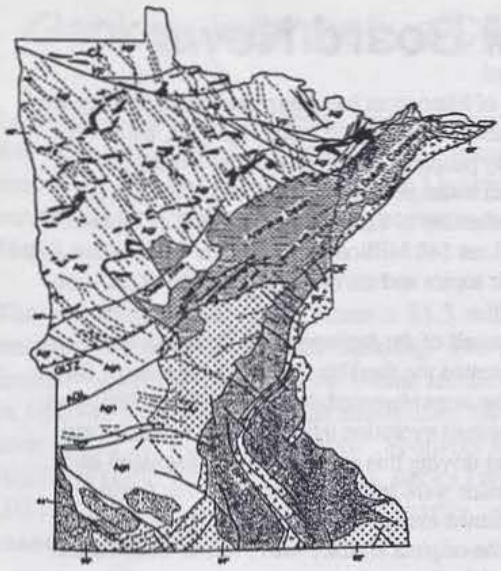

GEOLOGICAL SOCIETY OF MINNESOTA

NEWS

SUMMER 2000
VOLUME LIV NO. 2
http://www.geo.umn.edu/orgs/gsm/

SUMMER 2000 FIELD TRIPS

Saturday, June 3 St. Paul Brickyards - Lilydale
1-Day
Fossil Hunting
Leader: Jane (Cleland) Christopher
Science Museum of Minn.

Saturday, June 24 & 25 Alexandria Moraine and Glacial Lake Benson: Interactions and Influences
2-Day
Will look at landforms and sediments of the Des Moines Lobe Glacier
Leader: Jim Cotter, U of M Morris

July ? Iowa (near Mason City)
2-Day
Fossils, etc.
Leader: Undetermined at this time. July date and leader still being worked on.

Saturday, Aug. 5 Red Wing Area
1-Day
Focus on Lower Paleozoic bedrock and processes that sculpted this bedrock as well as a variety of geologic topics
Leader: Tony Runkel
Minnesota Geological Survey

Further information (directions, lodging, and site details) of each trip will be sent with each field trip mailing. Note that our usual May trip will be the first weekend in June as our leader was unable to schedule in May.

Judy Hamilton Co-Chair, Field Trips

New Guidebook by J. H. Mossler "Geology of the Root River State Trail Area Southeastern Minnesota"

See page 4

Right: Trailside exposure of St. Peter Sandstone overlain by a thin layer of till. The roadsigns are 5 feet tall.

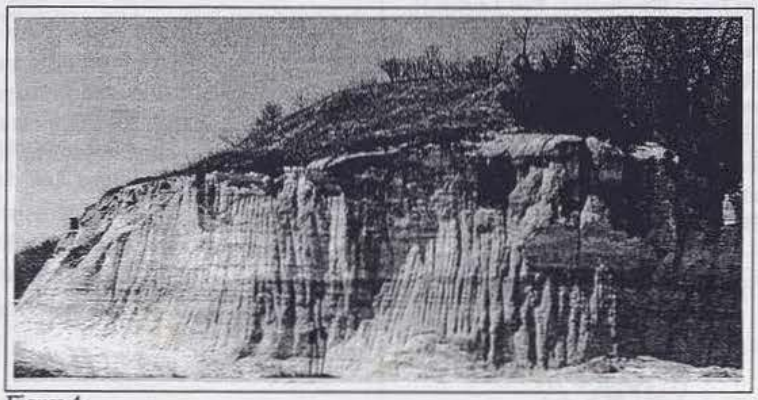

Figure 4

Announcement

After over two years of more fun than he ever imagined, Bruce Goetteman has reluctantly resigned his role as GSM Newsletter Publisher. Anyone who is interested in taking on this responsibilty (and who has access to a computer) please contact the Editor, Katy Paul.

The finest workers in stone are not copper or steel tools, but the gentle touches of air and water working at their leisure with a liberal allowance of time.

— Henry David Thoreau

GSM *NEWS*

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The purpose of this newsletter is to inform the members and friends of the activities of the Geological Society of Minnesota. GSM *News* is published four times a year: February 15, May 15, August 15, and November 15. It welcomes unsolicited Geology and Earth Science related articles and photographs. Deadline for article submission is three weeks before the date of publication. Send all material for GSM *NEWS* to: Geological Society of Minnesota c/o Katy Paul, 6901 West 84th Street, Bloomington, MN 55438. Phone: as listed above, or e-mail: again, as listed above.

