

NEWSLETTER

Minnesota Geological Survey

June, 1962

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This is the first of a series of Newsletters intended to inform citizens of the State and other interested parties of the activities of the Minnesota Geological Survey. The history, budget, staff, and current geologic investigations of the Survey are described in this issue.

MINNESOTA GEOLOGICAL SURVEY

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INTRODUCTION

The Minnesota Geological Survey has the responsibility for conducting investigations of the geology of Minnesota for the benefit of the citizens and industries of the State. It carries out this responsibility by geologic mapping of the rock strata, by research on the occurrence, quality and usefulness of geological mineral resources, and by publication of the results.

In comparison with the 46 other state geological surveys, the Minnesota Geological Survey is small. In 1960 it ranked 44th in available direct income and in 1961 it ranked 39th. However, in some states the geological survey organizations carry out functions which in Minnesota are the responsibility of other State agencies. For example, in Minnesota regulatory functions relating to mineral industries and water use are carried out by the Department of Conservation and programs for topographic mapping and water resource studies done in cooperation with the United States Geological Survey are administered by the Department of Conservation. In addition, the Iron Range Resources and Rehabilitation Commission has supported programs of topographic mapping and water resource investigations.

HISTORY

The Minnesota Geological Survey was established by an Act of the State Legislature and approved by Governor Austin in March, 1872. Its administration was entrusted to the Board of Regents of the University of Minnesota. Newton Horace Winchell was appointed State Geologist in 1872. During his tenure, from 1872 to 1900, the Survey became a strong organization that exerted active leadership in development of the mineral resources of the State. In these three decades 10 bulletins, 24 annual reports, and 6 major volumes were published. With Winchell's retirement, the Survey became inactive until 1911, when William Harvey Emmons became concurrently Director of the Minnesota Geological Survey and Head of the Department of Geology in the University. Since then, the Survey has been continuously active. Under Dr. Emmons and his successors until 1961, investigations of the geology of the State were conducted primarily on a part-time basis by faculty and graduate students of the Department of Geology. From Emmons's retirement in 1944 until 1947, Frank Fitch Grout held a similar split appointment as Professor and Director, and from 1947 to 1961 George Melvin Schwartz operated in the same pattern. Under Dr. Schwartz, in cooperation with the U.S. Geological Survey, airborne magnetometer maps were prepared for most of the northern part of the State. Also, a program of topographic mapping, done cooperatively with the U.S. Geological Survey, was started and has since continued. Dr. Schwartz retired in 1961 and was succeeded by the present Director, Paul K. Sims.

APPROPRIATIONS

Recognizing the need for a stronger, more active state geological survey, the Minnesota Legislature of 1961 appropriated substantially more funds than previously for geologic investigations in the State.

The available funds in the fiscal year 1961-62 amounted to \$64,360, an increase of \$40,000 from the previous year.

Salaries accounted for 52 percent of the budget for the year; field expenses, equipment, and miscellaneous expense accounted for 48 percent.

STAFF

The regular staff of the Geological Survey follows :

Paul K. Sims, Ph.D., Director
John E. Stone, Ph.D., Geologist
C. Marshall Payne, B.S., Geologist
George S. Austin, M.S., Geologist (temporary)
Sarah Pattison, (temporary)
Peter Stupnitsky, Draftsman
Judy Holmes, Secretary

In addition, 6 faculty members and 15 graduate students of the Department of Geology, University of Minnesota, have been employed for short intervals on a part-time basis.

The Director, Paul K. Sims, entered on duty September 1, 1961 after 18 years with the U.S. Geological Survey. He has specialized in studies of mineral deposits and Precambrian igneous and metamorphic rocks, and for most of the past 10 years was in charge of the U.S. Geological Survey's investigations in the Colorado Front Range.

John E. Stone was appointed in June, 1962, as geologist responsible for investigations in glacial and engineering geology. He received his Ph.D. degree at the University of Illinois in 1960 and was an Assistant Professor in geology at the University of Texas from 1960 until 1962. He has begun a comprehensive project on the geology of the St. Paul-Minneapolis metropolitan area that is intended to result in a new geologic map of the area and a comprehensive summation of the engineering properties of its rocks and soils as related especially to urban development.

C. Marshall Payne joined the staff in September 1961. He graduated from Arizona State University with a B.S. degree in 1959. Mr. Payne is studying the bedrock geology of the St. Paul-Minneapolis metropolitan area.

