London and Edinburgh Philosophical Magazine and Journal.
Man. Geol.—Manual of Geology.
Mich. Acad. Sci.—Michigan Academy of Science.
Mich. Acad. Sci., Arts and Lett.—Michigan Academy of Science, Arts and Letters.
Mich. Geol. Soc.—Michigan Geological Society.
M.G.S.—Michigan Geological Survey.
M.G.S. Ann. Rept.—Michigan Geological Survey Annual Report.
M.G.S. P.R.—Michigan Geological Survey Progress Report.

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M.G.S. Pub.—Michigan Geological Survey Publication.
M.G.S. Vol.—Michigan Geological Survey Volume.
Mich. Leg. H.D.—Michigan Legislature House Document.
Mich. Leg. J.D.—Michigan Legislature Joint Document.
Mich. Leg. S.D.—Michigan Legislature Senate Document.
Minnesota Geol. Nat. Hist. Surv.—Minnesota Geological and Natural History Survey.
Missouri Bur. Geol. and Mines—Missouri Bureau of Geology and Mines.
Mon.—Monograph.
Ohio Geol. Surv. Rept. Prog.—Ohio Geological Survey Report of Progress.
Ottawa Nat.—Ottawa Naturalist.
Pal. New York—Paleontology of New York.
pt.—Part.
Pennsylvania Geol. Surv. Rept. Appen.—Pennsylvania Geological Survey Report, Appendix.
Phil. Acad. Sci. Jour.—Philadelphia Academy of Science Journal.
Philos. Mag. 3 ser.—Philosophical Magazine, 3d series.
P.P.—Professional Paper.
P.R.—Progress Report.
Prel. Rept. Prog. Geol. Surv.—Preliminary Report of Progress of the Geological Survey.
Pub.—Publication.
Rept. St. Bd. Geol. Surv.—Report of the State Board of Geological Survey.
Sci. ns.—Science, new series.
Smithsonian Misc. Coll.—Smithsonian Miscellaneous Collections.
Twp.—Township.
Univ. Mich. Dept. Geol.—University of Michigan, Department of Geology.
U.S.G.S. Ann. Rept.—United States Geological Survey Annual Report.
U.S.G.S. Mon.—United States Geological Survey Monograph.
U.S.G.S. P.P.—United States Geological Survey Professional Paper.
U.S.G.S. W.-S.P.—United States Geological Survey Water-Supply Paper
U.S. Cong. Spec. Sess. Sen. Ex. Doc.—United States Congress Special Session, Senate Executive Document.
U.S. Nat. Mus. Proc.—United States National Museum Proceedings.
Vol.—Volume.
Wash. Acad. Sci. Jour.—Washington Academy of Science Journal.
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A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2. Bedford, Cuyahoga Co., Ohio.

Beebe School shale. Devonian.

- W. A. Kelly, 1949. Mich. Acad. Sci. and Mich. Geol. Soc. and M.G.S. Guidebook; A.A.P.G. Vol. 31.
Beebe School, Koehler Twp., T.34N., R.2W., Cheboygan Co., Michigan.

Beekmantown. Lower Ordovician.

- J. M. Clarke and C. Schuchert, 1899. Sci. ns. Vol. 10.
R. A. Smith, 1916. M.G.S. Pub. 21; 1917, M.G.S. Pub. 24. Calciferous Lower Magnesian which apparently includes the Hermansville ls.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37. Lower Magnesian, Calciferous, or Prairie du Chien. Beekmantown, New York.

Bell shale. Middle Devonian.

- A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37. Marcellus.
G. E. Eddy, 1936. M.G.S. P.R. 1.
E. A. Newman, 1936. M.G.S. P.R. 2.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
Mich. Acad. Sci., Mich. Geol. Soc., and M.G.S., 1937. 7th Ann. Field Excur. Guidebook.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1947. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 28.
Mich. Geol. Soc., 1949, 1951, and 1952. Ann. Geol. Excur. Guidebooks.
Bell, Presque Isle Co., Michigan.

Belmore beach. Pleistocene.

- Ancient Lake Ridge of Bela Hubbard. Mich. Leg. S.D. 1840, Vol. 2, No. 7.
N. H. Winchell, 1872. Am. Assoc. Adv. Sci. Proc. Vol. 21.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
Belmore, Putnam Co., Ohio.

Berea grit; shale. Mississippian.

- A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C. E. Wright.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; M.G.S. Ann. Repts. 1901, 1904, 1905, and 1906.
W. P. Cooper, 1906. M.G.S. Ann. Rept, 1905. Equivalent to Sunbury.
C. W. Cook, 1914. M.G.S. Pub. 15.
Berea, Cuyahoga Co., Ohio.

Berea sandstone. Mississippian.

- J. S. Newberry, 1870. Ohio Geol. Surv. Rept. Prog. 1869.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. "Richmondville sandstone which may as well be called Berea as it is much better developed in Ohio."
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
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R. A. Smith, 1914. M.G.S. Pub. 14.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
G. H. Pringle, 1937. M.G.S. P.R. 3.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1944. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations map 11; 1944, map 17; 1951, chart 41. Subsurface.
A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
Berea, Cuyahoga Co, Ohio.

Berville Moraine. Pleistocene.

- F. Leverett, 1915. U.S.G.S. Mon. 53.
Berville, Macomb Co., Michigan.

Bessemer sandstone. Huronian.

- W. A. Seaman, 1944. M.G.S. P.R. 10.
Bessemer, Gogebic Co., Michigan.

Big Buffalo. Lower Ordovician.

- E. O. Ulrich, 1911. G.S.A. Bull. Vol. 22.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Buffalo River, Newton Co., Arkansas.

Big Hill. Upper Ordovician. Richmond.

- R. C. Hussey, 1926. Univ. Mich. Mus. Geol. Contr. Vol. 2, No. 8.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
Mich. Geol. Soc., 1950 and 1954. Ann. Geol. Excur. Guidebooks.
R. C. Hussey, 1952. M.G.S. Pub. 46.
Big or Hinkers Hill, Sec. 11, T.39N., R.21W., Delta Co., Michigan.

Big Trap. Keweenawan.

- Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.

Bijiki iron fm. Upper Huronian.

- C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept. Member Michigamme slate.
W. C. Gordon and A. C. Lane, 1907. M.G.S. Ann. Rept. 1906. Ironwood.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Goodrich.
R. C. Allen, 1910. M.G.S. Pub. 3; 1912, M.G.S. Pub. 8; 1915, M.G.S. Pub. 18.
W. A. Seaman, 1944. M.G.S. P.R. 10; 1945, M.G.S. P.R. 11.
V. L. Ayres, 1944. M.G.S. P.R. 11.
Bijiki River, Marquette Co., Michigan.

Bills Creek. Upper Ordovician, Richmond.

- R. C. Hussey, 1926. Univ. Mich. Mus. Geol. Contr. Vol. 2, No. 8.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1948. U.S.G.S. (Co-op M.G.S., Univ. Mich. Dept. Geol.)
Oil and gas investigations chart 33.
R. C. Hussey, 1952. M.G.S. Pub. 46.
Mich. Geol. Soc., 1950 and 1954. Ann. Geol. Excur. Guidebooks.
Bills Creek, T. 41 N., R. 20 W., Delta Co., Michigan.

Birdseye. Ordovician. See Lowville.

- L. Vanuxem, 1838. N.Y. Geol. Surv. 2d Rept. (After Amos Eaton, 1824 ?).
W. Burt, 1847. U.S. 31st Cong., 1st Sess., House Ex. Doc. 5; Sen. Ex. Doc. 1.
J. W. Foster and J. D. Whitney, 1851. U.S. 31st Cong. Spec. Sess., Sen. Ex. Doc. 4.
C. Rominger, 1873. M.G.S. Vol. I, pt. 3.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906, legend geol. map.
Replaced 1899 by Lowville.

Birmingham Moraine. Pleistocene.

- F. Leverett, 1915. U.S.G.S. Mon. 53.
W. H. Sherzer, 1917. U.S.G.S. Geol. Atlas Detroit Folio No. 205.
Birmingham, Oakland Co., Michigan.

Black River. Middle Ordovician.

- L. Vanuxem, 1842. Geol. of N.Y., Pt. 3.
J. W. Foster and J. D. Whitney, 1851. U.S. 31st Cong. Spec. Sess. Sen. Ex. Doc. 4.
C. Rominger, 1873. M.G.S. Vol. I, pt. 3.
E. C. Case and W. I. Robinson, 1915. M.G.S. Pub. 18. Upper Buff.
R. A. Smith, 1917. M.G.S. Pub. 24, log of Henry Ford Well.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
R. C. Hussey, 1936. M.G.S. Pub. 40, pt. 3; 1952, M.G.S. Pub. 46.
G. V. Cohee, 1945. U.S.G.S. (Co-op M.G.S., Univ. Mich. Dept. Geol.)
Oil and gas investigations chart 11.
Mich. Acad. Sci, Arts and Lett., and M.G.S., 1948. Ann. Excur. Guidebook.
Mich. Geol. Soc., 1950 and 1954. Ann. Geol. Excur. Guidebooks.
Cliffs on Black River, New York.

Black shales of Ohio. See St. Clair, Huron, Antrim shales.

- C. Rominger, 1876. M.G.S. Vol. III.
C. E. Wright, 1895. M.G.S. Vol. V, pt. 2. Notes edited by A. C. Lane.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1900. M.G.S. Vol. VIII, pt. 2.

Blaney Segment of Newberry Moraine. Pleistocene.

- S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
Blaney, Schoolcraft Co., Michigan.

Bohemia Conglomerate. Keweenawan.

- L. L. Hubbard, 1898. M.G.S. Vol. VI, pt. 2.
Report Spec. Comm. L. Superior region, 1905. M.G.S. Ann. Rept. 1904.
Mt. Bohemia, Keweenaw Co., Michigan.

Bohemia Range Group. Keweenawan.

- R. D. Irving, 1883. U.S.G.S. Mon. 5.
L. L. Hubbard, 1898. M.G.S. Vol. VI, pt. 2.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
R. C. Allen, 1912. M.G.S. Pub. 8.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Keweenaw Co., Michigan.

Bois Blanc. Devonian.

- G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits Field Conference Guidebook.
G. M. Ehlers, 1945. M.G.S. Pub. 44. Defined.
K. K. Landes, 1945. M.G.S. Pub. 44. Subsurface.
K. K. Landes, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations map 28.
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A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
Bois Blanc Island, Mackinac Straits area, Michigan.

Bony Falls. Ordovician.

- R. C. Hussey, 1952. M.G.S. Pub. 46.
Mich. Geol. Soc., 1954. Ann. Geol. Excur. Guidebook.
Escanaba River, T. 41 N., R. 24 W., Delta Co., Michigan.

Brier slate fm. Huronian.

- C. R. Van Hise and W. S. Bayley, 1900. U.S.G.S. Menominee Folio No. 62.
C. E. Dutton, 1942. M.G.S. P.R. 9.
Brier Hill, Menominee Co., Michigan.

Brule volcanics, schists. Upper Huronian.

- R. C. Allen, 1910. M.G.S. Pub. 3.
Brule River, Iron Co., Michigan.

Bryozoan beds. Devonian. Traverse.

- A. Winchell, 1861. M.G.S. First Bien. Rept. Equivalent to Acervularia and Stropheodonta beds of Grabau.

Bucks Moraine. Pleistocene.

- W. A. Ver Wiebe, 1925. Michigan Land ec. Surv. ms.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Bucks Siding, Crawford Co., Michigan.

Buena Vista. Mississippian.

- E. Orton, 1874. Ohio Geol. Surv. Vol. 2, pt. 1.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
Buena Vista, Scioto Co., Ohio.

