GEOLOGICAL SOCIETY OF MINNESOTA

NEWS

SPRING 1993
VOLUME XLVII, NO. 2

CONTENTS

Meeting Bogs Down at Annual Banquet

On April 25, 1993, GSM members converged on the Old Country Buffet, Maplewood for the Annual Mary Kimball Memorial Banquet and Address. After dinner, Paul Glaser, limnologist at the U of M School of Earth Science, took members on a dry run swamp stomp through the Hudson Bay lowlands. This vast wetland along with other similar areas around the world is a major carbon sink and component of the water cycle.

The underlying topography of Hudson Bay was sculpted by the glaciers into peaks and valleys which never dried out. As the ice receded, it formed glacial Lake Agassiz to the west with the last glacial remnants finally melting out at Hudson Bay. The resulting lowlands remained as wetlands (now filled with peat) which differentiated into the kinds of habitats which attract hydrogeologists ... and mosquitoes.

Dr. Glaser discussed the relationship between acidity and vegetation and gave fascinating overviews (using satellite images and aerial photography) of the flow patterns of rivers fed from underground water sources. The impact of all this water, of course, is to dilute the acidification due to plant metabolism especially the floating plant, sphagnum (bog moss).

The impact of all this information was GSM member's undiluted attention. Getting "bogged down" can be a good time (in the right company). Dr. Glaser was very good company.

First Mini Driving Tour Available

The North Metro Mini Tour, "Fire and Ice", is finally printed. This first in a series of **three** driving tours, being prepared by the Geological Society in consultation with the Minnesota Geological Survey, lead you to discover the origins of rocks and landscapes observable in the Twin Cities area. Each tour covers a different area.

- continued next page -

Much time and effort went into the planning and preparation of these tours. The Society thanks all the members who worked so hard for so long to bring this project to completion.

Special thanks to Jan Mitchell for finishing the marathon road to publications. A copy of the tour can be obtained by calling Jan at 224-3242.

1993/94 Program Showcases Natural "Gems"

The 1993 - 94 lecture program will feature national parks. We start appropriately enough in Voyageurs N.P. The next stop is Acadia (Maine), then on to Great Smoky Mountains (Tennessee/North Carolina), Olympic (Washington), Arches & Canyonlands (Utah), Banff & Jasper (Alberta/British Columbia), Badlands/Black Hills (South Dakota), Mammoth Cave (Kentucky), Carlsbad Caverns (New Mexico)/Guadalupe Mountains (Texas), Big Bend (Texas) Death Valley (California) and Point Reyes National Seashore (California).

In between parks, there will be three laboratory sessions: igneous rocks and minerals, sedimentary rocks and minerals and reading topographic maps. As always, Dick Uthe has done a smash up job of picking topics and speakers. Whether you're planning to visit a park or you've been there and would like to brush up on the geology, this series is for you. Many speakers will be new to GSM. The series ends with a spring banquet talk on closing the "rift" between art and science through the study of geology by Dr. Dan Varner.

The series starts October 4, 1993 and continues approximately every other Monday evening through April 4, 1994. The Annual Banquet is the last Monday in April (the 25th). Join us for "Jewels of the Landscape -- Geologic Tours of our National Parks." The Program 93/94 schedule will be published about mid-summer or by State Fair time at the latest. Block out your calendars!

Summer of '93 Field Trips Planned

The Field Trip Committee has met, planned the trips and recruited leaders and the Summer Trips are all set. Here's a rundown:

June 19-20 (Two-day): Alexandria Moraine Complex, Leader: Prof. Jim Cotter, U of M - Morris, MN.

July 17 (One-day): Hastings Fault, Leader: Prof. Mike Middleton, U of W - Riverfalls, WI.

August 21-22 (Two-day): Structural Geology, NW Wisconsin, Leader: Prof. Gene LaBerge, U of W - Oshkosh, WI.