Officers: William Robbins, *President*; Bruce Goetteman, *Vice President*; Steve Erickson, *Treasurer*; Judy Hamilton, *Secretary*.

Directors: In addition to the officers listed above; David Christianson; Paul Lemke; Sylvia Huppler; Gail Marshall; Jean Hosterman.

Send all GSM membership dues, change of address cards, and renewals to the GSM Membership Chair: c/o Gail Marshall, 12232 Allen Drive, Burnsville, MN 55337. Phone: (612) 894-2961. Membership levels are: $10 for full-time Students, $20 for Individuals, or $30 for Families.

GSM Board News

The Geological Society of Minnesota has completed another successful season of lectures and laboratories. Attendance was high, with each lecture averaging seventy people and each laboratory averaging twenty-nine people, often swamping facilities. Contributing to the excellent turnout were selection of the theme "Evolution of Phanerozoic Life on Earth: The Last 540 Million Years" by the GSM board and selection of both specific topics and excellent speakers by Rick Uthe.

Professor Barbara O'Connell of the Anthropology Department at Hamline University presented the final laboratory of the season. She demonstrated many of the steps observed during the five million-year course of hominid and human evolution using skeletons, fossils and casts from fossils. Events driving this evolution were discussed and tools generated by hominids were inspected. Some of the remaining questions surrounding human evolution were raised and discussed. Doug Zbikowski made the original contact with Prof. O'Connell and Sylvia Huppler continued the interaction.

Field trip co-chairs Gail Marshall and Judy Hamilton are organizing field trips for this spring and summer. Single day field trips are planned to the Lilydale brickyards on June 3rd and to the Redwing area of Minnesota. Two-day field trips are planned to the Alexandria Moraines and possibly to Mason City, Iowa. For more information, see the field trip schedule elsewhere in this issue.

Sylvia Huppler has compiled and printed the GSM membership directory for the year 2000. This compilation required conversion of many phone numbers to new area codes. The directory will be mailed to all those members who did not collect one at the spring banquet.

Alan Smith, GSM Internet coordinator, has linked the GSM web site to two "Ask-a-Geologist sites", one at the Minnesota Geological Survey and the other at the United States Geological Survey (USGS). The Minnesota Geological Survey has also provided a link to our GSM web site.

As chosen by the GSM board, the 2000-2001 Lecture Series has the theme: "Earth Dynamics: Basic and Catastrophic". Rick Uthe has selected specific titles and speakers for this next season, beginning with Prof. E. Calvin Alexander and ending with Prof. Charles Matsch. Anticipate a very interesting and informative season.

The board has considered various approaches to ease travel to and parking at lectures. Individual efforts to share rides and divide parking costs may be the most viable approach. Try inviting a guest to each lecture.

Bill Robbins, President

Geology Interpretive Center Awaits Legislative Approval

by Tom Smalec

Legislation creating a Minnesota Geology Interpretive Center at Moose Lake State Park is among the host of items in limbo as the Minnesota Legislature continued in deadlock over budget issues as of May 1.

The proposal, which would create a $1.3 million museum and education center building, won preliminary approval from both the House and Senate in April as part of a larger bill authorizing sale of state bonds for building projects. Sponsors Rep. Bill Hilty (DFL-Finlayson) and Sen. Becky Lourey (DFL-Kerrick) say that would ordinarily mean chances for approval are high.

But because legislative leaders have so far been unable to agree on an overall plan for use of the state's budget surplus, no finance bills have been able to move forward in the legislative process. That budget plan will determine the size of the bonding bill. Once agreement is reached on the size of the bill, members of the House and Senate will meet in a conference committee to decide what projects to include. If deadlock continues, the bonding bill would not pass.

The proposed center will feature displays of the state's unique geological items, with a major focus on a large collection of Lake Superior agates donated by collectors. The proposal also envisions an Earth Science Education Center for students, an information hub to provide current information on geology tours and rockhounding opportunities, and a gift shop/bookstore.

The Carlton County Gem & Mineral Club, Anoka County Gem & Mineral Club and Minnesota Mineral Club have pledged to donate cash and specimens for the center.

Meanwhile, two other pieces of geology-related legislation appear to be dead for the current session:

* A proposal to provide $8 million for accelerated surface geology mapping, recommended by a legislative task force studying Minnesota's future supplies of sand, gravel and other building materials. The proposal is expected to return in 2001, when the Legislature will create the overall state budget for the following two years.