ADVISORY COMMITTEE

In October, 1961, Governor Elmer L. Andersen appointed an advisory committee on the Geological Survey, consisting of the following :-

Lee Armstrong, Geologist, E.J. Longyear Co.,
P.E. Cloud, Jr., Chairman, Department of Geology,
University of Minnesota.
Jack Everett, Geologist, W.S. Moore Co.,
H.L. James, Department of Geology, University of Minnesota
(Chairman)
Henry Lepp, Department of Geology, University of Minnesota
(Duluth)
Ralph Marsden, Manager, Geologic Investigations, Oliver
Iron Mining Corporation
Duncan Stewart, Chairman, Department of Geology, Carleton College
T. E. Stepheson, Resident Mining Engineer, J & L Steel Corp.

The Committee met once informally and twice formally during the year. It has contributed substantially to the development of long range plans and objectives for the Survey and has recommended substantial increases in geologic investigations, to a level consistent with the needs of the State.

CURRENT ACTIVITIES

The current program of geologic investigations, which is somewhat larger than in past years, consists mainly of geologic mapping and resource studies. It is as follows :-

Active and scheduled projects

1. Duluth gabbro complex, Lake County
Project chief: Dr. W.C. Phinney

Geologic mapping of Gabbro Lake 15-minute quadrangle and adjacent quadrangles in the central part of the complex; studies of petrology, structure and nickel-copper deposits. Mapping was begun in 1961. First phase of a long-range study of the gabbro complex to be carried out by Dr. Phinney mainly with National Science Foundation support.

2. Pre-Keweenawan rocks, Gabbro Lake quadrangle, Lake County
Project chief: Dr. J.C. Green

Geologic mapping of Giants Range granite complex, greenstone, and graywacke-slate in Gabbro Lake quadrangle; study petrology, structure and mineral deposits of rocks. Mapping started in 1962; estimated completion date, 1964. First phase of an intensive study of the pre-Keweenawan rocks of northeastern Minnesota.

3. Pre-Keweenawan rocks, Forest Center and Ensign Lake quadrangles, Lake County.

Project chief: Norris W. Jones
Supervisor: Dr. W.C. Phinney.

Geologic mapping of the Snowbank granite and associated pre-Keweenawan rocks in the Forest Center and Ensign Lake 15-minute quadrangles. Study petrology, structure and mineral deposits of pre-Keweenawan rocks. Mapping was begun in 1962. This investigation is closely allied with geochronology studies of rocks adjacent to Duluth gabbro complex, now in progress by Gilbert Hanson and Dr. P.W. Gast, and largely supported by National Science Foundation funds.

4. Granite Falls-Montevideo area, Minnesota River Valley, Medicine and Chippewa counties.

Project chief: Glen R. Himmelberg
Supervisor: Dr. W.C. Phinney

Geologic mapping, petrology, and structure of Precambrian rocks in a part of the Minnesota River Valley. Mapping was begun in 1961; to be completed in 1963. Project is supported in part by National Science Foundation funds. Initial phase of a restudy of the rocks of south-central Minnesota.

5. Brown iron ores, Fillmore County, Southeastern Minnesota

Project chief: Rodney L. Bleifuss
Supervisor: Dr. H.L. James

A study of the occurrence, distribution, and origin of the iron ores. Study nearing completion.

6. Geology of SE- $\frac{1}{4}$ Gunflint Lake quadrangle, Cook County

Project chief: Glenn B. Morey, under
Supervision of Dr. H.L. James and Dr. F.M. Swain.

Geologic mapping, with emphasis on stratigraphy of the Rove slate. Mapping started in 1962.

7. Paleozoic rocks of southeastern Minnesota

Project chief: Dr. R.E. Sloan

Compilation of completed geologic mapping on St. Paul, Mason City, La Crosse, and Eau Claire 1:250,000 AMS sheets. Plan to publish as part of a geologic atlas for Minnesota, a revision of the state geologic map. Project nearing completion.

8. Geology of Minneapolis-St. Paul metropolitan area
Project chief: Dr. John Stone

A long-range comprehensive re-study of the surface and subsurface geology of the metropolitan area. Compilation of well data and study of well cuttings was begun in 1961, and is being supported in part by the Division of Waters, Department of Conservation. Geologic mapping of surficial materials was begun in 1962.

9. Decorah shale
Project chief: Cyril M. Gallick, under
Supervision of Dr. F.M. Swain and Dr. P.K. Sims

A study of the stratigraphy, lithofacies, clay mineralogy, and clay resources of the formation. Study started in 1961; to be completed in 1962.

10. Conodont zonation, Upper Ordovician
Project chief: Gerald F. Webers, under
Supervision of Dr. R.E. Sloan

A paleontologic investigation to determine conodont zonation in Upper Ordovician rocks as an aid to subsurface correlation.