September 18 (One-day): Thomson Formation, Leader: G. B. Morey, Minnesota Geological Survey.

A mailing with complete information will precede each trip. (Note the enclosed flyer for information on the June trip.) Looking forward to seeing you!

The 1993 Field Trip Committee

Audit Done

An audit of The Geological Society of Minnesota books is done! Thanks to Jan Mitchell for her hard work. The audit report was overdue but as expected all is well with the books and the Society.

GSM switched from hand ledgers to spreadsheets in the late '80s. As with most such transitions, you could say it was a rocky start, but under the determined efforts of Warren Mitchell and Dwight Robinson, the computer got "tamed."

Now as Treasurer, Ed Huppler continues to tweak and refine the system, our records get better and better! See "techno wizard" Ed for the latest in almost anything computer-related.

Peat: Partly decomposed (carbonized) remains of vegetable matter (usually mosses) in bogs at the earth's surface used as fertilizer and/or fuel.

GEOLOGICAL SOCIETY OF MINNESOTA
1993 FIELD TRIP NUMBER ONE
ALEXANDRIA MORAINE

Type: Two-Day Trip
Date(s): Saturday & Sunday, June 19 & 20
Leader(s): **Jim Cotter**
Dept. of Geology, U of M, Morris

HIGHLIGHTS

This two-day field trip is entitled "Alexandria Moraine Complex: A Complex Moraine."

WHEN & HOW

Drive to Willmar Saturday morning, June 19, 1993. We will meet at 9:30 a.m. in the parking lot of the Hillcrest Restaurant, 12 miles north of Willmar on Hwy 71 - Right side of road. This location is about 2 - 2 1/2 hours from the Cities. From there we will travel north/northwest (stopping along the way) until we reach **Glacial Lakes State Park**. Dinner Saturday night will be at **Torgy's** Restaurant which overlooks Lake Minnewaska and is family style home cooking.

ACCOMMODATIONS **LODGING SUGGESTIONS BELOW ARE FOR SATURDAY NIGHT NEAR GLACIAL LAKES PARK. NO LODGING FRIDAY NIGHT IN WILLMAR UNLESS YOU CHOOSE TO DO SO ON YOUR OWN!**

(Add sales tax to prices)

Motels:

Scottwood Motel, Glenwood, 1-634-5105
Single 1 pers. $33.90, 2 pers. $38.90; Double (2 beds) $44.90

Hi-view Motel, Glenwood, 1-634-4541
Single $24.00, Couple $32.00

Cedar Inn Motel, Starbuck, 1-239-4300
2 pers. rooms $39.00, Suite w/ queen bed & sitting room $45.00

Campgrounds:

Glacial Lake State Park, 1-800-765-2267 ($5.50 fee for reservation).
Park Permit $4.00 per day (or $18.00 per year/$12.00 seniors.).
Campsite $10.00, with electricity $12.50. **(Ask for a site in the Upper Area)**

COST

Expenses of the field trip leader and mailing are paid for by the participating members of each field trip. Each adult shares expenses equally. Non-member guests pay an additional $5 fee.

OTHER

- Come prepared for any type of weather or terrain.
- We will be eating lunch in the field. Bring your own.
- Each field trip participant will be required to sign a waiver of liability on Saturday morning, prior to the start of the field trip.

TRIP COORDINATORS Eva & Dick Selander/Dee Schmaltz

PLEASE CALL If you are planning to participate in the 1993 Field Trip Number One, please call **Dee Schmaltz at 938-7875** and leave a message with your name. Include the number in your party so we will have field trip materials for all. Thanks!

BRING A CAMERA - TAKE SLIDES - FOR A FUTURE GSM SHOWING
(You need not be a professional photographer - do it for fun!)

Grappling With Graptolites

By Dwight Robinson

One "living fossil" that won't be appearing in Jurassic Park was recently dredged up out of the deep waters off New Caledonia. It's not that it wouldn't make a dandy "monster." The problem is size. It's measured in millimeters and very likely a graptolite or something closely related.