* A bill sponsored that would have allowed gold prospecting with small motorized sluices, dredges and other machinery for a $25 annual fee was killed in a Senate committee. The Department of Natural Resources Minerals Division said motorized prospecting can speed erosion, disturb wildlife habitat and destroy trout streams. The measure was backed by the Minnesota Recreational Gold Prospecting Club. Minnesota does allow recreational prospecting, but only with a pan. More details on laws governing recreational gold panning can be found on the Internet at www.dnr.state.mn.us/minerals/minrec.html

Remembering Phil Curtis...

On March 8, longtime and very active GSM member Philip Curtis passed away. Phil died of complications arising from surgery for cancer of the esophagus. I've known Phil for several years now. He was very active in the GSM Public Service Committee. Every year he helped us build rock boxes for schools. Phil also assisted in many classroom presentations in the School Outreach Program. Volunteerism runs in the Curtis family, because his wife, Joan, also volunteers in educational efforts for the Minneapolis Public Schools.

Phil loved to work with children, saying that they charged his batteries and kept him young. He was a real proponent of teaching by the Socratic method, asking leading questions and guiding young minds to logically arrive at an answer and an aspect of truth. He felt that the most important things one can learn are the methods of inquiry. Facts are important, but the methods are tools one can apply throughout life, no matter what the subject. Through the Outreach Program, Phil's insights enriched the learning of literally hundreds of elementary school children in the Metro area. We and many young students will fondly remember him.

Doug Zbikowski

"Geology of the Root River State Trail Area, Southeastern Minnesota"

a new guidebook by John H. Mossler

by Kate Pound, Minnesota Geological Survey, 2642 University Avenue West, St. Paul, MN 55114, email: pound001@tc.umn.edu

Have you ever traveled through southeastern Minnesota on Highway 52 and wondered what the scrub-filled depressions on the otherwise-flat plateau near the City of Fountain are? Or why there are very flat areas of sand and gravel (terraces) filling the narrow valleys that are cut into the steep-sided bedrock, such as in the Root River valley? What are the rocks that make up the steep valley sides or roadside outcrops? Or where you can see fossils such as stromatolites-what do they look like and what are they? The Minnesota Geological Survey recently published a guidebook "Geology of the Root River State Trail Area, Southeastern Minnesota," which will help you answer these questions and others. As well as introducing you to the geological origin of the landforms, rocks, and sediments that you see in southeastern Minnesota, it provides a primer on geology in general and Minnesota geology in particular.

The Root River State Trail

The Root River State Trail is a paved bicycle and walking trail that extends for 42 miles from Fountain in the west, through Lanesboro and Rushford, to Houston in the east (Figure 1). The guide book covers the 29 miles between Fountain and Rushford. The trail is maintained by the Minnesota Department of Natural Resources, Division of Trails and Waterways, which has an office in Lanesboro. Access points to the trail are approximately 2 hours drive from the Twin Cities. The trail is built on an old railroad bed, thus it has a very gentle grade. It descends approximately 600 feet between Fountain and Houston; 450 feet of this descent is between Fountain and Lanesboro. Consequently, if you are bicycling it in one direction, as I did when I bicycled with my 10- and 7-year old sons, it is easiest to travel eastward from Fountain. If you are feeling more energetic, and travel westward toward Fountain, you will appreciate the need the trains had for an extra engine when they traveled up the bedrock bluffs (the escarpment) from Isinours to Fountain. If you visit the trail during the spring or fall you will get the best views of the outcrops and boulder-filled gullies near the trail. Many of these views are obscured by foliage during the summer or by snow during the winter.

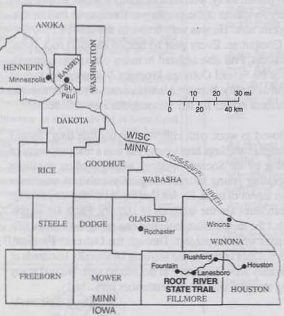

Figure 1: Location of the Root River State Trail

A Few Geological Snippets

The trail starts out in Fountain on a flat upland plateau that is almost parallel to the bedding in the Galena Group limestone and dolostone (Figure 2). This bedrock was deposited late during the Ordovician Period of the Paleozoic Era, about 450 million years ago, when sea levels were very high. At this time the highlands to the north and east that would normally have supplied coarser sediment were themselves covered with water, so carbonate sediments were deposited everywhere.