- Buff magnesian beds.** Devonian. Traverse.
A. Winchell, 1861. M.G.S. First Bien. Rept. With Stromatopora beds (Winchell) = Petoskey limestone of Grabau.
- Burnt Bluff.** Silurian.
G. M. Ehlers, 1921. G.S.A. Bull. Vol. 32. Defined.
G. M. Ehlers, 1924. M.G.S. Pub. 34. Well log communication to M.G.S.
G. M. Ehlers, 1926. Unpublished ms. on the Niagaran of Michigan.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38. Clinton.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mich. Acad. Sci. Arts and Lett. and M.G.S., 1948. Ann. Excur. Guidebook.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
Mich. Geol. Soc., 1951. Ann. Geol. Excur. Guidebook. Burnt Bluff, Garden Peninsula, Delta Co., Michigan.
- Butler amygdaloid.** Keweenawan.
Long local usage.
R. E. Hore, 1915. M.G.S. Pub. 19.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Capt. B. S. Butler discoverer. Ontonagon Co., Michigan.
- Byron.** Silurian.
T. C. Chamberlin, 1877. Geol. Wisconsin, Vol. 2.
G. M. Ehlers, 1926. Unpublished ms. on the Niagaran of Michigan.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mich. Geol. Soc., 1951 and 1954. Ann. Geol. Excur. Guidebooks.
Byron Twp., Fond du Lac Co., Wisconsin.
- Cabot Head shale.** Silurian.
A. W. Grabau, 1913. G.S.A. Bull. Vol. 24.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Cabots Head shale.
R. A. Smith, 1917. M.G.S. Pub. 24. Well log.
G. M. Ehlers, 1924. M.G.S. Pub. 34. Well log interpretation for M.G.S.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
Mich. Geol. Soc., 1951 and 1954. Ann. Geol. Excur. Guidebooks.
Cabots Head, Manitoulin Island, Ontario.
- Calcifereous sandstone; sand rock.** Compact or Lower Magnesian ss. (Cambrian).
J. Hall, 1843. Descriptive term for interval between Lowville and Potsdam.
See Lane below.
J. W. Foster and J. D. Whitney, 1851. U.S. 31st Cong., Spec. Sess. House of Rep. Ex. Doc. 69, Sen. Ex. Doc. 4. J. Hall.
A. Winchell, 1861. M.G.S. First Bien. Rept. Lower Silurian.
T. B. Brooks, 1873. M.G.S. Vol. I, pt. 1. Silurian = (Cambrian).
C. Rominger, 1873. M.G.S. Vol. I, pt. 3, = Lake Superior sandstone, Munsing.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Exhibit K.
- A. C. Lane, 1901. Michigan Miner, Vol. 9, No. 2.
A. C. Lane, 1902. M.G.S. Ann. Rept. 1901; 1905, M.G.S. Ann. Rept. 1903; 1905, M.G.S. Ann. Rept. 1904.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906. Defined formation, type localities.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Ozarkian, Lower Ordovician.
R. A. Smith, 1914. M.G.S. Pub. 14. Calciferous or Lower Magnesian (Prairie du Chien). Lower Ordovician.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map = Beekmantown, including Hermansville.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. "Calcifereous" in description of Hermansville.
Calcifereous Creek, Alger Co., Michigan.
- Calico amygdaloid.** Keweenawan. Central Mine Group.
Long local usage.
A. C. Lane, 1911. M.G.S. Pub. 6.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Houghton Co., Michigan.
- Calumet amygdaloid.** Keweenawan.
A. C. Lane, 1907. Lake Superior Min. Inst. Proc. Vol. 12. Calumet Mine, Houghton Co., Michigan.
- Calumet beach stage.** Pleistocene.
F. Leverett, 1899. U.S.G.S. Mon. 38.
A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
F. Leverett, 1912. M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
G. C. Tague, 1948. M.G.S. Pub. 45, pt. 1.
J. L. Calver, 1948. M.G.S. Pub. 45, pt. 2.
F. W. Terwilliger, 1955. M.G.S. Pub. 48, pt. 1.
Calumet, Illinois.
- Calumet conglomerate.** Keweenawan.
L. L. Hubbard, 1895. M.G.S. Vol. V, pt. 1.
A. C. Lane, 1911. M.G.S. Pub. 6.
R. E. Hore, 1912. M.G.S. Pub. 8; 1915, M.G.S. Pub. 19.
Calumet Mine, Houghton Co., Michigan.
- Calumet and Hecla conglomerate.** Keweenawan.
L. L. Hubbard, 1895. M.G.S. Vol. V, pt. 1.
A. C. Lane, 1911. M.G.S. Pub. 6.
R. E. Hore, 1915. M.G.S. Pub. 19.
Calumet and Hecla Mine, Houghton Co., Michigan.
- Cambrian.**
Rev. A. Sedgwick, 1835. Edinburgh New Philos. Jour. Vol. 19.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Exhibit K. States "Cambrian divided by Survey into Potsdam and Calciferous"; also "divided by most geologists into Keweenawan and Potsdam".
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.
A. C. Lane, 1905. M.G.S. Ann. Rept. 1904. Report Spec. Comm. Lake Superior Region. Legend geol. map = Upper Keweenawan and Lake Superior ss.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
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R. A. Smith, 1914. M.G.S. Pub. 14; 1924, M.G.S. Pub. 34.
R. C. Allen and L. P. Barrett, 1915. M.G.S. Pub. 18. Potsdam.
E. C. Case and W. I. Robinson, 1915. M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.

- S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1. Cambrian-Ozarkian.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci., Geol. Sec. and M.G.S., 1939. Ann. Excur. Guidebook.
- C. E. Dutton, 1942. M.G.S. P.R. 9
- W A. Seaman, 1944. M.G.S. P.R. 10. Includes Upper Keweenawan.
- Canadian.**
- J. D. Dana, 1874. Am. Jour. Sci. 3d, Vol. 8.
- R. B. Newcombe, 1928. M.G.S. Pub. 37. Ozarkian.
- R. B. Newcombe, 1933. M.G.S. Pub. 38.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
- Carboniferous.**
- R. Kirvan, 1779. Geological essays, London.
- B. Hubbard, 1840. M.G.S. 3d Ann. Rept. State Geologist Mich. Leg., S.D. 1840, Vol. 2, No. 7.
- A. Winchell, 1861. M.G.S. First Bien. Rept.
- C. Rominger, 1876. M.G.S. Vol. III.
- M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Exhibit K.
- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; M.G.S. Ann. Repts. 1904, 1906.
- A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Sub-Carboniferous.
- R. B. Newcombe, 1928. M.G.S. Pub. 37.
- Carboniferous limestone.**
- A. Winchell, 1861. M.G.S. First Bien. Rept. (Mountain Is. of England).
- C. Rominger, 1876. M.G.S. Vol. III.
- Cary Substage.** Pleistocene. Mid. Wisconsin.
- M. M. Leighton, 1933. Sci. ns. Vol. 77.
- Cary, McHenry Co., Illinois.
- Cascade,** Archean (Huronian ?).
- M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Exhibit K.
- Cascade Range, Marquette Co., Michigan.
- Cataract.** Silurian.
- C. Schuchert, 1913. G.S.A. Bull., Vol. 24.
- R. A. Smith, 1914. M.G.S. Pub. 14; 1917, M.G.S. Pub. 24, well log.
- G. M. Ehlers, 1924. M.G.S. Pub. 34, well log.
- R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
- G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ Mich. Dept. Geol.) Oil and gas investigations chart 33. Cataract, Ontario.
- Catskill series.** Upper and Middle Devonian and Carboniferous.
- W. W. Mather, 1840. New York Geol. Surv. 4th Rept.
- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2. Catskill first in New York. Napoleon later in Michigan as sea advanced. Catskill Mts. Green Co., New York.
- Cayugan.** Silurian.
- J. M. Clarke and C. Schuchert, 1899. Sci. ns Vol 10.
- R. B. Newcombe, 1933. M.G.S. Pub. 38.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
- G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits Field Conference Guidebook.
- G. M. Ehlers, 1945. M.G.S. Pub. 44.
- Mich. Geol. Soc., 1951. Ann. Geol. Excur. Guidebook.
- A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2. Cayuga Lake, New York.
- Cazenovian.** Middle Devonian.
- T. A. Conrad, 1841. New York Geol. Surv. 5th Ann. Rept.
- G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits Field Conference Guidebook.
- G. M. Ehlers, 1945. M.G.S. Pub. 44.
- A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2. Ulsterian. Cazenovia, Madison Co., New York.
- Cedar Point beach.** Pleistocene. Algonquin.
- G. M. Stanley, 1937. G.S.A. Bull., Vol. 48.
- G. M. Stanley, 1945. M.G.S. Pub. 43.
- Central Mine.** Keweenawan.
- A. C. Lane and A. E. Seaman, 1907. Jour. Geol. Vol. 15.
- A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
- A. C. Lane, 1911. M.G.S. Pub. 6.
- R. E. Hore, 1915. M.G.S. Pub. 19.
- R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Central Mine, Keweenaw Co., Michigan.
- Champion Revolution.**
- W. A. Seaman, 1944. M.G.S. P.R. 10. Defined.
- Champlain epoch.** Pleistocene. Terrace.
- J. D. Dana, 1873. Am. Jour. Sci. 3, Vol. 5.
- W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.
- A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
- Champlain.** Middle Ordovician.
- E. Emmons, 1842. Geol. New York, 2, div. 4. Champlainic system.
- R. A. Smith, 1917. M.G.S. Pub. 24.
- R. B. Newcombe, 1928. M.G.S. Pub. 37. Lake Champlain, New York.
- Chandler Falls.** Ordovician.
- R. C. Hussey, 1952. M.G.S. Pub. 46. Defined.
- Mich. Geol. Soc., 1954. Ann. Geol. Excur. Guidebook. Escanaba River, T. 39 N., R. 22 W., Delta Co., Michigan.
- Charlevoix stage.** Devonian.
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I. D. Scott, 1921. M.G.S. Pub. 30.
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R. E. Hore, 1912. M.G.S. Pub. 8.
- R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
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Kirkfield, Ontario.

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- J. M. Safford, 1869. Geol. Tennessee.
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- W. A. Kelly, 1949. A.A.P.G. Vol. 31; Mich. Geol. Soc. Ann. Geol. Excur. Guidebook.
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Kona dolomite. Lower Huronian.

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- L. L. Hubbard, 1898. M.G.S. Vol. VI, pt. 2.
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- C. Rominger, 1881. M.G.S. Vol. IV, pt. 2.
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- R. D. Irving, 1883. U.S.G.S. Mon. 5.
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Lake Whittlesey, glacial. Pleistocene. See Whittlesey.

L'Anse series. Huronian.

- T. B. Brooks, 1873. M.G.S. Vol. I, pt. 1.
L'Anse, Baraga Co., Michigan.

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- F. Leverett, 1915. U.S.G.S. Mon. 53.
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Southern Peninsula Michigan.
Lansing, Ingham Co., Michigan.

Lansing ss. Pennsylvanian (?)

- Name proposed by O. F. Poindexter for a white ss. in Delhi Twp., Ingham Co., Michigan. Reported by Bela Hubbard. Examined but not described by M.G.S.

Laramide (?)

- J. D. Dana 1895. Textbook geol. 4th Ed. Revolution.
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Laramide Mountain Range.

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- A. C. Lane, 1911. M.G.S. Pub. 6.
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- W. E. Logan, 1854. Canada, Geol. Surv. Prog. Rept. 1852-1853.
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Lighthouse Point series. Mississippian.

- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.
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Huron Co., Michigan.

Lingula shales. Pennsylvanian. Saginaw.

- W. A. Kelly, 1936. M.G.S. Pub. 40, pt. 2.
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- C. C. Douglass, 1841. Ann. Rept. St. Geologist, Mich. Leg. J.D. 1841.
A. Winchell, 1873. Walling's Atlas of Michigan.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Dropped "Little".
A. C. Lane, 1893. Reported by M. E. Wadsworth, M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
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- J. Hall, 1839. New York Geol. Surv. 3d Rept.
E. C. Case and W. I. Robinson, 1915. M.G.S. Pub. 18.
R. A. Smith, 1916. M.G.S. Pub. 21. Included in "Niagara".
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R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
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G. M. Ehlers, 1945. M.G.S. Pub. 44.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
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Lockport, New York.

Lodi fm. Upper Cambrian.

- F. T. Thwaites, 1923. Jour. Geol. Vol. 31.
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Lodi, Columbia Co., Wisconsin.

Logan fm. Mississippian.

- E. B. Andrews, 1870. Ohio Geol. Surv. Rept. Prog. 1869.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C. E. Wright.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; 1907, M.G.S. Ann. Rept. 1906, legend geol. map.
Logan, Hocking Co., Ohio.

Long Lake series. Middle Devonian.

- A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901.
R. A. Smith, 1916. M.G.S. Pub. 21.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
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Long Lake, Alpena Co., Michigan.

Loretto slate. Huronian.

- C. E. Dutton, 1942. M.G.S. P.R. 9.
Loretto, Dickinson Co., Michigan.

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- E. Emmons, 1842. Geol. New York, pt. 2, div. 4, geol. 2d dist.
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I. C. Russell, 1905. M.G.S. Ann. Rept. 1904.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906, legend geol. map.
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Eden.
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New York (?)

Lower Grand Rapids. Mississippian.

- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.
W. M. Gregory, 1902. M.G.S. Ann. Rept. 1901.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
R. A. Smith, 1912. M.G.S. Pub. 8.
W. M. Gregory, 1912. M.G.S. Pub. 11. The Michigan series.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37.
Grand Rapids, Kent Co., Michigan.

Lower Helderberg. See Helderberg.**Lower Keweenawan.**

- A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Eo-Cambrian.
R. E. Hore, 1912. M.G.S. Pub. 8.

Lower Limerock fm.

- D. Houghton, 1840. 2d Ann. Rept. Mich. Leg. H.D. No. 27, Vol. 1; S.D. No. 8, Vol. 2.
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Lower Magnesian. See Prairie du Chien.

- A. C. Lane, 1905. M.G.S. Ann. Rept. 1903.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.

Lower Marshall. Mississippian.

- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.
W. M. Gregory, 1912. M.G.S. Pub. 11.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
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R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Marshall, Calhoun Co., Michigan.

Lower Monroe. Silurian.

- R. A. Smith, 1914. M.G.S. Pub. 14. Bass Island. 1916, M.G.S. Pub. 21; 1917, M.G.S. Pub. 24.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Monroe Co., Michigan.

Lower Munising. Cambrian. Dresbach (?)

- E. O. Ulrich, 1936. Personal communication to G. M. Ehlers.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Munising, Alger Co., Michigan.

Lower Ontarian (Niagaran). Silurian.

- R. B. Newcombe, 1928. M.G.S. Pub. 37. South shore Lake Ontario.

Lower Pentamerus. Silurian.

- T. A. Conrad, 1839. New York Geol. Surv. 2d Ann. Rept.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
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Lower Saginaw. Pennsylvanian.