Graptolites (Greek: "grapto"/write; lithos/stone) are (were?) an extinct group of colonial organisms scattered prolifically throughout shale deposits of Ordovician and Silurian age. Their remains which resemble thin, black pencil lines in shale on closer inspection look more like tiny saw blades. However these "blades" squashed flat in shale bedding planes turn out to be stacked, cup-like sacks (or in Latin - thecae) when seen in 3 dimensions. They are made of **chitin**. (See Figure 3)

Most likely a tiny, filter feeding organism occupied each theca (Latin singular). The thecae were stacked up atop one another along a central stalk or stipe and the stipes in each colony were connected to a central point (the first theca from which the colony began) and this was often crowned with a spine or "nema." The biology of graptolites was a mystery especially the formation of the nema. Whatever the biology, graptolites evolved rapidly and were world-wide in distribution making them ideal **index** or **zone fossils**. (See Figure 5, Page 7)

Enter the little beast from the waters off New Caledonia. It was easily recognizable as a "Pterobranch." Pterobranchs (ptero/wing; branch/gill), like graptolites, are tiny colonial organisms which secrete tubular sheaths made of chitin. They branch off from a central stalk and collect food by means of feathery feeding arms. (See Figures 1, 2, 4)

A connection between pterobranchs and graptolites has long been suspected. Similarity of structures suggested that graptolites, like pterobranchs, secreted their theca.

The problem was the nema. (Figure 3) How in the world could a little filter feeding animal connected to the main colony by a stalk and trapped in a theca often with a constricted opening (especially in later graptolites) have crawled out of its theca and traveled many times its own length all the way out to the end of the nema to secrete more material? It so happens the little pterobranch off New Caledonia sports a long spine (akin to a nema) up to 35 millimeters long whereas the animal itself is only about 1.5 millimeters in length.

The tubular opening is similarly constricted yet the little animal, or zooid, squeezes out the opening, crawls up to 30 times its own length to the tip of the spine where it secretes an increment and then returns to its "cell." Noel Dilly, the discoverer of the spiny pterobranch, concluded that his find was indeed a living graptolite. Or are graptolites extinct pterobranchs? Pterobranchs appear more primitive but there isn't much doubt that these two groups are closely related and in the evolutionary sweepstakes, "specialists" tend to come and go whereas "primitive" forms often linger on.

Why the nema? This "modern" pterobranch uses it to elevate its feeding arms above the slow moving boundary layer of water close to the shells on which it lives. **Benthic** graptolites may have used it like an anchor. However, most of the best index fossil species must have been free floating in open ocean surface waters. Some graptolites seem to have been attached at the nema to a float. In others, the nema was extended into a vane and some may have used the nema to hitch rides on floating seaweed.

- continued page 4 -

Chitin: A polysaccharide (multiple chemically linked sugar molecules) chemically bonded with protein to form the hard, resilient outer covering of such organisms as insects, crustaceans, pterobranchs.

The fossil remains of graptolites provide powerful evidence for a floating lifestyle. The most likely way for fossils to become as widely disbursed as graptolites is to live as a passive floater in the open seas. Further evidence comes from their deposition in shales. When an organism dies in the open waters well off shore, it sinks to great depths where sediments are fine (muds), turbulence is low and oxygen is deficient. Anaerobic (metabolism without oxygen) bacteria digested the soft bodies but left the chitin intact.

Tech Notes: Pterobranchs like *Rhabdopleura* (Figures 1, 2) do not have the geometric regularity of graptolites. Their common tubular exterior is called a coenecium. The graptolitic pterobranch discovered by Dilly belongs to a different genus: *Cephalodiscus* species: *graptolitoides*. It is similar in body shape to *Rhabdopleura*. However, *Cephalodiscus* species typically have 5 feeding arms instead of the 2 *Rhabdopleura* uses to funnel microscopic food particles into a mouth opening similar to *Rhabdopleura's*. (Figure 4)

Cephalodiscus zooids have been observed creeping out of their colonial skeleton onto adjacent objects hinting at the flexibility of the stalk anchoring them to the main colony. Dilly's species is the real athlete with its long distance spine creep. We can only imagine the graptolitic "Olympians" of ages past when being a "big creep" would have been high praise!