The shrub-filled depressions that dot the farmland on the plateau are sinkholes, which are openings into the underlying limestone or dolostone. They form when slightly acidic surface water trickles through fractures, enlarging them through dissolution to form cavities. Eventually the soil and sediment overlying the cavity collapses, creating a sinkhole. The limestone beneath the plateau surface is a veritable underground labyrinth, through which water travels. When the water reaches rocks that it cannot travel through, it flows horizontally until it reaches the land surface, where it emerges as a spring or seep, such as at Fountain Springs northwest of the trailhead near Fountain. At Big Springs Creek, which is not far from the trail between Whalen and Peterson, you can see a typical spring. Here, water is flowing from the upper part of the Franconia Formation.

Not far from Fountain the trail descends down the relatively steep slope that separates the upper plateau (developed on Galena Group rocks) from the lower plateau. The lower plateau is essentially parallel to bedding in the older (deposited earlier during the Ordovician) Prairie du Chien Group sandstone and dolostone (Figure 2). The Galena Group is separated from the Prairie du Chien Group by the Decorah Shale, Platteville

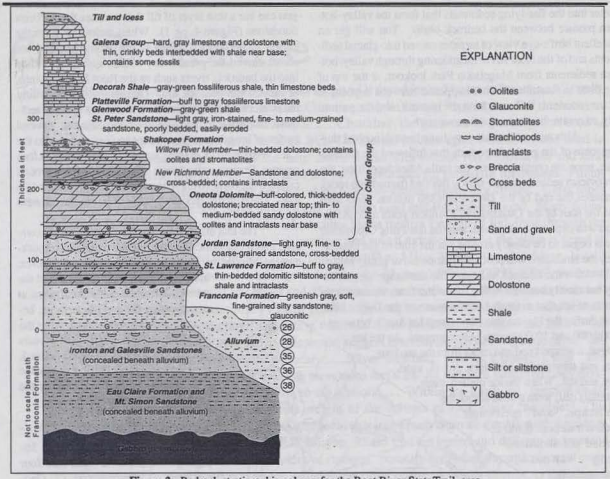

Figure 2: Bedrock stratigraphic column for the Root River State Trail area.

Formation, Glenwood Formation and St. Peter Sandstone. The Platteville and Glenwood Formations are well exposed in trailside and roadside outcrops. The St. Peter Sandstone is superbly exposed where the trail crosses a gravel township road; here you can see and feel what an uncemented quartzose sandstone is like. Just to the east of Isinours (where there are toilets and a parking lot) there are excellent outcrops of the Willow River and New Richmond Members of the Shakopee Formation on the west side of county road 17. In the New Richmond Member you will see excellent cross-bedding, which here is the result of deposition by wind as sand dunes, during a period of low sea level. The dome-like structures in the Willow River Member are stromatolites (Figure 3). Stromatolites are mounds that were built up by single-celled organisms called cyanobacteria, which formed sticky mats that trapped carbonate mud as tides moved in and out. Cyanobacteria are one of the most primitive groups of organisms in the world, and have a record that extends back more than 3 billion years. Almost a mile farther north up County Road 17 the Glenwood and Platteville Formations are well exposed, and you may want to search for fossils such as brachiopods, gastropods, crinoids and bryozoans in the Platteville Formation. Several miles west of Lanesboro, Oneota Dolomite starts to crop out at trail level (west of there it just forms bluffs high on the valley sides). Oneota Dolomite was quarried locally, and was used to construct many early buildings.

The trail joins the valley of Watson Creek just west of Isinours. The meandering creek has cut down at least a

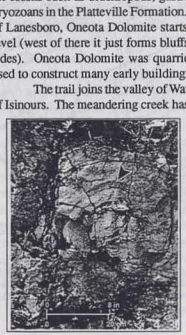

Figure 3. Stromatolite in the Willow River Member of the Shakopee Formation. The arrow points to one of the layers that defines the dome-like shape of the stromatolite.

meter into the flat-lying sediments that form the valley-bottom pasture between the bedrock bluffs. You will get an excellent bird's-eye view of terraces carved into glacial sediments and of the Root River meandering through valley-bottom sediments from Magelsson Park lookout, at the top of the bluff in Rushford. What happened between deposition of the sediments that now form the bedrock, and the present day, to create the landscape that we see?