- W. A. Kelly, 1936. M.G.S. Pub. 40. (Pre-Verne cyclical fm.)
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Coal mines, Saginaw Co., Michigan.

Lower St. Louis. Mississippian.

- R. B. Newcombe, 1928. M.G.S. Pub. 37. St. Louis, Missouri.

Lower Silurian.

- A. Winchell, 1861. M.G.S. First Bien. Rept. Cambrian.
C. Rominger, 1876. M.G.S. Vol. III. Includes Potsdam, Calciferous, Chazy, Trenton, Hudson River group.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Trenton, Silurian shales.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C. E. Wright, Hudson River, Utica, Trenton.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Niagaran.
R. A. Smith, 1917. M.G.S. Pub. 24. Oswegan.

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Lower Verne. See Verne. Pennsylvanian.

Lowville. Middle Ordovician. Black River group. See Birdseye.

- J. M. Clarke and C. Schuchert, 1899. Sci. ns. Vol. 10. Replaced Birdseye.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
Lowville, Lewis Co., New York.

Lucas dolomite. Lower Devonian.

- C. S. Prosser, 1903. Jour. Geol. Vol. 11.
A. C. Lane, 1905. M.G.S. Ann. Rept. 1903; 1909, M.G.S. Ann. Rept. 1908.
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W. H. Sherzer, 1910. M.G.S. Pub. 2.
R. A. Smith, 1916. M.G.S. Pub. 21.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
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A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2. Lucas Co., Ohio.

Lundy, glacial lake. Pleistocene. See Elkton.

- J. W. W. Spencer, 1894. Am. Jour. Sci. 3d ser., Vol. 48.
F. Leverett, 1902. U.S.G.S. Mon. 41; 1910, Mich. Acad. Sci. 12th Ann. Rept.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
F. Leverett, 1917. M.G.S. Pub. 25. (Grassmere, Elkton).

Lyons Moraine. Pleistocene.

- F. Leverett, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Lyons, Ionia Co., Michigan.

Mabb aplite. Keweenawan.

- A. R. Marvine, 1873. M.G.S. Vol. I, pt. 2. "Mabbs' vein".
A. C. Lane, 1911. M.G.S. Pub. 6. Isle Royale Mine, Houghton Co., Michigan.

Mackinac breccia. Devonian-Silurian.

- G. M. Ehlers and K. K. Landes, 1945. M.G.S. Pub. 44. Mich. Geol. Soc., 1951. Ann. Excur. Guidebook. Mackinac Straits area, Michigan.

Mackinac limestone. Middle Devonian.

- D. Houghton, 1840. M.G.S. 3d Ann. Rept. St. Geologist, Mich. Leg. S.D. 1840, Vol. 2, Mo. 7.
C. C. Douglass, 1841. M.G.S. Ann. Rept. St. Geologist, Mich. Leg. J.D. 1841, Vol. 1, No. 11, H.D. No. 27: S.D. No. 16.
A. W. Grabau 1902, M.G.S. Ann. Rept. 1901.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mackinac Island, Michigan.

Maclurites zone. Ordovician. Chandler Falls.

- R. C. Hussey, 1952. M.G.S. Pub. 46. Mich. Geol. Soc., 1954. Ann. Excur. Guidebook.

Madison. Cambrian.

- R. D. Irving, 1875. Am. Jour. Sci. 3d, Vol. 9.
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Mandon amygdaloid. Keweenawan.

- A. C. Lane, 1911. M.G.S. Pub. 6. Mandon Mine, Keweenaw Co., Michigan.

Manistee limestone.

- C. C. Douglass, 1841. M.G.S. Ann. Rept. St. Geologist, Mich. Leg. J.D. 1841, Vol. 1, No. 11.
May have been a glacial boulder ledge along lower Manistee River.

Manistee Moraine. Pleistocene.

- A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
F. Leverett, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Manistee Co., Michigan.

Manistique Complex. Pleistocene.

- S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
Manistique River area, Schoolcraft Co., Michigan.

Manistique series. Silurian. Niagaran.

- R. A. Smith, 1916. M.G.S. Pub. 21. Defined.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
G. M. Ehlers, 1921. G.S.A. Bull. Vol. 32. Formation.
R. A. Smith, 1924. M.G.S. Pub. 34. Well log.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci. Arts and Lett., Mich. Geol. Soc., and M.G.S., 1948. Ann. Excur. Guidebook.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
Mich. Geol. Soc., 1951 and 1954. Ann. Excur. Guidebooks.
Manistique, Schoolcraft Co., Michigan.

Manitou amygdaloid. Keweenawan.

- Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Manitou Mine, Keweenaw Co., Michigan.

Manitoulin dolomite; limestone. Silurian.

- J. J. Bigsby, 1824. Notes on the geog. and geol. of L. Huron. Manitouline.
D. Houghton, 1840. M.G.S. 3d Ann. Rept. St. Geol., Mich. Leg. S.D. Vol. 2, No. 7.
A. Winchell, 1861. M.G.S. First Bien. Rept.
A. C. Lane, 1905. M.G.S. Ann. Rept. 1903; 1909, M.G.S. Ann. Rept. 1908.
M. Y. Williams, 1913. Ottawa Nat. Vol. 27. Cataract.
R. A. Smith, 1917. M.G.S. Pub. 24.
G. M. Ehlers, 1924. M.G.S. Pub. 34.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
Mich. Geol. Soc., 1951 and 1954. Ann. Excur. Guidebooks.
Manitoulin Island, Ontario.

Mankato substage. Pleistocene.

- M. M. Leighton, 1931. Jour. Geol. Vol. 39; 1933, Sci. Vol. 77.
Mankato Co., Minnesota.

Manlius limestone. Silurian. Cayugan.

- L. Vanuxem, 1840. New York Geol. Surv. 4th Rept.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1. (See footnote by A. C. Lane).
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
Manlius, New York

Maple Forest Moraine. Pleistocene.

- W. A. Ver Wiebe, 1925. Michigan Land ec. Surv. ms.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Maple Forest Twp., Crawford Co., Michigan.

Marcellus shale. Middle Devonian.

- J. Hall, 1839. New York Geol. Surv. 3d Rept.
H. Ries, 1900. M.G.S. Vol. VIII, pt. 1.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906; 1909, M.G.S. Ann. Rept. 1908.
W. H. Sherzer, 1913. M.G.S. Pub. 12
R. A. Smith, 1916. M.G.S. Pub. 21.
Marcellus, Onondaga Co., New York.

Mareniscan series. Huronian.

- C. R. Van Hise, 1892. U.S.G.S. Bull. 86.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Abandoned 1909 for Keewatin, a synonym. ?
Marenisco Twp., Gogebic Co., Michigan.

Marlette Moraine. Pleistocene.

- A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
Marlette, Sanilac Co., Michigan.

Marquette brownstone. Cambrian.

- F. F. Sharpless, 1891. Reported by M. E. Wadsworth, 1893, M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
Marquette Co., Michigan.

Marquette series.

- Used in some early reports for Huronian of Marquette District, Michigan.

Marshall group; sandstone. Mississippian.

- A. Winchell, 1861. M.G.S. First Bien. Rept.
A. C. Lane, 1893. Reported by M. E. Wadsworth, M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; 1907, M.G.S. Ann. Rept. 1906.
C. H. Gordon, 1900. M.G.S. Vol. VII, pt. 3.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Upper (Napoleon) Lower.
R. A. Smith, 1912. M.G.S. Pub. 8; 1914, M.G.S. Pub. 14.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
G. E. Eddy, 1936. M.G.S. P.R. 1.
E. A. Newman, 1936. M.G.S. P.R. 2.
G. H. Pringle, 1937. M.G.S. P.R. 3.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
C. H. Riggs, 1938. M.G.S. P.R. 4.
G. V. Cohee, 1944. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations map 11.
G. V. Cohee, 1951. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 41.
A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
Marshall, Calhoun Co., Michigan.

Marvin beds. Devonian.

W. A. Kelly, 1940. Mich. Acad. Sci. and M.G.S. 10th Ann. Field Trip Guidebook.
Marvin Quarry, Sec 7, T.34N., R.1W., Cheboygan Co., Michigan.

Mass amygdaloid. Keweenawan.

Local usage.
R. E. Hore, 1915. M.G.S. Pub. 19.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Mass Mine, Ontonagon Co., Michigan.

Mattawa-Ottawa outlet. Pleistocene.

G. M. Stanley, 1945. M.G.S. Pub. 43.
Mattawa and Ottawa rivers, Ontario.

Maumee, glacial lake; beach. Pleistocene.

C. R. Dryer, 1888. Indiana Dept. Geol. and Nat. Hist. 16th Ann. Rept.
F. Leverett, 1902. M.G.S. Ann. Rept. 1901; 1912, M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
Maumee River valley, Ohio.

Maxville limestone. Mississippian. Bayport.

E. B. Andrews, 1870. Ohio Geol. Surv. Rept. Prog. 1869.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; 1907, M.G.S. Ann. Rept. 1906.
G. P. Grimsley, 1903. M.G.S. Vol. IX, pt. 2.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
R. A. Smith, 1916. M.G.S. Pub. 21.
Maxville, Perry Co., Ohio.

Mayflower amygdaloid; flows. Keweenawan.

Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Mayflower Mine, Houghton Co., Michigan.

Mayville. Silurian.

T. C. Chamberlin, 1877. Geol. Wisconsin Vol. 2. Mayville beds.
G. M. Ehlers, 1921. G.S.A. Bull. Vol. 32, Formation.
G. M. Ehlers, 1924. M.G.S. Pub. 34. Well log. Dolomite.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mich. Geol. Soc., 1951 and 1954. Ann. Excur. Guidebooks.
Mayville, Dodge Co., Wisconsin.

Mayville Moraine. Pleistocene.

A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Mayville, Tuscola Co., Michigan.

Maysville. Upper Ordovician.

A. F. Foerste, 1905. Sci. ns. Vol. 22.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mich. Acad. Sci., Arts and Lett., Mich. Geol. Soc., and M.G.S., 1948. Ann. Field Excur. Guidebook.
Maysville, Kentucky.

Mazomanie. Upper Cambrian.

E. O. Ulrich, 1920. Wash. Acad. Sci. Jour. Vol. 10.
R. B. Newcombe, 1933. M.G.S. Pub. 38. Suggests use of term.
E. O. Ulrich, 1936. Personal communication to G. M. Ehlers.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mazomanie on Wisconsin River, Dane Co., Wisconsin.

Medina. Silurian and Upper Ordovician.

L. Vanuxem, 1840. New York Geol. Surv. 4th Rept.
A. Winchell, 1861. M.G.S. First Bien. Rept.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Or Clinton.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Also edited notes of C. E. Wright.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37. Medina-Clinton.
R. B. Newcombe, 1933. M.G.S. Pub. 38. Medinan Lower or Alexandrian.
Medina, Oswego Co., New York.

Medora amygdaloid. Keweenawan.

Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Medora Mine, Keweenaw Co., Michigan.

Mendota. Upper Cambrian.

R. D. Irving, 1875. Am. Jour. Sci. 3d, Vol. 9.
R. B. Newcombe, 1933. M.G.S. Pub. 38. Discusses use of term in Michigan.
Lake Mendota, Wisconsin.

Menominee series.

Used in early reports for Huronian of Menominee District, Michigan.

Meramec group. Mississippian.

E. O. Ulrich, 1904. Missouri Bur. Geol. and Mines Vol. 2, 2d ser.
R. B. Newcombe, 1933. M.G.S. Pub. 38. Meramecian.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Meramec Highlands and River west of St. Louis, Missouri.

Merchants amygdaloid. Keweenawan.

Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Merchants Mine, Ontonagon Co., Michigan.

Mesnard epidote. Keweenawan.

A. C. Lane and A. E. Seaman, 1907. Jour. Geol. Vol. 15; 1909, M.G.S. Ann. Rept. 1908.
A. C. Lane, 1911. M.G.S. Pub. 6.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mesnard Mine, Houghton Co., Michigan.

Mesnard fm. Huronian.

M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906. Eo-Huronian series.
Mt. Mesnard, Marquette Co., Michigan.

Mesnard quartzite. Huronian.

- C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
W. A. Seaman, 1944. M.G.S. P.R. 10; 1945, M.G.S. P.R. 11.
Mt. Mesnard, Marquette Co., Michigan.

Meso-Devonian.

- A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.

Michigamme jasper. Upper Huronian.

- H. L. Smyth, 1894. Am. Jour. Sci. Vol. 3, No. 47.
Michigamme Mt., Iron Co., Michigan.

Michigamme slate. Upper Huronian.

- C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept.
W. C. Gordon and A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
Tyler, A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
R. C. Allen, 1912. M.G.S. Pub. 8; 1915, M.G.S. Pub. 18.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mich. Acad. Sci., Arts and Lett., and M.G.S., 1939. 9th Ann. Excur. Guidebook.
W. A. Seaman, 1944. M.G.S. P.R. 10; 1945, M.G.S. P.R. 11.
V. L. Ayres, 1944. M.G.S. P.R. 10.
Lake Michigamme, Marquette Co., Michigan.

Michigan conglomerate. Keweenawan.

- Local usage.
R. E. Hore, 1915. M.G.S. Pub. 19.
Michigan Mine, Ontonagon Co., Michigan.

Michigan period. Huronian.

- Proposed by M. E. Wadsworth to include Holyoke and Negaunee iron formations. 1893, M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.