The information on graptolites was gleaned from a variety of sources. For more detail on pterobranchs, once considered a distant "relative" on the **chordate** line, see "Living Invertebrates" by Pearse et al, Boxwood Scientific Publications, 1987.

Figures 1, 2, 4 reproduced from "Living Invertebrates" by permission of the Boxwood Press. Special thanks to Dr. Ralph Buchsbaum, expert emeritus on the fascinating world of invertebrates.

Thanks to Alex Lowe for the tip-off on the Nature article, "Graptolites come to life." See Nature, March 18, 1993, page 209 for the whole story.

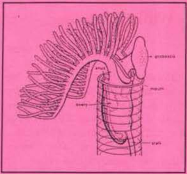

Figure 1

Rhabdopleura, with 2 tentaculate arms. Cilia on the tentacles and ciliated tracts down the center of each arm direct food particles to the mouth. The proboscis serves as a creeping foot and secretory organ secreting the chitin in consecutive rings which stack on top of one another to form the colonial tubes.

Colony of pterobranchs, *Rhabdopleura*. The animals are sensitive to any disturbance; muscles in the stalk pull the body quickly into the safety of the tube. When undisturbed, the animals creep back up the tubes to perch on the rims to feed. In *Rhabdopleura*, the colony members are budded from a stolon.

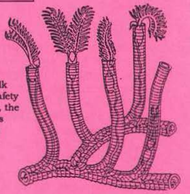

Figure 2

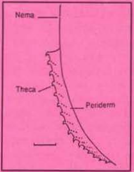

Figure 3

Graptolite showing main morphological features. Graptolites appeared in two major forms, the dendroid or benthic form (see bottom left of Figure 5, page 7) and graptoloid or pelagic forms (see Lower Ordovician to Devonian, Figure 5, page 7). The greater regularity of form in the graptoloid forms was probably due to the rigors of pelagic life and the constant threat of rough water. Pterobranch colonies are sedentary bottom dwellers. Graptolites have been considered extinct since Devonian times. **Scale bar in drawing = 2 mm**

Cephalodiscus (species) in feeding position attached to its spine by the proboscis. As cilia drive water past the arms, particles caught by individual tentacles are flicked into a central groove of the arm and moved by cilia down into the mouth. Graptolites may have looked very similar as they perched on the rim of their theca.

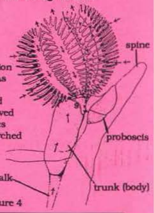

Figure 4

Chordate: Animal with a backbone or a precursor to a backbone (notochord).

Curating Your Rocks, Minerals And Fossils

By Alan M. Cvancara
(Earth Magazine July, 1992)

This is the first of a two-part series. The second part will be published in the August News. The article is reprinted by permission of the publisher. Copyright 1992 by Kalmbach Publishing Co.

If you have squirreled away rock, mineral or fossil specimens in boxes, cans bags, and buckets, you are a prime candidate for a fascinating hobby. Minerals, rocks, and fossils are the tangible stuff of which Earth is made. Organizing your collection will help you appreciate how our planet formed and how it has changed. If geology isn't your focus, you can still admire your Earth bits for their sheer beauty. Read on and follow this simple guide to ordering and displaying your treasurers so you can enjoy them now and ensure their value to the next owner.

Preparing. To prepare most specimens for later use, first wash them thoroughly with detergent and water. Use an old toothbrush to remove dirt and cobwebs from nooks and crannies; sometimes a pre-soak or immersion in boiling water before scrubbing may help. Avoid washing fragile specimens; cracked pieces often crumble in water. Do not wash water-soluble minerals such as halite. Test pieces you're willing to sacrifice if you're unsure of their solubility.