11. Organic sediments of Minnesota lakes
Project chief: Dr. F.M. Swain

Continuing studies, as a part of investigations of lakes in the Western Hemisphere, supported largely by other funds. Study will provide a background for marl and peat investigations in the State.

12. Paleontology of the Decorah shale
Project chief: Olgerts L. Karklins, under
Supervision of Dr. F.M. Swain

A study of Ordovician cryptostome bifoliate Ectoprocta. Started in 1961; to be completed in 1962. Partial support by Minnesota Geological Survey in view of possible utility in subsurface correlation.

13. Gravity investigations, Southeastern Minnesota
Project chief: Dr. J.C. Craddock

An investigation of the positive gravity anomaly extending southwestward from the vicinity of Duluth into Iowa. 3,000 gravity stations were established in 1961; study and report nearing completion.

14. Glacial geology of Western Carlton County
Project chief: Richard G. Baker, under
Supervision of Dr. H.E. Wright

Geologic mapping of surficial deposits adjacent to former Glacial Lake Upham. Field work to be completed in 1962. Part of current restudy of glacial geology of State, supported in part by the State Survey, to provide a basis for reclassification of the Pleistocene materials and investigations

of the resources and engineering properties of the surficial deposits.

15. Glacial geology of parts of Pine and Kanabec counties
Project chief: Edward J. Cushing, under
Supervision of Dr. H.E. Wright

Geologic mapping of surficial deposits in Grantsburg sub-lobe (Valders) of Des Moines lobe. Purpose is similar to Project 14.

16. Magnetometer investigations, Central Minnesota
Project chief: Dr. P.K. Sims

Ground magnetic investigations in areas with anomalous positive airborne magnetometer anomalies. Field work was begun in 1962.

17. Clay deposits, Goodhue County, Minnesota
Project chief: George S. Austin

Short-range study of the occurrence and origin of Cretaceous clay deposits. Field work completed in 1962.

NOTEWORTHY RESULTS

During the spring of 1962 the Minnesota Survey aided in an investigation for clay deposits in Cretaceous rocks in Goodhue County, (Project 17) and contributed to the discovery of substantial reserves suitable for making sewer pipe and tile. The reserves that have been found appear to be adequate to sustain the industrial plant at Red Wing for several years.

Combined geologic and gravity investigations in the vicinity of Belle Plaine, in the Minnesota River Valley, by Dr. R.E. Sloan and Dr. Z.F. Danes, have disclosed a hitherto unknown asymmetry that may reflect a fault of possible major significance. The line of apparent offset trends northwestward and lines up with offsets of sedimentary strata that appear to have a displacement of about 1,000 feet in the Minnesota River Valley. Earlier movements may have been transcurrent and of large magnitude. Further investigations of this feature and its possible relationship to the distribution of iron-formation rocks are being carried out this summer.

The initial geologic mapping in the central part of the Duluth gabbro complex by Dr. W.C. Phinney and Paul W. Weiblen has disclosed a troctolite (an olivene-bearing gabbro) intrusion in the Duluth gabbro complex heretofore unknown in this area. This discovery leads to new concepts of the origin and history of the large complex.

NEED FOR DETAILED SYSTEMATIC GEOLOGIC MAPPING

Geologic mapping is needed in the State to sustain intelligent mineral exploration, to evaluate fully the mineral resource potential, and to provide data necessary for engineering planning.

Geologic maps are the basic element in development of natural resources whether these resources be groundwater, clay, construction materials, or iron ore. They provide data on the distribution and structure of the rock strata and surficial materials and thus are essential for determining areas most suitable for exploration for mineral and water resources.

Many engineering problems involved in highway construction and in urban and industrial development are basically geologic; geologic maps of areas of interest can serve as the basis for specific engineering studies by private firms and State organizations.

Currently, geologic maps suitable for modern-day needs are available for less than one percent of the State. Geologic mapping is needed in all parts of the State, but most urgently in the northeastern counties and the large metropolitan areas. Modern topographic maps on which geologic mapping of the desired accuracy can be done are now available for most areas in these regions.

PUBLICATIONS ISSUED BY THE SURVEY DURING THE YEAR

Bulletins

34. Supplement. Bibliography of Minnesota Geology (for period 1951-61), by J.F. Splettsøesser and S.A. Sloan, 1962, 72p.
42. Lower Upper Cretaceous plant microfossils from Minnesota, by R.L. Pierce, 1961. 86 pages.
43. The geology of the East Mesabi district, Minnesota, by James Gundersen and G.M. Schwartz, 1962, 139 pages. (scheduled for publication in July, 1962).