Michigan salt group. Mississippian.

- A. Winchell, 1861. M.G.S. First Bien. Rept.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2. Suggested dropping "salt".

Michigan series. Mississippian.

- A. C. Lane, 1900. Defined. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; 1902, M.G.S. Ann. Rept. 1901; 1907, M.G.S. Ann. Rept. 1906; 1909, M.G.S. Ann. Rept. 1908.
H. Ries, 1900. M.G.S. Vol. VIII, pt. 1.
G. P. Grimsley, 1903. M.G.S. Vol. IX, pt. 2.
R. A. Smith, 1914. M.G.S. Pub. 14. Lower Grand Rapids.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. A. Smith, 1924. M.G.S. Pub. 34; 1925, M.G.S. Pub. 35.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
G. E. Eddy, 1936. M.G.S. P.R. 1.
E. A. Newman, 1936. M.G.S. P.R. 2.
G. H. Pringle, 1937. M.G.S. P.R. 3.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
C. H. Riggs, 1938. M.G.S. P.R. 4.

- G. V. Cohee, 1944. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations map 11; 1951, chart 41.

"Michigan stray". Mississippian.

- Oil well drillers' usage.
G. E. Eddy, 1936. M.G.S. P.R. 1.

Middle Conglomerate. Keweenawan.

- L. L. Hubbard, 1898. M.G.S. Vol. VI, pt. 2.
Keweenaw Peninsula, Michigan.

Middle Lake shale. Devonian. See Ferron Point.

- A. W. Grabau, 1916?. Unpublished ms. M.G.S. Open file.
Ferron Point of Warthin and Cooper.
Alpena Co., Michigan.

Middle Ordovician or Champlainian.

- R. A. Smith, 1917. M.G.S. Pub. 24.

Middle Silurian or Niagaran.

- R. A. Smith, 1917. M.G.S. Pub. 24.

Millington Moraine. Pleistocene.

- A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
Millington Twp., Tuscola Co., Michigan.

Millstone grit. Mississippian.

- A. Eaton. Early New York reports.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906, legend geol. map.

Minesota conglomerate; trap. Keweenawan.

- S. H. Broughton, 1863. Remarks on the mining interest and details of the geology of Ontonagon Co. Phila., 1863.
R. E. Hore, 1915. M.G.S. Pub. 19.
B. S. Butler, 1929. U.S.G.S. P.P. 144. Kearsarge congl. Minesota Mine, Ontonagon Co., Michigan.

Minong breccia; porphyrite; trap; conglomerate.

- Keweenawan.
A. C. Lane, 1898. M.G.S. Vol. VI, pt. 1.
Minong Mine, Isle Royale, Michigan.

Mio-Cambrian.

- A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.

Mio-Huronian.

- A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.

Mississinewa morainic system. Pleistocene.

- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Mississinewa River, Wabash Co., Indiana.

Mississinewa shale. Silurian. Niagaran.

- E. R. Cumings and R. R. Schrock, 1927. Indiana Acad. Sci. Proc. Vol. 36.
E. R. Cumings, 1930. Indiana Acad. Sci. Proc. Vol. 39.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mississinewa River, Wabash Co., Indiana.

Mississippian system.

- A. Winchell, 1869. Am. Philos. Soc. Proc. Vol. 2.
A. C. Lane, 1900. M.G.S. Vol. VII. Sub-Carboniferous (Mississippian).
A. C. Lane, 1905. M.G.S. Ann. Rept. 1904. (Sub-Carboniferous).
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
All subsequent reports.
Upper Mississippi Valley.

Mohawkian series. Middle Ordovician.

- J. Hall, 1842. Am. Jour. Sci. 3d ser. Vol. 8.
J. M. Clarke and C. Schuchert, 1899. Sci. ns. Vol. 10.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mohawk River valley, New York.

Mona schist. Keewatin.

- C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept.
R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mona Hills, Marquette Co., Michigan.

Monroan. Upper Silurian.

- A. W. Grabau, 1909. Sci. ns. Vol. 29. Sylvania and Bass Islands.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Upper Silurian or Monroan, Detroit River, Sylvania and Bass Island.
Monroe Co., Michigan.

Monroe beds; formation; group. Lower Devonian and Silurian, Lower, Middle, Upper. (See Bass Island, Detroit River, Sylvania.)

- D. Houghton, grey limestone, Mountain limestone, 1838. M.G.S. Rept. St. Geologist, Mich. Leg. S.D. 16, H.D. 24, 1838.
A. C. Lane, 1893. Reported by M. E. Wadsworth, M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Defined Monroe beds.
A. C. Lane, 1899. U.S.G.S. W.-S.P. 30.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1902. M.G.S. Ann. Rept. 1901. Salina and Helderberg.
I. C. Russell, 1905. M.G.S. Ann. Rept. 1904.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
A. W. Grabau, 1908. Sci. ns. Vol. 27. Proposed Upper, Middle, Lower Monroe.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Lower Monroe, Bass Islands series. Middle Monroe = Sylvania sandstone. Upper Monroe = Detroit River series.
R. A. Smith, 1916. M.G.S. Pub. 21.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37.
R. B. Newcombe, 1933. M.G.S. Pub. 38. Monroe—Salina group.
Monroe Co., Michigan.

Montreal amygdaloid. Keweenawan.

- A. C. Lane, 1911. M.G.S. Pub. 6.
Montreal Mine, Keweenaw Co., Michigan.

Mountain limestone.

- Nongeographic name used by D. Houghton and B. Hubbard in 1840 for limestones of southeastern Michigan to correlate with "Mountain limestone" of Indiana.

Mount Bohemia conglomerate; gabbro; felsite.

- Keweenawan.
A. C. Lane, 1906. Mines and minerals Vol. 27.
A. C. Lane, 1911. M.G.S. Pub. 6. Same as Bohemia or No. 8 Conglomerate.
Mt. Bohemia, Keweenaw Co., Michigan.

Mt. Clemens Moraine. Pleistocene.

- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Mt. Clemens, Macomb Co., Michigan.

Mount Houghton felsite; quartz porphyry. Keweenawan.

- A. C. Lane, 1898. M.G.S. Vol. VI, pt. 1; 1911, M.G.S. Pub. 6.
Mt. Houghton, Keweenaw Co., Michigan.

Mount Mesnard quartzite. Huronian.

- M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
Mt. Mesnard, Marquette Co., Michigan.

Mount Simon sandstone. Upper Cambrian.

- C. D. Walcott, 1914. Smithsonian Misc. Coll. Vol. 57.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9.
Mount Simon, near Eau Claire, Wisconsin.

Munising Moraine. Pleistocene.

- S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
Munising, Alger Co., Michigan.

Munising sandstone. Upper Cambrian.

- A. C. Lane and A. E. Seaman, 1907. Jour. Geol. Vol. 15. Defined.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Munising, Alger Co., Michigan.

Naples goniatile beds. Devonian.

- J. M. Clarke, 1885. U.S.G.S. Bull. 16.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
R. B. Newcombe, 1928. M.G.S. Pub. 37.
Naples, Ontario Co., New York.

Napoleon sandstone. Mississippian.

- A. Winchell, 1861. M.G.S. First Bien. Rept.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1900, M.G.S. Vol. VIII, pt. 2; 1907 M.G.S. Ann. Rept. 1906.
A. C. Lane, 1904. Mich. Acad. Sci. 5th Ann. Rept.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Upper Marshall.
R. A. Smith, 1912. M.G.S. Pub. 8; 1914, M.G.S. Pub. 14; 1924, M.G.S. Pub. 34.
C. W. Cook, 1914. M.G.S. Pub. 15.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.

- E. A. Newman, 1936. M.G.S. P.R. 2.
 G. H. Pringle, 1937. M.G.S. P.R. 3.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
 C. H. Riggs, 1938. M.G.S. P.R. 4.
 G. V. Cohee, 1951. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 41.
 Napoleon, Jackson Co., Michigan.
- National sandstone.** Keweenawan.
 S. H. Broughton, 1863. Remarks on the mining interest and details of the geology of Ontonagon Co.
 B. S. Butler, 1929. U.S.G.S. P.P. 144.
 National Mine, Ontonagon Co., Michigan.
- Negaunee iron fm.** Middle Huronian.
 M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
 W. C. Gordon and A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
 A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
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 A. C. Lane, 1911. M.G.S. Pub. 6.
 R. C. Allen, 1915. M.G.S. Pub. 18.
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 Mich. Acad. Sci. and M.G.S., 1939. 9th Ann. Excur. Guidebook.
 W. A. Seaman, 1944. M.G.S. P.R. 10; 1945, M.G.S. P.R. 11.
 Negaunee, Marquette Co., Michigan.
- Neo-Cambrian.**
 A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
- Neo-Devonian.** Black shale. Antrim.
 A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901.
 A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
- New Albany shale.** Upper Devonian.
 W. W. Borden, 1874. Indiana Geol. Surv. 5th Ann. Rept.
 A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C. E. Wright.
- New Albany, Floyd Co., Indiana.
- Newberry Moraine.** Pleistocene.
 S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
 Newberry, Luce Co., Michigan.
- New Mass amygdaloid.** Keweenawan.
 W. H. Weed, 1925. The Mines Handbook.
 Mass Consolidated Mining Co. property, Ontonagon Co., Michigan.
- New Mayflower amygdaloid.** Keweenawan.
 Local usage.
 Mayflower Mine, Houghton Co., Michigan.
- New Richmond.** Lower Ordovician.
 L. C. Wooster, 1878. Wisconsin Geol. Surv. Ann. Rept. 1877.
 G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9.
 New Richmond, St. Croix Co., Wisconsin.
- Newton Creek.** Devonian.
 A. S. Warthin, Jr. and G. A. Cooper, 1941. Wash. Acad. Sci. Jour. Vol. 31.
 G. V. Cohee, 1947. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 28.
 Mich. Geol. Soc., 1951 and 1952. Ann. Excur. Guidebooks.
 Newton Creek, Alpena Co., Michigan.
- Niagaran fm.; limestone; dolomite.** Silurian.
 J. Hall, 1842. Am. Jour. Sci. 1st, Vol. 42.
 J. W. Foster and J. D. Whitney, 1851. U.S. 31st Cong. Spec. Sess. Ex. Doc. 4.
 A. Winchell, 1861. M.G.S. First Bien. Rept.
 C. Rominger, 1873. M.G.S. Vol. I, pt. 3.
 M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
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 H. Ries, 1900. M.G.S. Vol. VIII, pt. 1.
 A. C. Lane, 1902. M.G.S. Ann. Rept. 1901. "Niagaran (Manitoulin) dolomite".
 I. C. Russell, 1905. M.G.S. Ann. Rept. 1904.
 A. C. Lane, 1905. M.G.S. Ann. Rept. 1904, (Upper) Silurian; 1907, M.G.S. Ann. Rept. 1906.
 A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Or Manitoulin.
 W. H. Sherzer and A. W. Grabau, 1910. M.G.S. Pub. 2; 1913, M.G.S. Pub. 12.
 R. A. Smith, 1914. M.G.S. Pub. 14. Guelph and Lockport.
 E. C. Case and W. I. Robinson, 1915. M.G.S. Pub. 18. Lockport.
 R. A. Smith, 1916. M.G.S. Pub. 21. (Guelph and Lockport).
 G. M. Ehlers, 1926. Unpublished ms. on the Niagaran of Michigan.
 R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
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 G. M. Ehlers, 1945. M.G.S. Pub. 44.
 G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
 Michigan Geol. Soc., 1951, 1954, and 1955. Ann. Excur. Guidebooks.
 Niagara Co., New York.
- Nipigon.** Keweenawan. Replaced by Keweenawan series.
 R. Bell, 1875. Can. Nat. and Geol. 2d ser., Vol. 7.
 A. C. Lane, 1905. M.G.S. Ann. Rept. 1904.
 Lake Nipigon, Ontario.
- Nipissing, glacial lake; beach.** Pleistocene.
 F. B. Taylor, 1894. Am. Geol. Vol. 13.
 W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1; 1913, M.G.S. Pub. 12.
 A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1908, M.G.S. Ann. Rept. 1907; 1911, M.G.S. Pub. 6.
 F. Leverett, 1902. M.G.S. Ann. Rept. 1901; 1911, M.G.S. Pub. 7; 1912, M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
 L. J. Cole, 1903. M.G.S. Vol. IX, pt. 1.
 I. C. Russell, 1905. M.G.S. Ann. Rept. 1904.
 W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
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 S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
 G. M. Stanley, 1945. M.G.S. Pub. 43; 1945, M.G.S. Pub. 44.
 G. C. Tague, 1948. M.G.S. Pub. 45, pt. 1.
 J. L. Calver, 1948. M.G.S. Pub. 45, pt. 2.