Although sediments may have been deposited during some of the geologic periods that followed the Ordovician, none are preserved near the trail. After deposition, the Ordovician sediments were slowly lithified (turned into rock). Between the end of the Devonian (360 million years ago) and the start of the Quaternary (2 million years ago) the region was exposed as dry land, and the flat-lying Ordovician rocks began to be slowly eroded. At the start of the Quaternary the landscape was probably composed of gently rolling hills with wide bedrock valleys. The landscape we see today has mostly been carved by meltwater from the enormous sheets of ice that extended across much of the Upper Midwest during the Pleistocene (the "Great Ice Age"), between 2,000,000 and 10,000 years before present. As the ice moved, it scraped soil and rocks from the land surface and transported boulders, gravel, sand, clay, and silt. When the ice melted, these materials (till) were spread across the landscape, and meltwater streams transported and deposited the sediment along various drainageways. On the trail you can see a thin layer of till that overlies the St. Peter Sandstone (Figure 4, pg 1). When meltwater from the earlier (2,000,000-500,000 years before present) ice sheets carved the present-day Mississippi River valley into the bedrock, rivers such as the Root River cut into, or incised the bedrock too. Ultimately, the dwindling meltwater streams dropped their enormous loads of sediment, filling the valley bottoms with sediment. Several cycles of ice advance and retreat took place prior to the Late Wisconsinan glacial stage, 25,000 years before present. During each of these episodes meltwater eroded existing deposits, to leave terraces, and then dumped its load. Through this process a series of terrace levels were created.

The last major Late Wisconsinan ice sheet covered much of Minnesota, but did not extend into southeastern Minnesota or southern Wisconsin. However, meltwater from this ice sheet had the greatest influence on the configuration of the valley fill and the terraces, because it was the most recent. After the ice sheet melted about 10,000 years ago and Glacial Lake Agassiz drained, streams again started to cut down; the final chapter in the production of the landscape that we see today.

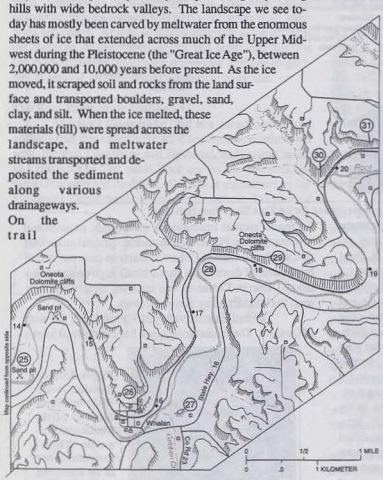

Figure 5: Example of part of the trail map that accompanies the guidebook (reduced to 70 percent of the original). The circled numbers refer to sites of geologic interest, and are keyed in to site descriptions in the guidebook. Other numbers are mile-markers. The topography (bluffs, gentle slopes, or terrace edges) are shown with symbolized hachures.

About The Guidebook

The copiously illustrated 56-page guidebook is divided into four sections: (1) Background, (2) Geologic history, (3) Trail guide, and (4) Further information. The background section introduces general geologic principles and the geology of Minnesota. The geologic history section summarizes the geologic history of southeastern Minnesota. In the trail guide section, features of geologic interest on or near the Root River State Trail are described and explained on a site-by-site basis. The site numbers are keyed to the fold-out color map of the Root River State Trail in the pocket at the back of the booklet (Figure 5). The booklet also includes a glossary of geologic terms and suggestions for further reading. A preview of the