Publications by Survey Personnel Published Outside the Survey During the Year

1. Gundersen, J.V., and Schwartz, G.M., 1962, Magnetic taconites of the Eastern Mesabi district, Minnesota; American Institute of Mining and Metallurgical Engineers, Technical Paper 601222.
2. *Swain, F.M., 1961, Limnology and amino-acid content of some lake deposits in Minnesota, Montana, Nevada and Louisiana: Geological Society of America Bulletin, v.72, p.519-546.
3. *Wright, H.E. Jr., 1962, Role of the Wadena lobe on the Wisconsin glaciation in Minnesota: Geological Society of America Bulletin, v.73, p.73-100.

*Work partly supported by Minnesota Geological Survey.

PLANS FOR NEW PUBLICATION SERIES

Arrangements have been completed with the University Press to issue a formal geologic map series. The new series will consist mainly of colored geologic maps of standard quadrangles or larger areas and will be published in booklet form with a short descriptive text. The first of the series to be issued will be GM-1, "Bedrock geology of Duluth and vicinity, St. Louis County", by R.B. Taylor. The maps in this series will sell for \$1.75 each.

Tentative plans are being made to prepare a Geologic Atlas of Minnesota, which will be a revision of the state geologic map. The atlas will consist of colored geologic maps on Army Map Service 1:250,000 topographic base maps. A sheet that comprises an area of dominant Paleozoic rocks in the southeastern part of the State now is being compiled (Project 7). Additional sheets will be completed as personnel and funds become available.

A new formal publication series -- Reports of Investigations -- will be initiated in the coming year. This series will provide a means for publishing brief reports and preliminary data of immediate interest to the public. Reports in this series will be issued free of charge.

TOPOGRAPHIC MAPPING

Cooperative programs for topographic mapping by the U.S. Geological Survey were continued by the Department of Conservation and the Iron Range Resources & Rehabilitation Commission during the year ending June 30, 1962. A total of \$86,000 of State funds was matched by Federal funds. Additional topographic mapping in the State was supported entirely by Federal funds.

Currently, 32,757 square miles or about 41 percent of the State is covered by modern standard topographic maps. The topographic maps are quadrangle maps that cover unit areas bounded by parallels and meridians, and are either 7½-minute (scale 1:24,000) or 15-minute (scale: 1:62,500) maps.

About 11,000 square miles of new topographic mapping and map revision are in progress toward publication.

OTHER GEOLOGIC ACTIVITIES IN THE STATE

In September, 1961, an area of about 10,000 square miles centering at the nuclear reactor site at Elk river was surveyed by the U.S. Geological Survey with airborne scintillation and airborne magnetometer equipment.

Cooperative programs for water resources investigations in the State by the U. S. Geological Survey were continued by the Department of Conservation, the Department of Iron Range Resources and Rehabilitation, the Department of Highways, and Hennepin County during the year ending June 30, 1962; about \$133,270 of State funds were matched by Federal funds. Water resources reports are in press and were released to the open file for the following areas: Halma-Lake Bronson, Kittson County; Lyon County; Nobles County; Redwood Falls, Redwood County; and the Duluth Air Force Base. A basic data report was released to open file for Chisholm, St. Louis County. A map of the bedrock topography of the eastern Mesabi Range was also released to open file.

Current cooperative projects include: Water resources near the municipalities on the Mesabi and Vermilion ranges; Surficial geology of the Mesabi and Vermilion ranges; Bedrock topography of the western Mesabi Range; Water resources in the Grand Rapids area, Itasca County; Water resources of Kittson, Marshall and Roseau Counties; Water resources near Aurora, St. Louis County; Hydrology of Nett Lake Indian Reservation; Geology of sinuous melt water channels near Marshall, Lyon County; Depositional characteristics of Lake Agassiz Beach Ridges; and Water levels and artesian pressures in observation wells in Minnesota.

Surface water cooperative studies include the maintenance of 105 gaging stations throughout the State, of which 60 are operated under the cooperative program, and 128 crest stage gages for determination of peak flows at selected sites throughout the State. Water quality stations for chemical quality were operated at 63 sites and for sediment studies at 20 sites. Most of these studies were of reconnaissance type.

The Division of Waters, Department of Conservation, issued three reports on water resources during the past year: (1) Water Resources of Minneapolis-St. Paul Metropolitan Area (Bulletin 11), (2) Floods in Minnesota, magnitude and frequency (Bulletin 12), (3) Water use for irrigation in Minnesota (Bulletin 17).