- H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan. Lake Nipissing, Ontario.
- No. 8 Conglomerate.** Keweenawan.
A. R. Marvine, 1873. M.G.S. Vol. I, pt. 2.
A. C. Lane, 1911. M.G.S. Pub. 6.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
K. Spiroff, 1941. M.G.S. P.R. 7.
Eagle River District, Keweenaw Peninsula, Michigan.
- Nonesuch Lode.** Keweenawan.
R. E. Hore, 1915. M.G.S. Pub. 19.
Nonesuch Mine, Gogebic Co., Michigan.
- Nonesuch shale; sandstone.** Keweenawan.
R. D. Irving, 1883. U.S.G.S. Mon. 5.
C. R. Van Hise and C. K. Leith, 1909. U.S.G.S. Bull. 360.
W. C. Gordon and A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
A. C. Lane, 1911. M.G.S. Pub. 6.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Nonesuch Mine, Gogebic Co., Michigan.
- Norrie member iron fm.** Upper Huronian.
W. O. Hotchkiss, 1919. Eng. and Min. Jour. Vol. 108.
Norrie Mine, Ironwood, Gogebic Co., Michigan.
- North amygdaloid.** Keweenawan.
Local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
- North Bay outlet.** Pleistocene.
G. M. Stanley, 1945. M.G.S. Pub. 44.
North Bay, Ontario.
- North Butler amygdaloid; flow.** Keweenawan. Local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
North of Butler amygdaloid, Keweenaw Co., Michigan.
- North Higgins Moraine.** Pleistocene.
W. A. Ver Wiebe, 1927. Mich. Acad. Sci., Arts and Lett. Vol. 7.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Higgins Lake, Roscommon Co., Michigan.
- North Star conglomerate.** Keweenawan.
A. R. Marvine, 1873. M.G.S. Vol. I, pt. 2.
B. S. Butler, 1929. U.S.G.S. P.P. 144. Probably Allouez congl.
North Star Mine, Houghton Co., Michigan.
- Northville Moraine.** Pleistocene.
W. H. Sherzer, 1913. M.G.S. Pub. 12. Replaced by Defiance.
Northville, Wayne Co., Michigan.
- Norway limestone.** Huronian.
C. Rominger, 1881. M.G.S. Vol. IV, pt. 2.
Norway, Dickinson Co., Michigan.
- Norway Point fm.** Middle Devonian.
A. S. Warthin, Jr. and G. A. Cooper, 1935. Wash. Acad. Sci. Jour. Vol. 25, No. 12.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci. and M.G.S., 1937, 1938, and 1940. 7th, 8th, and 10th Ann. Excur. Guidebooks.
G. V. Cohee, 1947. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 28.
Mich. Geol. Soc., 1949, 1951, and 1952. Ann. Excur. Guidebooks.
Norway Point (Seven Mile) Dam, Thunder Bay River, Alpena Co., Michigan.
- Norwich conglomerate; trap.** Keweenawan.
S. H. Broughton, 1863. Remarks on the mining interest and details of the geology of Ontonagon Co.
Norwich Mine, Ontonagon Co., Michigan.
- Norwood shale.** Devonian.
G. M. Ehlers, 1938. Mich. Acad. Sci. and M.G.S. 8th Ann. Excur. Guidebook.
Norwood, Charlevoix Co., Michigan.
- Ogima amygdaloid; trap; flow.** Keweenawan. Central Mine Group.
Local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Ogima Mine, Ontonagon Co., Michigan.
- Ogontz member Stonington beds.** Upper Ordovician.
R. C. Hussey, 1926. Univ. Mich. Mus. Geol. Contr. Vol. 2.
R. C. Hussey, 1936. M.G.S. Pub. 40, pt. 3; 1952; M.G.S. Pub. 46.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Geol. Soc., 1950 and 1954. Ann. Excur. Guidebooks.
Ogontz Creek, Delta Co., Michigan.
- Ohio shale.** Upper Devonian. (See Huron shale, St. Clair shale, Antrim shales).
E. B. Andrews, 1870. Ohio Geol. Surv. Rept. Prog. 1869.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C. E. Wright.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906, legend geol. map.
Ohio River hills.
- Ohio Trap Rock traps.** Keweenawan.
S. H. Broughton, 1863. Remarks on the mining interest and details of the geology of Ontonagon County.
Ohio Trap Rock or Colling locations, Ontonagon Co., Michigan.
- Old Colony amygdaloid; flow.** Keweenawan.
Local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Old Colony Mine, Houghton Co., Michigan.
- Old Colony sandstone.** Keweenawan. Central Mine Group.
A. C. Lane, 1911. M.G.S. Pub. 6.
Old Colony Mine, Houghton Co., Michigan.
- Old Pewabic amygdaloid; flow.** Keweenawan. Ashbed group.
A. R. Marvine, 1873. M.G.S. Vol. I, pt. 2.
Pewabic property, Keweenaw Co., Michigan.

Oneida conglomerate. Keweenawan.

- S. H. Broughton, 1863. Remarks on the mining interest and details of the geology of Ontonagon Co.
B. S. Butler, 1929. U.S.G.S. P.P. 144. Probably Allouez congl.
Oneida Location, Ontonagon Co., Michigan.

Oneota dolomite in Prairie du Chien group. Lower Devonian. Beekmantown.

- W. J. McGee, 1891. U.S.G.S. 11th Ann. Rept., pt. 1.
E. O. Ulrich, 1936. Personal communication to G. M. Ehlers.
G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9.
Oneota River, Allamakee Co., Iowa.

Onesquethaw group. Silurian.

- G. A. Cooper, 1942. G.S.A. Bull. Vol. 53. Stage.
G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits Field Conference Guidebook.
G. M. Ehlers, 1945. M.G.S. Pub. 44, Group.
Onesquethaw Creek, Albany Co., New York.

Onondaga. Middle Devonian.

- J. Hall, 1839. New York Geol. Surv. 3d Rept.
A. Winchell, 1873. Walling's Atlas of Michigan.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
H. Ries, 1900. M.G.S. Vol. VIII, pt. 1.
I. C. Russell, 1905. M.G.S. Ann. Rept. 1904.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. M. Ehlers, 1945. M.G.S. Pub. 44.
Mich. Geol. Soc., 1951. Ann. Excur. Guidebook.
Onondaga Co., New York.

Onondaga salt group. Silurian-Cayugan.

- L. Vanuxem, 1840. New York Geol. Surv. 4th Rept.
J. Hall, Foster and Whitney, 1851. U.S. 31st Cong. Spec. Sess. Sen. Ex. Doc. 4.
A. Winchell, 1861. M.G.S. First Bien. Rept.
C. Rominger, 1873. M.G.S. Vol. I, pt. 3.
A. C. Lane, 1902. M.G.S. Ann. Rept. 1901.
G. M. Ehlers, 1945. M.G.S. Pub. 44.
Salines of Onondaga Co., New York.

Ontarian.

- J. D. Dana, 1890. G.S.A. Bull. Vol. 1. Proposes Ontarian for Silurian.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
South shore Lake Ontario.

Ontario. Silurian.

- E. Emmons, 1842. Geol. New York pt. 2, div. 4, Geol. 2d Dist. Group.
A. C. Lane, 1902. M.G.S. Ann. Rept. 1901.
South shore Lake Ontario.

Ontonagon, glacial lake. Pleistocene.

- F. Leverett, 1911. M.G.S. Pub. 7; 1917, M.G.S. Pub. 25.
I. D. Scott, 1921. M.G.S. Pub. 30.
Ontonagon Co., Michigan.

Ordovician system.

- C. Lapworth, 1879. Geol. Mag. London, ns. Vol. 6.
A. C. Lane, 1905. M.G.S. Ann. Rept. 1904, legend geol. map. Lower Silurian or Ordovician.
I. C. Russell, 1905. M.G.S. Ann. Rept. 1904. Ordovician or Lower Silurian.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906. Ordovician.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908. Upper, Middle, Lower.
R. C. Allen, 1910. M.G.S. Pub. 3.
R. A. Smith, 1914. M.G.S. Pub. 14; 1916, M.G.S. Pub. 21; 1917, M.G.S. Pub. 24.
R. C. Allen and L. P. Barrett, 1915. M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
All subsequent reports.

Oriskany. Lower Devonian.

- L. Vanuxem, 1839. New York Geol. Surv. 3d Rept.
A. Winchell, 1861. M.G.S. First Bien. Rept.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
Oriskany, New York.

Osage group. Mississippian.

- H. S. Williams, 1891. U.S.G.S. Bull. 80.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908. Or Augusta.
R. B. Newcombe, 1928. M.G.S. Pub. 37.
Osage River, near Osceola, St. Clair Co., Missouri.

Osagian. Used by some geologists to cover time of deposition of Osage group.

- R. B. Newcombe, 1933. M.G.S. Pub. 38.

Osceola amygdaloid; flow. Keweenawan. Central Mine Group.

- L. L. Hubbard, 1894. Lake Superior Min. Inst. Proc. 2d Ann. Meeting.
R. E. Hore, 1912. M.G.S. Pub. 8; 1915, M.G.S. Pub. 19.
Osceola Mine, Houghton Co., Michigan.

Oscoda Moraine. Pleistocene.

- H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Oscoda Co., Michigan.

Otisville Moraine. Pleistocene.

- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Otisville, Genesee Co., Michigan.

Otter Lake Moraine. Pleistocene.

- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
Otter Lake, Lapeer Co., Michigan.

Outer Conglomerate. Keweenawan. Copper Harbor Group.

- R. D. Irving, 1883. U.S.G.S. Mon. 5.
W. C. Gordon, 1907. M.G.S. Ann. Rept. 1906.
C. R. Van Hise and C. K. Leith, 1909. U.S.G.S. Bull. 360.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
A. C. Lane, 1911. M.G.S. Pub. 6.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
K. Spiroff, 1941. M.G.S. P.R. 7.

On Keweenaw Point the Outer Conglomerate is nearest the lake shore. The thicker, Great Conglomerate is the inner conglomerate of the Point.

Outer Copper Harbor Conglomerate. Keweenawan.

A. C. Lane, 1911. M.G.S. Pub. 6. Outer Conglomerate of Copper Harbor Group.
Copper Harbor, Keweenaw Co., Michigan.

Outer morainic system. Pleistocene.

F. Leverett, 1929. U.S.G.S. P.P. 154a.

Owosso Moraine. Pleistocene.

F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Owosso, Shiawassee Co., Michigan.

Ozarkian.

E. O. Ulrich, 1909. Sci. ns. Vol. 29.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Ozarkian ?
E. O. Ulrich, 1911. G.S.A. Bull. Vol. 22.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Or Canadian.
Ozark region, Missouri.

Pabst member of Tyler slate. Upper Huronian.

W. O. Hotchkiss, 1919. Eng. and Min. Jour. Vol. 108.
Pabst Mine, Gogebic Co., Michigan.

Paint slate. Upper Huronian.

R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
Paint River, Iron Co., Michigan.

Palaeozoic, Paleozoic.

Rev. A. Sedgwick, 1838. Geol. Soc. London Proc. Vol. 2, No. 58.
T. B. Brooks, 1873. M.G.S. Vol. I, pt. 1.
C. Rominger, 1873. M.G.S. Vol. I, pt. 3; 1876, M.G.S. Vol. III.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
I. C. Russell, 1907. M.G.S. Ann. Rept. 1906.
All subsequent reports.

Palmer gneiss. Laurentian.

C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept.
C. R. Van Hise and C. K. Leith, 1909. U.S.G.S. Bull. 360; 1911, U.S.G.S. Mon. 52. Archean, partly Middle Huronian.
R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
C. A. Lamey, 1935. G.S.A. Bull. Vol. 46, No 7. Middle and Lower Huronian.
C. K. Leith, R. J. Lund, and A. Leith, 1935. U.S.G.S. P.P. 184. Laurentian.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Palmer Lake, Marquette Co., Michigan.

Palms quartzite. Middle Huronian.

C. R. Van Hise, 1901. U.S.G.S. 21st Ann. Rept., pt. 3. Palms fm.
R. C. Allen, 1915. M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
S. of Palms Mine, Bessemer, Gogebic Co., Michigan.

Parma conglomerate; sandstone. Pennsylvanian. Pottsville.

A. Winchell, 1861. M.G.S. First Bien. Rept.
A. Winchell, 1873. Walling's Atlas of Michigan. Conglomerate.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1907, M.G.S. Ann. Rept. 1906; 1908 M.G.S. Ann. Rept. 1907.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
R. A. Smith, 1912. M.G.S. Pub. 8; 1914, M.G.S. Pub. 14.
C. W. Cook, 1914. M.G.S. Pub. 15.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. A. Smith, 1924. M.G.S. Pub. 34.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
W. A. Kelly, 1936. M.G.S. Pub. 40, pt. 2.
G. E. Eddy, 1936. M.G.S. P.R. 1.
E. A. Newman, 1936. M.G.S. P.R. 2.
G. H. Pringle, 1937. M.G.S. P.R. 3.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1951. U.S.G.S. (Co-op M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 41.
Parma, Jackson Co., Michigan. Sec. 34 Sandstone Twp. East of Parma said to be type loc.

Partridge Point fm. Middle Devonian.

A. S. Warthin, Jr. and G. A. Cooper, 1935. Wash. Acad. Sci. Jour. Vol. 25, No. 12.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci. Arts and Lett. and M.G.S., 1937, 1938, and 1940. 7th, 8th, and 10th Ann. Excur. Guidebooks.
Partridge Point, Alpena Co., Michigan.

Payette stage; beach. Pleistocene.

G. M. Stanley, 1937. Mich. Acad. Sci., Arts and Lett. Vol. 23; 1937, G.S.A. Bull. Vol. 48; 1945, M.G.S. Pub. 43.
Payette, Ontario.

Peanut Conglomerates. Mississippian. Marshall-Coldwater.

A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Descriptive term.

Penetang stage; beach. Pleistocene.