You can remove unwanted rock material several ways. **CAUTION:** *Wear goggles to protect your eyes from flying rock shrapnel.* Nibble away thin or slabby sections with pliers or cut with an old hacksaw. Break away thicker unwanted rock with a hammer and chisel. When the specimen is not at risk, you might work faster with silicon carbide cutoff disks or grinding wheels and brass brushes mounted in power drills. (You can find these in hobby shops.) For detailed work, especially with fossils, use discarded dental tools or crochet hooks (hooks removed) shaped and sharpened into points and chisel edges. Their small working areas give you good control to scrape, flake, and chip. Needles mounted in wooden handles also work well, particularly for the softer shales and mudstones. You can speed up finer work with a vibrating-point engraving tool. (Dental drills are upgrades for the more serious collector!) Fine work is easier if you hold the specimen down and cushion it against a sandbag.

You may need to saturate fragile fossils with hardener as you remove surrounding rock. Brush on white glue thinned with water, nail polish thinned with acetone, or shellac thinned with alcohol. Start with a half-and-half solution and experiment. Generally, the smaller the pores in the rock, the thinner the solution needed for penetration.

Removing a mineral or fossil specimen from a large matrix requires a different strategy. First, study the block or slab for natural fractures that might separate the rock around the specimen; tap lightly into them with a chisel and hammer. If this doesn't work, carefully cut a deep channel around the specimen with the hammer and chisel until the specimen sits on a pedestal. Then break off the pedestal. You can cut away the specimen quickly and

Benthic: Bottom dwelling plants and animals in water bodies as opposed to pelagic, i.e., living in the open waters near the surface.

cleanly using a saw with a diamond blade; this generally works best with thinner rock slabs.

For minerals or fossils in limestone or other limy rocks, leaching with acid may be the answer. Many rockhounds use hydrochloric and acetic acids. Hydrochloric acid, commercially known as muriatic acid, is the stronger. Acetic acid is used as a stopbath in photographic processing and is also present, in weakened form, in vinegar. **CAUTION:** *Wear goggles and gloves. Use nonmetallic containers. Always add acid to water, never water to acid.*

Make dilute solutions of one part acid to five to ten parts water. Test expendable specimens to determine the type and strength of acid needed.

The acid-leaching method works, of course, only if the desired mineral or fossil specimen does not dissolve. This means that the desired specimen cannot be limy. (Calcite is a limy mineral that makes up many fossils.) Acids work best for freeing fossils when the original limy fossils have been replaced with silica. (Siliceous fossils easily scratch a penny and cannot be scratched by a pocket-knife blade.) In some sandstones and shales lithified by a limy mineral cement, you can free limy minerals or fossils by dabbing weak acid near the specimens and carefully removing the mush rock with tools mentioned above.

Identifying Specimens. You clean minerals, rocks, and fossils not only to improve their looks but also to more easily see features that aid in their identification. First try to match specimens to illustrations in books. (Several useful references will be listed at the end of Part II). But usually you must go further: read descriptions and, in the case of minerals and rocks, perhaps try various tests. As you work with your collection, you will become familiar with the technical jargon -- not only the rock, mineral, and fossil names but also the properties of minerals and rocks and the parts of fossils.

You may identify specimens in other ways. Join a club and get help from other collectors and from collections larger than your own. University, museum, and geological survey staff can provide you with loads of help, but their willingness will diminish if you overpower them with too many specimens too often. Offer to repay them with some specimens they deem valuable.

Sorting. What exactly differentiates minerals, rocks, and fossils? Minerals are naturally formed, in organic, solid substances with a characteristic crystal form and a definite chemical composition. Quartz, diamond, gold mica, and calcite are examples. Minerals are the ingredients of rocks.

