



THE MAINE GEOLOGIST

THE NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

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President's Message

by Carolyn Lepage

Once again, we had an excellent spring meeting at Bates College. I would like to thank Dyke Eusden for organizing the event. I would also like to congratulate the students on their fine presentations. I was impressed by the variety and caliber of their research and feel they will be a credit to our profession. Abstracts of their talks are included in this newsletter.

At the spring meeting, Bill Fisher of the Consulting Engineers of Maine (CEM) organization asked the Society to consider becoming involved in the DEP Task Force CEM had helped to form. The purpose of the Task Force is to improve communications between consulting engineers and scientists and Maine Department of Environmental Protection staff. However, the Society members felt they needed more information concerning the agenda and goals of the Task Force before voting on the Society's participation. They therefore voted that I should attend upcoming Task Force meetings and report back to the members. My summary of the meetings I've attended so far is also included in this newsletter. Please take a moment to read it. If you have any questions or comments, just give me a call at 865-6138. We will vote on the Society's participation in the Task Force at the summer meeting.

Another item we discussed at the spring meeting was the development of study materials and/or review sessions suitable for both geologists studying for the state certification exam, and practicing professionals wishing to keep up with developments in various geologic fields. Given the enthusiastic support Marc Loiselle's proposal received, I am dismayed that only three people have volunteered so far to compile outlines and bibliographies in their specialties. This is an endeavor we can all benefit from. I encourage you to contact Marc at the Maine Geological Survey, 289-2801, to offer your services.

Bob Johnston is again organizing the Society's annual summer field trip. Steve Pollock and Dee Caldwell will be leading trips in the Mount Katahdin area on the last weekend of July. Bob tells me he's made arrangements for a group campsite (capacity 50) at Baxter State Park. Look for details in this newsletter.

Peter Garrett has suggested the Society sponsor a symposium on nitrates in groundwater and other problems related to septic systems. We are investigating the possibility of holding this event in the fall in Augusta. I will provide an update at our summer meeting.

Finally, Joe Kelley has suggested that the fall meeting be held at the University of Maine at Orono. This would provide an opportunity for many of us to catch up on what's going on at the Orono campus. We should have a date and location nailed down by our next meeting.

I hope to see you on the field trip!

GEOLOGICAL SOCIETY OF MAINE
ANNUAL SUMMER FIELDTRIP

July 28 and 29, 1990

BAXTER STATE PARK AREA

Dee Caldwell, Boston University
**Geomorphology and sedimentology of northern
Baxter State Park**
Saturday, July 28

Meeting place: Hay Lake Maine Forest Service Offices
(approx. 10 miles west of Shin Pond, on the road to
the north entrance of Baxter Park)

Part of the trip will include walking in and along a
streambed—old sneakers are recommended

8:30 AM

Steve Pollock, University of Southern Maine
**Bedrock Geology of the Early-Devonian
Matagamon Sandstone**

(weather permitting—some stops by canoe—bring your
canoe)

Sunday, July 29

Meeting place: Matagamon Gate (north entrance to
Baxter Park)

8:30 AM

Matagamon Gate Hours: 6 am to 9 pm

A **group campsite** in Baxter State Park is reserved for Friday and Saturday night at **Trout Brook Farm**, just **west of Matagamon Gate** (the north entrance to Baxter Park). A Saturday evening cookout will be provided by GSM, but all other meals are on your own. **Remember that stores and other facilities are a long way from the Park.** No pets, motorcycles, or mineral collecting is allowed in the Park and **please carpool.**

Anyone planning on staying at the group campsite, or wanting other information, should contact Bob Johnston
207-289-2801

Maine Geological Survey
State House Station #22
Augusta, Maine 04333

MAINE MINERAL SYMPOSIUM
HELD IN AUGUSTA

by Woodrow Thompson

On April 21-22, 1990, the Maine Geological Survey and the Harvard University Mineralogical Museum Association co-sponsored the first symposium on Maine minerals. The meeting was very successful, with 200 people in attendance. Saturday's program was held at the University of Maine at Augusta. It featured a series of lectures on mineral deposits, Maine State Museum activities, and the history of the Maine Geological Survey. Highlights included Vandall King's talk on granite pegmatites, and a fine presentation on metal mining by Rudy Rawcliffe.

On Saturday afternoon there was a series of talks by persons who are currently mining for mineral specimens in Maine. Among the panelists were Phillip McCrillis, who is operating the Sweden amethyst mine for Plumbago Mining Corp., and Ronald Holden and Gary Laverdiere, who discussed the rich assemblage of pegmatite minerals being worked at the Bennett Mine in Buckfield. (Both of these localities are presently yielding exciting new finds.)