G. M. Stanley, 1937. Mich. Acad. Sci., Arts and Lett. Vol. 23; 1937, G.S.A. Bull. Vol. 48; 1945, M.G.S. Pub. 43.
Penetang, Georgian Bay, Ontario.

Pennsylvanian system.

- H. S. Williams, 1891. Arkansas Geol. Surv. Ann. Rept. Vol. 4.
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Saganing Creek, Bay Co., Michigan.

Saginaw fm. Pennsylvanian. Pottsville.

- A. C. Lane, 1900. M.G.S. Vol. VIII, pt. 2; also M.G.S. Ann. Repts. 1904, 1905, and 1906.
A. C. Lane, 1901. Michigan Miner Vol. 3, No. 1.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Upper Pottsville.
W. M. Gregory, 1912. M.G.S. Pub. 11.
R. A. Smith, 1914. M.G.S. Pub. 14. Upper Pottsville.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
W. A. Kelly, 1936. M.G.S. Pub. 40, pt. 2.
G. E. Eddy, 1936. M.G.S. P.R. 1.
E. A. Newman, 1936. M.G.S. P.R. 2.
G. H. Pringle, 1937. M.G.S. P.R. 3.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1951. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 41.
Saginaw Co., Michigan. Coal Mines.

- "Saginaw sand".** Drillers' term. Middle Devonian. Subsurface.
R. A. Smith, 1914. M.G.S. Pub. 14.
C. G. Carlson, 1927. A.A.P.G. Bull. Vol. 11, No. 9.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1947. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 28. Saginaw oil field, Saginaw Co., Michigan.
- Saginaw, glacial lake.** Pleistocene.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1908, M.G.S. Ann. Rept. 1907.
F. Leverett, 1902. M.G.S. Ann. Rept. 1901; 1912, M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
Saginaw River drainage basin, Michigan.
- Saginaw Moraine.** Pleistocene.
Used by F. B. Taylor in early reports for the Saginaw Valley section of the moraine now known as the Port Huron morainic system.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905. Saginaw Co., Michigan.
- St. Clair shale.** Upper Devonian. See Antrim.
A. C. Lane, 1893. Reported by M. E. Wadsworth, M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1. Genesee shale.
H. Ries, 1900. M.G.S. Vol. VIII, pt. 1.
C. H. Gordon, 1900. M.G.S. Vol. VIII, pt. 3.
A. C. Lane, 1901. Michigan Miner Vol. 3, No. 1.
A. C. Lane, 1902. M.G.S. Ann. Rept. 1901. Replaced preoccupied St. Clair by Antrim.
St. Clair Co., Michigan.
- St. Croix.** Upper Cambrian.
N. H. Winchell, 1873. Minnesota Geol. and Nat. Hist. Surv. 1st Ann. Rept. for 1872. St. Croix.
C. D. Walcott, 1912. Smithsonian Misc. Coll. Vol. 57, No. 10. St. Croixan.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. St. Croix, Minnesota.
- St. Ignace fm.** Silurian.
G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits Field Conference Guidebook.
G. M. Ehlers, 1945. M.G.S. Pub. 44. Defined. Mich. Acad. Sci., Arts and Lett., Mich. Geol. Soc., and M.G.S., 1948. Ann. Excur. Guidebook.
St. Ignace, Mackinac Co., Michigan.
- St. Johns Moraine.** Pleistocene. Wisconsin.
F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
St. Johns, Clinton Co., Michigan.
- St. Lawrence.** Upper Cambrian. Subsurface.
N. H. Winchell, 1874. Minnesota Geol. and Nat. Hist. Surv. 2d Ann. Rept. for 1873.
E. O. Ulrich, 1924. Wisconsin Acad. Sci., Arts and Lett. Trans. Vol. 21.
W. H. Twenhofel, G. O. Raasch, and F. T. Thwaites, 1935. G.S.A. Bull. Vol. 46, No. 11.
G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9. St. Lawrence, Scott Co., Minnesota.
- St. Louis amygdaloid.** Keweenawan.
Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
St. Louis lode, Central Mine Group, Houghton Co., Michigan.
- St. Louis fm.** Mississippian.
G. Engelmann, 1847. Am. Jour. Sci. 2d ser. Vol. 3.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
St. Louis, Missouri.
- Ste. Marie sandstone.** Upper Cambrian.
W. E. Logan, 1863. Canada Geol. Surv. Rept. Prog. to 1863.
St. Marys River area, Michigan.
- St. Marys sandstone.** Upper Cambrian.
C. Rominger, R. Pumpelly, and T. B. Brooks. 1873. M.G.S. atlas. Map to accompany M.G.S. Vol. I. Or Potsdam.
T. B. Brooks, 1880. Geol. Wisconsin Vol. 3. (Also Potsdam).
St. Marys Peninsula of Rominger, eastern half of Northern Peninsula, Michigan.
- St. Marys epidote.** Keweenawan.
A. R. Marvinne, 1873. M.G.S. Vol. I, pt. 2.
A. C. Lane, 1911. M.G.S. Pub. 6. Same as Mesnard epidote.
St. Mary's Location, Keweenaw Co., Michigan.
- St. Peter sandstone.** Lower Ordovician.
D. D. Owen, 1847. Prel. Rept. Prog. Geol. Surv. Wisconsin and Iowa, U.S. Gen. Land Office Rept. 1847.
A. C. Lane, 1905. M.G.S. Ann. Rept. 1903; 1907, M.G.S. Ann. Rept. 1906, legend geol. map. = Silurian-Calcareous and St. Peters.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908. Lane states A. W. Grabau suggested part of Lake Superior ss. is St. Peter and accepted suggestion. Lane used St. Peter and St. Peters.
R. A. Smith, 1914. M.G.S. Pub. 14; 1917, M.G.S. Pub. 24; 1924, M.G.S. Pub. 34.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9. St. Peter, now Minnesota, River, Minnesota.
- Salina fm.** Silurian. Cayugan.
J. D. Dana, 1863. Man. of Geol. 1st ed.
A. Winchell, 1873. Walling's Atlas of Michigan.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906, legend geol. map.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
W. H. Sherzer and A. W. Grabau, 1910. M.G.S. Pub. 2.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
R. A. Smith, 1914. M.G.S. Pub. 14; 1916, M.G.S. Pub. 21; 1917, M.G.S. Pub. 24; 1924, M.G.S. Pub. 34.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.

- G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits Field Conference Guidebook.
 G. M. Ehlers, 1945. M.G.S. Pub. 44.
 K. K. Landes, 1945. M.G.S. Pub. 44.
 K. K. Landes, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations map 40.
 A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2. Salt wells at Salina, New York.
- Sangamon stage.** Pleistocene.
 F. Leverett, 1898. Jour. Geol. Vol. 6.
 A. C. Lane, 1908. M.G.S. Ann. Rept. 1907. Sangamon Co., Illinois.
- Saratogan.** Upper Cambrian or St. Croixan.
 C. D. Walcott, 1903. Jour. Geol. Vol. 11.
 A. C. Lane, 1909. M.G.S. Ann. Rept. 1908. Saratoga Springs, New York.
- Sault Ste. Marie sandstone.** See St. Marys sandstone.
- Saunders fm.** Huronian.
 R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18. Defined.
 R. A. Smith, 1916. M.G.S. Pub. 21. Pre-Cambrian.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Saunders, Iron Co., Michigan.
- Schoolcraft.** Silurian. Niagaran.
 G. M. Ehlers, 1926. Unpublished ms. on the Niagaran of Michigan.
 R. B. Newcombe, 1933. M.G.S. Pub. 38.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci., Arts and Lett., Mich. Geol. Soc., and M.G.S., 1948, Ann. Excur. Guidebook.
 Mich. Geol. Soc., 1951 and 1954. Ann. Geol. Excur. Guidebooks.
 Schoolcraft Co., Michigan.
- Senecan.** Devonian.
 J. M. Clarke and C. Schuchert, 1899. Sci. ns. Vol. 10.
 A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
 R. B. Newcombe, 1933. M.G.S. Pub. 38.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Seneca Lake, Seneca Co., New York.
- Seney complex.** Pleistocene.
 S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1. Seney, Schoolcraft Co., Michigan.
- Seven Mile Dam.** See Norway Point.
- Shakopee dolomite.** Lower Ordovician. Prairie du Chien.
 N. H. Winchell, 1874. Minnesota Geol. and Nat. Hist. Surv. 2d Ann. Rept.
 G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9. Shakopee, Scott Co., Minnesota.
- Shawmut amygdaloid; flow.** Keweenawan.
 Long local usage.
 B. S. Butler, 1929. U.S.G.S. P.P. 144. Shawmut mine, Houghton Co., Michigan.
- Shawmut conglomerate.** Keweenawan.
 A. C. Lane, 1911. M.G.S. Pub. 6.
 B. S. Butler, "this cgl. is probably No. 11 or 12 of Central Mine group . . ." See U.S.G.S. Bull 896.
 Shawmut Mine, Houghton Co., Michigan.
- Sheridan fm.** Middle Ordovician. Iron River Dist.
 R. C. Allen, 1910. M.G.S. Pub. 3. Sheridan Hill, Iron River Dist., Iron Co., Michigan.
- Siamo slate.** Middle Huronian.
 C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept.
 A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept, 1908.
 R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
 R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci. and M.G.S., 1939. 9th Ann. Excur. Guidebook.
 Siamo Hill, Marquette Co., Michigan.
- Sibley fm.** Huronian.
 W. A. Seaman, 1944. M.G.S. P.R. 10. Sibley Peninsula, Keweenaw Co., Michigan.
- Silica shale.** Middle Devonian.
 G. A. Stewart, 1927. Ohio Geol. Surv. 4th ser. Bull. 32.
 E. R. Pohl, 1930. Tennessee Acad. Sci. Jour. Vol. 5.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci. Arts and Lett. and M.G.S., 1937. 7th Ann. Excur. Guidebook.
 Silica, Lucas Co., Ohio.
- Silurian period; system.**
 R. I. Murchison, 1835. London and Edinburgh Philos. Mag. and Jour. Sci. 3d ser. Vol. 7.
 J. W. Foster and J. D. Whitney, 1850. U.S. 31st Cong. House Rep. Ex. Doc. 69, legend geol. map.
 J. W. Foster and J. D. Whitney, 1851. U.S. 31st Cong. Spec. Sess. Sen. Ex. Doc. 4, pt. 2. Lower Silurian system = Potsdam and Calciferous sandstone. By James Hall. Upper Silurian = Clinton gr., Niagara gr. and Onondaga Salt Group.
 A. Winchell, 1861. M.G.S. First Bien. Rept. Lower Silurian = Lake Superior sandstone, Calciferous sandstone, Trenton gr., Hudson River gr. Upper Silurian = Clinton, Niagara, Onondaga Salt Group.
 C. Rominger, 1873. M.G.S. Vol. 1, pt. 3. Same usage.
 A. C. Lane, 1902. M.G.S. Ann. Rept. 1901; 1905, M.G.S. Ann. Rept. 1903. Excluded Potsdam from Silurian; included Monroe.
 A. C. Lane, 1909. M.G.S. Ann. Rept. 1908. Upper Silurian or Ontarian. Medina to Raisin River inclusive. Lower Silurian or Ordovician. Trenton to Richmond inclusive.
 W. H. Sherzer, 1913. M.G.S. Pub. 12. Silurian, Ordovician.
 R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Niagaran, Middle Silurian or Salinan, Upper Silurian or Monroan.
 G. M. Ehlers, 1924. M.G.S. Pub. 34. Well log.
 R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
 H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
 G. M. Ehlers, 1945. M.G.S. Pub. 44.
 A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
- Slender (Deployed) moraines.** Pleistocene.
 F. Leverett, 1915. U.S.G.S. Mon. 53.
 F. Leverett, 1917. M.G.S. Pub. 25.
- Solen series.** Mississippian.
 A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2. Huron Co., Michigan.