Rocks may be igneous, sedimentary, or metamorphic. Igneous rocks form when molten material lithifies (becomes rock) as it cools. They may be intrusive (they cooled deep underground) or extrusive (they cooled on the surface). Common examples are granite and basalt. Coarse grained granite forms by slow underground cooling of a mixture of quartz, feldspar, and mica. Fine-grained basalt forms by rapid surface cooling of a mixture of pyroxene and plagioclase.

Sedimentary rocks lithified as a result of pressure. Subdivision are based on the source of the sediment. Clastic sedimentary rocks consist of cemented and compacted mineral or rock fragments, usually eroded materials. Chemical sedimentary rocks come from minerals once dissolved in water; either the minerals precipitated or the water evaporated.

Lithification: The processes by which unconsolidated sediments become consolidated into rocks.

Organic sedimentary rocks originated in living things. Examples of sedimentary rocks include sandstone, rock salt, and coal.

Metamorphic rocks result when rocks -- igneous, sedimentary, or other metamorphic rocks -- are altered by heat, pressure, hot gasses or fluids, or any combination thereof. They are foliated (layered) or non-foliated. Common metamorphic rocks are slate (once shale) and marble (once limestone).

Fossils are any evidences, direct or indirect, of life forms that existed in the geologic past. Rocks, most commonly sedimentary rocks, harbor many fossils such as leaf outlines,molds and casts of shells or skeletons, petrified bones and wood, and imprints of animal tracks. Non-rock fossils include insects encased in amber and animal remains preserved in tar, permafrost, or bogs.

As your collection grows, you must decide how you wish to organize it. Sorting according to the information above makes the job easy. Collectors most frequently organize minerals by their chemical composition (silicates, sulfides, carbonates), rocks by formation groups (intrusive and extrusive igneous rocks), and fossils by life groups (brachiopods, trilobites, ferns).

Article illustrations by Bill Melton

To Be Continued --

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EVOLUTION OF GRAPTOLITES

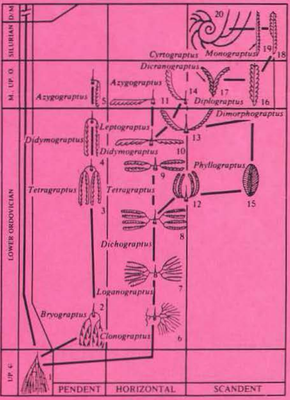

Figure 5

From William H. Easton, *Invertebrate Paleontology et. al.* In "Historical Geology. The Science of a Dynamic Earth." 3rd Edition, Mintz, L. M. 1981.

Zone (Index) Fossil: A fossil species that is selected as characteristic of those found in a particular stratum. The stratum is named after the fossil.

Calendar

June 17/19, August 12/14: "Minnesota Geology", Open U, Rick Krigbaum, $20, Call (612)379-3846 to register.

NEWS FLASH: Calling all Friends of the Chalets. The public comment (scoping) period has begun on the environmental assessment document the National Park Service is doing on the Glacier Park chalets. **Comments matter:** the deadline is May 28, 1993. For info/comment sheet, contact Dwight Robinson at 227-3394.

Notes

Need a magnifier? Call VWR Scientific for information on kinds and prices. 1-800-932-5000.

Plan for a Book Exchange: Is it an idea whose time has come? For members who ponder or glance askance or trip over burgeoning book collections, member Thom Jordan, has an idea. He proposes a time out for book exchange. Members might share lists of holdings with other members. Perhaps we could have book exchanges at lectures or whatever. Call Thom at 699-4718 with your ideas. Remember, however, all books must be claimed at the end of the exchange. No dumping allowed.

Look for more exciting new features in upcoming issues of your newsletter.

The purpose of this newsletter is to inform members and friends of the activities of the Geological Society of Minnesota. NEWS is published four times a year - Feb. 15, May 15, Aug. 15, Nov. 15. Deadline for article submission is the 1st day of the month of publication.

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This season's color: **Pulsar Pink**