Van King exhibited an assortment of historically interesting Maine minerals from old collections, and books about the state's mines and minerals were on sale at the meeting. MGS did a brisk business in guidebooks, while C. J. Stevens sold his new book on placer gold in Maine ("The Next Bend in the River"). Despite some possible food poisoning and incredible bungling of room reservations by hotel management, several mineral dealers finally got established at the nearby Comfort Inn, and many symposium participants stopped in to purchase specimens and socialize until late at night.

Field trips were held on Sunday to the Bennett Quarry, and to Mount Mica in Paris. The weather was perfect and participants collected some good minerals from these famous pegmatite deposits. Carl Francis from Harvard and Michael Wise of the National Museum of Natural History were on hand to discuss the localities. The exchange of information between amateurs and professional mineralogists was one of the highlights of the symposium, with mutual benefits to both hobby and science.

I particularly want to thank Mike Foley and Bob Johnston of MGS for their assistance in running this meeting, Louise and Larissa Thompson for working the registration table, and the Maine mineral clubs for publicizing and supporting the symposium.

1990 Henry Darcy Distinguished Lecture

Hydrogeology and Hazardous Waste Disposal

by
Ralph C. Heath
Consulting Hydrogeologist
Raleigh, North Carolina

September 7, 1990
7:00 p.m.

Carnegie Science Building
Bates College

Abstract

In the United States, the generation of wastes that include hazardous components amount to about 246,000,000 tons per year. This waste, when compacted, is sufficient to cover an area of 24 sq. mi. to a depth of 30 feet. Both active and closed waste disposal sites exceed 27,000, of which municipal landfills alone occupy more than 1200 sq. mi.

Federal laws designed to protect ground-water quality and to bring the national waste disposal problem under control have succeeded in generating a long list of new acronyms and spending large sums of money to accomplish very little. One product of the Nation's efforts to avoid problems caused by the disposal of wastes is, the "engineered hazardous waste disposal site". These sites rely on multiple liners, leachate-collection systems, and monitoring wells, rather than on hydrogeology, to protect groundwater. The cost of these sites is prohibitive and their designers have failed to convince the public of their long term effectiveness.

The alternative to engineered sites is to locate waste disposal sites at those places where hydrogeologic conditions are favorable and to rely on man-made creations only where the hydrogeologic conditions are less than ideal. Ideally, hazardous waste disposal sites should be located in or near groundwater discharge areas and be underlain by unsaturated silty clays. Upon closure, waste cells should be covered by thick impermeable caps that are maintained as long as there is a potential for generation of hazardous effluent. Instead of relying on monitoring wells to detect effluent, reliance should be placed on samples collected under baseflow conditions from nearby streams to which groundwater discharges.

THE AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS

On April 5th, William V. Knight, Executive Director of the American Institute of Professional Geologists (AIPG), spoke to a group of geologists in Augusta. The topic of his speech was AIPG membership, and trends and issues in the certification of geologists in the United States.

AIPG, as described in their promotional brochure, is a group of "responsible scientists and citizens organized to contribute to their profession and not just to receive from it." Members strengthen geology as a profession and interact with the public. AIPG is organized into 36 state sections, Maine belongs to the Northeast Section. Membership, split between academia, government and industry, has been declining in recent years as the oil industry has fallen off and is now at about four thousand members.

Certification issues were described, as the Institute's purpose is "to establish professional qualifications, certify those qualifications to the public, and to monitor the ethical conduct of its members." Geologist certification is an important issue to the membership as a number of state legislatures are presently discussing certification procedures. At present only about 15 states, including Maine, require geologists to be certified in their states. Practice in specialty fields requires qualified, certified (?) geologists doing the investigations. The AIPG promotes unified certification/registration standards so a geologist's skills would be marketable throughout the country.

Three levels of membership are available: 1) Certification (degree and minimum of five years of experience), 2) Candidate for Certification (degree and less than five years of experience), and 3) Student (major in geology and minimum of eighteen hours of geology coursework). Anyone interested in joining should write to AIPG, 7828 Vance Drive, Suite 103, Arvada, Colorado 80003 or call (303) 431-0831.