- Soule beds.** Mississippian.
A. C. Lane, 1900. M.G.S. Vol. VII, pt 2.
Huron Co., Michigan.
- South Butler amygdaloid.** Keweenawan.
Long local usage.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
South of Butler amygdaloid, Ontonagon Co., Michigan.
- South Higgins Moraine.** Pleistocene.
W. A. Ver Wiebe, 1927. Mich. Acad. Sci., Arts and Lett. Vol. 7.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms.
Southern Peninsula Michigan.
Higgins Lake, Roscommon Co., Michigan.
- South Pewabic amygdaloid; flow.** Keweenawan. Ashbed group.
A. R. Marvine, 1873. M.G.S. Vol. I, pt. 2.
Old South Pewabic Mine, Houghton Co., Michigan.
- Squaw Bay limestone.** Devonian.
A. S. Warthin, Jr. and G. A. Cooper, 1935. Wash. Acad. Sci. Jour. Vol. 25, No. 12.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Mich. Acad. Sci. and M.G.S., 1937, 1938, and 1940. 7th, 8th, and 10th Ann.
Excur. Guidebooks. G. V. Cohee, 1947. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 28.
Mich. Geol. Soc., 1949, 1951, and 1952. Ann. Geol. Excur. Guidebooks.
Squaw Bay, Alpena Co., Michigan.
- Steuben segment of Newberry Moraine.** Pleistocene.
S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
Steuben, Schoolcraft Co., Michigan.
- Stewartville.** Middle Ordovician.
E. O. Ulrich, 1911. G.S.A. Bull. Vol. 22.
E. C. Case and W. I. Robinson, 1915. M.G.S. Pub. 18.
Upper (?) Galena.
Mich. Geol. Soc., 1954 and 1955. Ann. Geol. Excur. Guidebooks.
Stewartville, Olmsted Co., Minnesota.
- Stones River group.** Lower Ordovician. Chazy.
J. M. Safford, 1851. Am. Jour. Sci. 2d ser. Vol. 12.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. A. Smith, 1917. M.G.S. Pub. 24.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Stone River, Nashville, Tennessee.
- Stonington beds.** Upper Ordovician. Richmond.
R. C. Hussey, 1926. Univ. Mich. Mus. Geol. Contr. Vol. 2, No. 8; 1952, M.G.S. Pub. 46.
R. B. Newcombe, 1933. M.G.S. Pub. 38.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 33.
Mich. Geol. Soc., 1950 and 1954. Ann. Geol. Excur. Guidebooks.
Stonington Peninsula, Delta Co., Michigan.
- Stony Point.** Devonian. (Name used by H. H. Hindshaw).
A. W. Grabau, 1916 ? Unpublished ms. M.G.S. Open File.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Stony Point, Alpena, Alpena Co., Michigan.
- Stromatopora beds.** Devonian, Traverse.
A. Winchell, 1861. M.G.S. First Bien. Rept.
A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901. Suggested these beds be named Petoskey.
- Stropheodonta nacreata beds.** Devonian. Traverse.
A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901. With Acervularia beds the equivalent of Winchell's Bryozoa beds.
- Sturgeon quartzite.** Lower Huronian.
H. L. Smyth, 1899. U.S.G.S. 19th Ann. Rept., pt. 3.
R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
C. A. Lamey and C. E. Dutton, 1942. M.G.S. P.R. 8.
Sturgeon River, Dickinson Co., Michigan.
- Sturgeon River Moraine.** Pleistocene.
S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
Sturgeon River, Delta Co., Michigan.
- Sturgis Moraine.** Pleistocene.
F. Leverett, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms.
Southern Peninsula, Michigan.
Sturgis, St. Joseph Co., Michigan.
- Sub-Carboniferous.**
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
- Summerville limestone.** Devonian. See Genshaw.
A. W. Grabau, 1916 (?). Unpublished ms. M.G.S. Open File. Upper ls. of Genshaw above El Cajon sh.
Summerville, south shore Long Lake, Alpena Co., Michigan.
- Sunbury shale.** Mississippian.
L. E. Hicks, 1878. Am. Jour. Sci. 3d ser. Vol. 16.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905; 1907, M.G.S. Ann. Rept. 1906.
A. C. Lane, 1909. M.G.S. Ann. Rept. 1908. Or Berea.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
R. A. Smith, 1924. M.G.S. Pub. 34.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
E. A. Newman, 1936. M.G.S. P.R. 2.
G. H. Pringle, 1937. M.G.S. P.R. 3.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
G. V. Cohee, 1951. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 41.
A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
Sunbury, Delaware Co., Ohio.
- Sunday quartzite.** Lower Huronian.
C. R. Van Hise and C. K. Leith, 1911. U.S.G.S. Mon. 52.
R. C. Allen, 1915. M.G.S. Pub. 18.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
Sunday Lake, Gogebic Co., Michigan.
- Sunnyside limestone.** Devonian. See Genshaw.
A. W. Grabau, 1916 (?). Unpublished ms. M.G.S. Open File. Lower ls. of Genshaw below El Cajon sh.
Sunnyside, east shore Long Lake, Alpena Co., Michigan.

Superior amygdaloid. Keweenawan. Bohemia Range.

Long local usage.

B. S. Butler, 1929. U.S.G.S. P.P. 144, = Baltic.

Superior Mine, Houghton Co., Michigan.

Superior granite.

W. A. Seaman, 1944. M.G.S. P.R. 10. Killarney or Republic granite.

W. A. Seaman, 1945. M.G.S. P.R. 11. Killarney. Lake Superior Region.

Superior West amygdaloid. Keweenawan.

Long local usage.

R. E. Hore, 1915. M.G.S. Pub. 19.

B. S. Butler, 1929. U.S.G.S. P.P. 144.

Superior Mine, Houghton Co., Michigan.

Sylvania sandstone. Lower Devonian.

E. Orton, 1888. Ohio Geol. Surv. Vol. 6.

A. C. Lane, 1895. M.G.S. Vol. V, pt. 2.

W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.

A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.

A. W. Grabau, 1908. Sci. ns. Vol. 28. Assigned Sylvania to Middle Monroe.

A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.

W. H. Sherzer and A. W. Grabau, 1910. M.G.S. Pub. 2.

W. H. Sherzer, 1913. M.G.S. Pub. 12.

R. A. Smith, 1914. M.G.S. Pub. 14; 1916, M.G.S. Pub. 21; 1917, M.G.S. Pub. 24. Middle Monroe.

R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.

R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.

J. E. Carman, 1936. G.S.A. Bull. Vol. 47, No. 2.

H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.

K. K. Landes, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations map 28; 1945, M.G.S. Pub. 44.

Mich. Geol. Soc., 1951 and 1952. Ann. Geol. Excur. Guidebooks.

G. M. Ehlers, E. C. Stumm, and R. V. Kesling, 1951. G.S.A. Guidebook; 1952, Mich. Geol. Soc. Ann. Geol. Excur. Guidebook. Included in Detroit River group.

A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2. Sylvania, Lucas Co., Ohio.

Tawas Moraine. Pleistocene. Port Huron system.

F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.

H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan. Tawas, Iosco Co., Michigan.

Tazewell stage. Pleistocene. Early Wisconsin.

M. M. Leighton, 1933. Sci. ns. Vol. 77.

Tazewell Co., Illinois.

Tekonsha Moraine. Pleistocene.

F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.

H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan. Tekonsha, Calhoun Co., Michigan.

Tennesseean system.

E. O. Ulrich, 1905. U.S.G.S. P.P. 36; 1911, G.S.A. Bull. Vol. 22.

R. B. Newcombe, 1933. M.G.S. Pub. 38.

Thunder Bay limestone. Middle Devonian.

C. C. Douglass, 1841. M.G.S. Ann. Rept. St. Geol., Mich. Leg. J.D. 1841, Vol. 1, No. 11.

A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2.

A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901. Series. Redefined.

R. A. Smith, 1916. M.G.S. Pub. 21.

R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.

R. B. Newcombe, 1933. M.G.S. Pub. 38.

A. S. Warthin, Jr. and G. A. Cooper, 1935. Wash. Acad. Sci. Jour. Vol. 25, No. 12.

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Thunder Bay, Alpena Co., Michigan.

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W. G. Miller, 1911. Eng. and Min. Jour. Vol. 92.

Temiskaming.

J. Zinn, 1939. Mich. Acad. Sci. and M.G.S. Ann. Excur. Guidebook. Temiskaming.

Lake Temiskaming, Ontario.

Toleston beach. Pleistocene.

F. Leverett, 1899. U.S.G.S. Mon. 38; 1915, U.S.G.S. Mon. 53.

A. C. Lane, 1908. M.G.S. Ann. Rept. 1907. Toleston.

F. Leverett, 1912. M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.

W. H. Sherzer, 1913. M.G.S. Pub. 12.

Toleston, Lake Co., Indiana (absorbed by Gary, Indiana).

Toll pit beds. Devonian.

W. H. Sherzer and A. W. Grabau, 1910. M.G.S. Pub. 2. Toll pit quarry, near Scofield, Monroe Co., Michigan.

Torch Lake amygdaloid. Keweenawan.

Local usage.

Torch Lake Mining Co. property, Houghton Co., Michigan.

Traders iron fm. Middle Huronian. Member Vulcan fm.

C. R. Van Hise and W. S. Bayley, 1900. U.S.G.S. Menominee Folio No. 62.

C. K. Leith, R. J. Lund, and A. Leith, 1935. U.S.G.S. P.P. 184.

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C. A. Lamey and C. E. Dutton, 1941. M.G.S. P.R. 6; 1942, M.G.S. P.R. 8.

C. E. Dutton, 1942. M.G.S. P.R. 9.

Traders Mine, Menominee District, Michigan.

Trappean series. Trap rock. Keweenawan.

D. Houghton, 1841. M.G.S. Ann. Rept. St. Geol., Mich. Leg. J.D. 1841, Vol. 1, No. 11.

C. Rominger, 1873. M.G.S. Vol. I, pt. 3.

Traverse fm. Middle Devonian.

- A. Winchell, 1861. M.G.S. First Bien. Rept. Little Traverse Group.
- A. C. Lane, 1893. Reported by M. E. Wadsworth, M.G.S., Rept. St. Bd. Geol. Surv. 1891-1892.
- A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Dropped "Little" of Winchell. (Traverse includes Hamilton and Marcellus = Erian of Clarke and Schuchert.)
- W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1; 1913, M.G.S. Pub. 12.
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- C. H. Gordon, 1900. M.G.S. Vol. VII, pt. 3.
- A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901.
- W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
- R. A. Smith, 1914. M.G.S. Pub. 14, Hamilton-Marcellus; 1916, M.G.S. Pub. 21; 1924, M.G.S. Pub. 34; 1925, M.G.S. Pub. 35.
- R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Hamilton. Marcellus.
- R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S. Pub. 38.
- E. R. Pohl, 1930. U.S. Nat. Mus. Proc. Vol. 76, art. 14.
- A. S. Warthin, Jr. and G. A. Cooper, 1935. Wash. Acad. Sci. Jour. Vol. 25, No. 12.
- G. E. Eddy, 1936. M.G.S. P.R. 1.
- E. A. Newman, 1936. M.G.S. P.R. 2.
- G. H. Pringle, 1937. M.G.S. P.R. 3.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
- C. H. Riggs, 1938. M.G.S. P.R. 4.
- G. V. Cohee, 1947. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 28; 1951, U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 41.
- Mich. Acad. Sci., Arts and Lett., Mich. Geol. Soc., and M.G.S., 1948. Ann. Excur. Guidebook.
- Mich. Geol. Soc., 1949 and 1952. Ann. Geol. Excur. Guidebooks.
- A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
- Little Traverse Bay of Lake Michigan, Charlevoix Co., Michigan.

Trempealeau fm. Upper Cambrian.

- F. T. Thwaites, 1923. Jour. Geol. Vol. 31, No. 7. Proposed by E. O. Ulrich.
- E. O. Ulrich, 1924. Wisconsin Acad. Sci., Arts and Lett. Trans. Vol. 21.
- R. B. Newcombe, 1933. M.G.S. Pub. 38.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
- G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 9.
- Trempealeau Bluff, Trempealeau Co., Wisconsin.

Trenary till plain. Pleistocene.

- S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
- Trenary, Alger Co., Michigan.

Trent Outlet. Pleistocene.

- A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
- F. Leverett, 1911. M.G.S. Pub. 7.
- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
- Trent River, Ontario.

Trenton limestone; group. Middle Ordovician.

- L. Vanuxem, 1838. New York Geol. Surv. 2d Rept. Silurian.
- J. Hall, 1851. Foster and Whitney Rept. U.S. 31st Cong. Spec. Sess. Sen. Ex. Doc. No. 4.
- A. Winchell, 1861. M.G.S. First Bien. Rept. Lower Silurian.
- C. Rominger, 1873. M.G.S. Vol. I, pt. 3. Silurian.
- M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892. Lower Silurian.
- A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C. E. Wright.
- A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1902, M.G.S. Ann. Rept. 1901; 1905, M.G.S. Ann. Rept. 1903, Silurian; 1905, M.G.S. Ann. Rept. 1904, Lower Silurian or Ordovician; 1907, M.G.S. Ann. Rept. 1906, Ordovician.
- I. C. Russell, 1905. M.G.S. Ann. Rept. 1904. Ordovician or Lower Silurian.
- W. H. Sherzer, 1913. M.G.S. Pub. 12.
- R. A. Smith, 1914. M.G.S. Pub. 14; 1916, M.G.S. Pub. 21, Galena and Platteville; 1917, M.G.S. Pub. 24; 1924, M.G.S. Pub. 34.
- R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
- R. B. Newcombe, 1933. M.G.S. Pub. 38.
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- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
- G. V. Cohee, 1945. U.S.G.S. (Co-op. M.G.S., Univ. Mich. Dept. Geol.) Oil and gas investigations chart 11.
- Mich. Acad. Sci., Arts and Lett., Mich. Geol. Soc., and M.G.S., 1948. Ann. Excur. Guidebook.
- Mich. Geol. Soc., 1950 and 1954. Ann. Geol. Excur. Guidebooks.
- Trenton Falls, New York.

Tropidoleptus beds. Middle Devonian. Traverse.

- A. Winchell, 1861. M.G.S. First Bien. Rept. Renamed Bryozoa beds.

Tyler slate. Upper Huronian.

- C. R. Van Hise, 1901. U.S.G.S. 21st Ann. Rept., pt. 3.
- R. C. Allen, 1910. M.G.S. Pub. 3; 1915, M.G.S. Pub. 18.
- R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map. Middle Huronian.
- H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Upper Huronian (Coppes).
- Tylers Fork, Wisconsin.

Tymochtee shale. Silurian. Cayugan.