Root River Guide *continued page 8.*

Conglomerate

The deepest part of the **ocean** is 38,518 feet deep and is found in the Marianas Trench.....**Granite** from Minnesota's Redwood and Renville Counties, may be seen in Washington, DC, in the fountains on the Ellipse at Constitution Avenue.....**Cinnabar**, the main ore of mercury, was used as the pigment vermilion as early as 1500 BC. During the middle ages, vermilion was used in illuminated manuscripts to color the large initial letters with intense red.....Beaches and sand dunes composed primarily of quartz sand are good candidates for **fulgurite formation**. Fulgurites are natural glasses that can be created by cloud-to-ground lightening strikes. Glass tubes form as the lightning bolt burns through and melts the sand and soil underground. Many fulgurites are tubular structures that take on branching forms tracing the path of lightning through the soil. Tubular fulgurites display glassy interiors and rough exteriors where the glass is fused to sand grains. Fossilized lightning???.....The **White Pine Mine**, White Pine, Michigan, has 13 square miles of underground workings and during its 42-year life span (1953-1995) produced more than 4 billion pounds of copper and 45 million ounces of silver.....**Hot spots** are volcanically active sites above stationary mantle plumes. Seismic tomography of deep mantle beneath Hawaii has revealed structures suggesting that rock flows horizontally toward the base of the mantle plume, then rises vertically. This would suggest that mantle plumes originate at the base of the mantle, at the core-mantle boundary.....**Silver** was once used as a drawing tool. The metal was made into a stylus for drawing on various surfaces. As the lines tarnished, they darkened over time, giving more definition to the artwork..... Within the Earth, an object is under pressure from all directions due to the weight of the column of rock above the object. This pressure is often called confining pressure, because it is the push from all directions that tends to confine material to the smallest possible volume. Rocks that are buried and undergo an increase in confining pressure go through a variety of changes: porosity decreases through physical compaction and recrystallization, and the actual mineralogy of the rock may change so that denser minerals replace those that are less dense. The recrystallization that often takes place as rocks are buried, is called **metamorphism**.....The arch-shaped middle Proterozoic **Midcontinent Rift System** which stretches for more than 1200 miles in the Great Lakes region, is one of the world's greatest continental rifts. Over a period of geologic time from 1,109 to 1,060 Ma (million years ago) the rift valley was filled with thick sequences of rift-related basalts and clastic sedimentary rocks. Regional contraction of the rift about 1,060 Ma resulted in folding, fracturing, and faulting that uplifted the rocks on the edge of the rift and formed the Lake Superior Basin..... Most known **diamond deposits** are associated with old, continental shield areas, e.g., Africa, South America, Siberia, and Canada. The source rocks, however, are not themselves that old. Ages of kimberlites range from about 1.6 billion years before present, to a mere 50 million years. The unique thing about kimberlite magmas is evidenced by rock and mineral chemistry which suggests that kimberlite magmas originate more than 300 km below the surface, deep in the mantle. They rapidly ascend through fractures in continental crust, and punch their way upward in an explosive eruption. No one has witnessed an eruption of kimberlite and the erupted material is fragmented so that the actual volcanoes are not preserved for long. Kimberlite "pipes" are often exposed on the surface only as flat surfaces or depressions. The diamond crystals are formed at depth in the mantle, and as the magma ascends, many crystals don't have time to revert to their stable form at Earth's surface (graphite). Even so, diamonds are quite rare in their source rock, normally less than 100 parts per billion.....

FREE POSTER

American Geological Institute (AGI) has produced a poster to illustrate the Earth as the source of mineral resources. The poster creates a visual time line progressing through the Stone Age, Bronze Age, Iron Age, and Industrial Revolution into our modern stone age. The reverse side of the 17" x 22" poster contains two educational activities with clues for identifying rock and mineral resources by their properties and uses. The poster also provides information on the uses of the 12 rock and mineral resources for which the United States depends entirely on imports as well as a list of rock and mineral resources that the United States exports. Single copies of the poster are available upon request from the American Geological Institute.

To receive a free copy of the poster, or for bulk order pricing, contact Chris Houston at the American Geological Institute, 4220 King Street, Alexandria, VA 22302, Tel. (703) 379-2480, ext. 220, E-mail: ch@agiweb.org.

Root River Guide *continued*

booklet is accessible on the Minnesota Geological Survey website at: http://www.geo.umn.mgs/rrst_web/cvrpage.html. The booklet is 5.5" by 8.5", and fits into a bike bag or the outside pocket of a backpack. The booklet is designed for families, bicyclists, cross-country skiers, people interested in our natural environment, as well as K-12 educators and students.

What spurred MGS on to publish this booklet? The author, John Mossler, worked in southeast Minnesota during preparation of the geologic atlases for Fillmore and Mower counties, and realized the potential for a publication of this type. He combined specific information with general knowledge to prepare the map and text. The Minnesota Geological Survey plans to produce more guidebooks that follow this general format in the future, and would like to know what you think about this guidebook.

It costs $7.50, and is available from: Publication Sales, Minnesota Geological Survey, 2642 University Avenue West, St. Paul, MN 55114
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First Class

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