- N. H. Winchell, 1873. Ohio Geol. Surv. Vol. 1.
- A. C. Lane, C. S. Prosser, W. H. Sherzer, and A. W. Grabau, 1909. G.S.A. Bull. Vol. 19.
- A. C. Lane, 1909. M.G.S. Ann. Rept. 1908.
- W. H. Sherzer and A. W. Grabau, 1910. M.G.S. Pub. 2.
- R. A. Smith, 1916. M.G.S. Pub. 21; 1917, M.G.S. Pub. 24.
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- J. E. Carman, 1927. Jour. Geol. Vol. 35.
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- A. J. Mozola, 1955. M.G.S. Pub. 48, pt. 2.
- Tymochtee Creek at Crawford, Wyandot Co., Ohio.

Tyre-Ubly Channel. See Ubly.

Uby Outlet (Tyre-Uby Channel). Pleistocene.

- F. B. Taylor, 1897. G.S.A. Bull. Vol. 8.
C. H. Gordon, 1900. M.G.S. Vol. VII, pt. 3.
F. Leverett, 1902. M.G.S. Ann. Rept. 1901.
Uby, Huron Co., Michigan.

Ulsterian. Middle Devonian.

- J. M. Clarke and C. Schuchert, 1899. Sci. ns. Vol. 10.
G. M. Ehlers and K. K. Landes, 1944. Mackinac Straits
Field Conference Guidebook.
G. M. Ehlers, 1945. M.G.S. Pub. 44. Mich. Geol. Soc.,
1951. Ann. Geol. Excur. Guidebook.
Ulster Co., New York.

Upper Algonquin beaches. (See Algonquin).

- G. M. Stanley, 1945. M.G.S. Pub. 43.

Upper Cambrian. St. Croixan.

- C. D. Walcott, 1888. Nature, Vol. 38.
C. D. Walcott, 1912. Smithsonian Misc. Coll. Vol. 57, No.
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R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
Pub. 23, legend geol. map. Or Potsdam.

Upper Carboniferous (Pennsylvanian).

- Early reports.
R. A. Smith, 1912. M.G.S. Pub. 8.

Upper Grand Rapids or Maxville. Mississippian.

- W. M. Gregory, 1902. M.G.S. Ann. Rept. 1901; 1913,
M.G.S. Pub. 12. Maxville or Bayport.
W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905. Maxville or
Bayport.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
Pub. 23, legend geol. map.
Grand Rapids, Michigan.

Upper Helderberg. See Helderberg.

- A. C. Lane, 1907. M.G.S. Ann. Rept. 1906. Dundee.

Upper Keweenawan. See Keweenawan.

- A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept.
1908.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
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W. A. Seaman, 1944. M.G.S. P.R. 10. Cambrian.

Upper Limerock formation.

- D. Houghton, 1840. 2d Ann. Rept. St. Geol. Mich. Leg.
H.D. No. 27, Vol. 2, S.D. No. 8, Vol. 2, 1840.
Divided into "the lower or Pentamerus portion, the middle
or Polypferous portion and the upper or Mackinac and
Manitouline portion."
Northern Peninsula Silurian of modern nomenclature.

Upper Limerock group.

- D. Houghton, 1841. Mich. Leg. J.D. 1841, Vol. 1, No. 11. "
. . . embracing as members the Drummond Island and
Mackinac limestone."

Upper Marshall or Napoleon. Mississippian.

- W. F. Cooper, 1906. M.G.S. Ann. Rept. 1905.
W. M. Gregory, 1912. M.G.S. Pub. 11.

Upper Monroe. Devonian. Detroit River.

- W. H. Sherzer and A. W. Grabau, 1910. M.G.S. Pub. 2.
R. A. Smith, 1916. M.G.S. Pub. 21. Or Detroit River series.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
Pub. 23, legend geol. map.

Upper Ordovician.

- R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
Pub. 23, legend geol. map. Or Cincinnati.
R. B. Newcombe, 1928. M.G.S. Pub. 37. Cincinnati.
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich.
Dept. Geol.) Oil and gas investigations chart 33.

Upper Pentamerus. Becraft of New York reports.

- W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
Mich. Acad. Sci., Arts and Lett., Mich. Geol. Soc., and
M.G.S., 1948. Ann. Excur. Guidebook.

Upper Saginaw. Pennsylvanian.

- W. A. Kelly, 1936. M.G.S. Pub. 40, pt. 2. (Post-Verne
cyclical fms.).
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.

Upper Silurian.

- J. Hall, 1851. Foster and Whitney Rept. U.S. 31st Cong.
Spec. Sess. Sen. Ex. Doc. No. 4. Clinton, Niagara and
Onondaga Salt Group.
A. Winchell, 1861. M.G.S. First Bien. Rept.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv.
1891-1892.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept.
1908. Or Ontarian.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
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Upper Traverse shales and limestone. Middle Devonian.

- A. W. Grabau, 1902. M.G.S. Ann. Rept. 1901.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S.
Pub. 23, legend geol. map.

Utica shales. Upper Ordovician.

- E. Emmons, 1842. Geol. New York, pt. 2, div. 4, geol., 2d
dist.
C. Rominger, 1873. M.G.S. Vol. I, pt. 3.
A. C. Lane, 1895. M.G.S. Vol. V, pt. 2. Edited notes of C.
E. Wright.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1902. M.G.S. Ann. Rept. 1901; 1905, M.G.S.
Ann. Rept. 1903; 1907, M.G.S. Ann. Rept. 1906, legend
geol. map.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept.
1908.
R. A. Smith, 1914. M.G.S. Pub. 14, Eden; 1917, M.G.S.
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Pub. 23, legend geol. map.
R. B. Newcombe, 1928. M.G.S. Pub. 37; 1933, M.G.S.
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H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map.
(Eden).
G. V. Cohee, 1948. U.S.G.S. (Co-op. M.G.S., Univ. Mich.
Dept. Geol.) Oil and gas investigations chart 33.
Utica, New York.

Valparaiso morainic system. Pleistocene. Wisconsin.

- L. C. Wooster ms.
F. Leverett, 1897. Geol. and Nat. Hist. Surv. Chicago Acad. Sci. No. 2; 1899, U.S.G.S. Mon. 38. Proposed by L. C. Wooster.
A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
F. Leverett, 1912. M.G.S. Pub. 9; 1917, M.G.S. Pub. 25. Valparaiso-Charlotte.
F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
I. D. Scott, 1921. M.G.S. Pub. 30.
G. C. Tague, 1948. M.G.S. Pub. 45, pt. 1.
F. W. Terwilliger, 1955. M.G.S. Pub. 48, pt. 1.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Valparaiso, Indiana.

Van Wert stage; beach. Pleistocene.

- W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
Van Wert, Ohio.

Verne limestone. Pennsylvanian.

- W. A. Kelly, 1936. M.G.S. Pub. 40, pt. 2. Defined. Name revived from Verne coal of A. C. Lane, 1900. M.G.S. Vol. VIII, pt. 2.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Verne Mine, Saginaw Co., Michigan.

Volcanic group.

- A. Winchell, 1861. M.G.S. First Bien. Rept.

Vulcan fm. Middle Huronian.

- C. R. Van Hise, 1899. U.S.G.S. 19th Ann. Rept. and Mon. 36.
C. R. Van Hise and W. S. Bayley, 1900. U.S.G.S. Menominee Folio No. 62.
R. C. Allen, 1910. M.G.S. Pub. 3; 1912, M.G.S. Pub. 8; 1915, M.G.S. Pub. 18.
C. R. Van Hise and C. K. Leith, 1911. U.S.G.S. Mon. 52.
R. C. Allen, 1915. Jour. Geol. Vol. 23; 1920, Am. Inst. Min. and Met. Eng. Trans. Vol. 63 (Bull. 153, September, 1919).
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Vulcan, Menominee Co., Michigan.

Warren, glacial lake; beach. Pleistocene. Wisconsin.

- J. W. W. Spencer, 1888. Sci. Vol. 11.
F. B. Taylor, 1897. G.S.A. Bull. Vol. 8. Applied Spencer's name to a restricted lake.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1; 1913, M.G.S. Pub. 12.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1908, M.G.S. Ann. Rept. 1907; 1909, M.G.S. Ann. Rept. 1908.
F. Leverett, 1902. M.G.S. Ann. Rept. 1901; 1912, M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
L. J. Cole, 1903. M.G.S. Vol. IX, pt. 1.
F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53. Named for General G. K. Warren.

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W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.

Warsaw limestone. Mississippian.

- A. Winchell, 1861. M.G.S. First Bien. Rept.
J. Hall, 1857. A.A.A.S. Proc. Vol. 10, pt. 2.
Warsaw, Hancock Co., Illinois.

Waverlian, early.

- R. B. Newcombe, 1933. M.G.S. Pub. 38.

Waverly group. Mississippian.

- C. Briggs, Jr., 1838. Ohio Geol. Surv. 1st Ann. Rept.
W. W. Mather, 1838. Am. Jour. Sci. 1st ser. Vol. 34.
A. Winchell, 1861. M.G.S. First Bien. Rept.
C. Rominger, 1876. M.G.S. Vol. III.
M. E. Wadsworth, 1893. M.G.S. Rept. St. Bd. Geol. Surv. 1891-1892.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1907, M.G.S. Ann. Rept. 1906, legend geol. map.
Waverly, Pike Co., Ohio.

Wayne, glacial lake. Pleistocene.

- F. B. Taylor, 1911. Ms. for U.S.G.S. Mon. 53.
F. Leverett, 1912. M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
W. H. Sherzer, 1913. M.G.S. Pub. 12.
F. B. Taylor, 1915. U.S.G.S. Mon. 53.
Wayne Co., Michigan.

West Branch Moraine. Pleistocene.

- F. Leverett, 1915. U.S.G.S. Mon. 53; 1912, M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
West Branch, Ogemaw Co., Michigan.

West Haven Moraine. Pleistocene. Wisconsin.

- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
West Haven, Shiawassee Co., Michigan.

West Minesota conglomerate; trap. Keweenawan.

- S. H. Broughton, 1863. Remarks on the mining interest and details of the geology of Ontonagon Co.
West Minesota Mining Co. property, Ontonagon Co., Michigan.

Wetmore outwash plain. Pleistocene.

- S. G. Bergquist, 1936. M.G.S. Pub. 40, pt. 1.
Wetmore, Alger Co., Michigan.

Wewe slate. Lower Huronian.

- C. R. Van Hise and W. S. Bayley, 1895. U.S.G.S. 15th Ann. Rept.
A. C. Lane, 1907. M.G.S. Ann. Rept. 1906.
A. C. Lane and A. E. Seaman, 1909. M.G.S. Ann. Rept. 1908.
R. C. Allen, R. A. Smith, and L. P. Barrett, 1917. M.G.S. Pub. 23, legend geol. map.
H. M. Martin, 1937. M.G.S. Pub. 39, legend geol. map. Mich. Acad. Sci. and M.G.S., 1939. 9th Ann. Field Excur. Guidebook.
Wewe Hills, Marquette Co., Michigan.

Whitehall Moraine. Pleistocene. Wisconsin.

- F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
H. M. Martin, 1955. M.G.S. Pub. 49, map surface fms. Southern Peninsula Michigan.
Whitehall, Muskegon Co., Michigan.

Whitefish Bay. Devonian. Replaced by Newton Creek.

- A. S. Warthin, Jr. and G. A. Cooper, 1940. Mich. Acad. Sci., Arts and Lett., and M.G.S. 10th Ann. Geol. Excur. Guidebook.
Whitefish Bay, Alpena Co., Michigan.

White Pine Lode. Keweenawan.

- R. E. Hore, 1915. M.G.S. Pub. 19.
White Pine Mine, Ontonagon Co., Michigan.

Whittlesey, glacial lake; beach. Pleistocene.

- F. B. Taylor, 1897. G.S.A. Bull. Vol. 8.
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1; 1913, M.G.S. Pub. 12.
A. C. Lane, 1900. M.G.S. Vol. VII, pt. 2; 1908, M.G.S. Ann. Rept. 1907.
C. H. Gordon, 1900. M.G.S. Vol. VII, pt. 3.
F. Leverett, 1902. M.G.S. Ann. Rept. 1901; 1912, M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
F. Leverett and F. B. Taylor, 1915. U.S.G.S. Mon. 53.
Named for Colonel Charles Whittlesey, Ohio geologist.

"Wier sand". Mississippian. Subsurface. Berea?

- E. A. Newman, 1936. M.G.S. P.R. 2.
Oil well drillers' usage. West Branch oil field, Ogemaw Co., Michigan.

Winona conglomerate. Keweenawan.

- Long local usage.
R. E. Hore, 1915. M.G.S. Pub. 19.
B. S. Butler, 1929. U.S.G.S. P.P. 144.
Winona Mine, Houghton Co., Michigan.

Wisconsin glaciation; drift.

- T. C. Chamberlin, 1894. (Great Ice Age, by James Geikie, 3d ed.). Proposed and used East Wisconsin stage and East Wisconsin fm.
T. C. Chamberlin, 1895. Jour. Geol. Vol. 3. Dropped "East".
W. H. Sherzer, 1900. M.G.S. Vol. VII, pt. 1; 1913, M.G.S. Pub. 12.
I. C. Russell, 1905. M.G.S. Ann. Rept. 1904; 1907, M.G.S. Ann. Rept. 1906.
A. C. Lane, 1908. M.G.S. Ann. Rept. 1907.
F. Leverett, 1912. M.G.S. Pub. 9; 1917, M.G.S. Pub. 25.
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