DEP Task Force Update

by Carolyn Lepage

At the March 23rd meeting, the members present voted to postpone a decision on participating in the DEP Task Force initiated by the Consulting Engineers of Maine (CEM). While some members felt the opportunity to facilitate technology transfer between the DEP and consulting professionals fit with the Society's commitment to education, others expressed concern regarding conflict of interest, alignment with an organization composed solely of consultants (CEM), focus limited to a single state agency, and uncertainty of the Task Force agenda and goals. The members instead voted that I should attend upcoming Task Force meetings and provide the members with additional information so that they could make an informed decision at the next meeting. (See your February 1990 newsletter for background information on the Task Force.)

I have attended meetings of the DEP Task Force on April 5, May 10, and May 21, 1990. The next meeting is scheduled for June 28, 1990. Representatives from the DEP include Cheryl Fontaine, Bruce Hunter, and Florence Grosvenor, Senior Geologists with the Land, Oil, and Solid Waste Bureaus respectively; Jane Gilbert, Fred LaVallee, and Harrison Bispham, Engineers with the Air, Oil, and Solid Waste Bureaus; Cynthia Kuhns, Environmental Specialist IV with the Water Bureau, and Art Walsh, DEP's Human Resources Director. Deputy Commissioner Liz Armstrong attended the first meeting for a short while. Attendees from outside organizations included Bill Fisher for CEM, Liz Champeon for Maine Mineral Resource Association, Charlie Nickerson for the Maine Chapter of the American Society of Civil Engineers, and Doug Reilly for the Maine Society of Professional Engineers.

The focus of the first meeting was to develop a common understanding of the issues to be addressed and to determine a course of action for resolving problems. The topics discussed included staff development, training, technology transfer, accountability, and future meeting formats. Participants agreed that both "sides" had technical and procedural information to offer. Liz Armstrong and Art Walsh made it abundantly clear that policy matters were off-limits for Task Force discussion.

A mission statement and objectives were developed at the second meeting. The mission statement is as follows:

"To establish a forum and process to effect productive dialogue between Consulting Professionals in the private and public sectors that will encourage a positive atmosphere in which to resolve technical and other issues of mutual concern in a responsive manner."

The term "consulting professionals" was selected to cover other professions in addition to engineers and geologists. It also represents the role DEP staff plays

in providing technical information and assistance during the decision-making process. The objectives include:

- (1) Assistance with mutual training needs.
- (2) Identification of management techniques to increase productivity, improve retention, and increase job satisfaction for staff.
- (3) Share perspectives on environmental goals.
- (4) Facilitate the use of best technological practices and promote the transfer of information about new technology.

A "wish list" of possible training topics was also developed. A subcommittee was formed to set priorities for training and identify sources of facilitators, as well as formats, to meet the training needs.

Members of the training subcommittee met on May 21, 1990 in Augusta. In addition to the groups already involved in the Task Force, other organizations with something to offer include the university system and private colleges; other state agencies; U.S. EPA, SCS, and USGS; other engineering societies; professional societies for chemists, biologists, land surveyors, soil scientists, etc.; national organizations such as National Water Well Association; and multidisciplinary groups such as the Associated General Contractors of Maine and JETCC (Joint Education and Training Curriculum Committee). Formats for training and technology transfer include symposia, tours, field trips, courses, seminars, field training, and workshops. Top priorities selected from the "wish list" suitable for symposium format include: modeling, QA/QC (quality assurance/quality control), environmental project management, chemical fate and transport, and risk assessment. The idea of an Environmental Professionals Society was also discussed. Implementation of the subcommittee's findings will be addressed at the June 28, 1990 meeting of the entire Task Force.

At each of the meetings, the Geological Society of Maine's Distinguished Lecture Series, regular meeting programs (such as last fall's meeting focus on solid waste issues), and possible nitrates/septic system symposium were cited as examples of low cost/no cost training and technology transfer opportunities available to consulting professionals in both the private and public sector.

We will vote on the Society's participation in the Task Force at the summer field trip meeting. If you will not be able to attend that meeting and have an opinion you would like to share with the other members, please give me a call at 865-6138. I have copies of the minutes of the three meetings I can send to anyone wishing more details.

Secretary's Report

by Bob Johnston

Geological Society of Maine Business Meeting March
23, 1990 Bates College

Meeting convened by GSM President Carolyn Lepage at
4:48 pm

Old Business:

The minutes of the GSM Fall Meeting held at Bowdoin College on 11/17/89 were summarized. The Treasurer's Report was read by Bob Johnston in Mike Foley's absence (see attached report).

Marc Loiselle was introduced to talk about training courses for Maine geologists. Marc is chairperson of the committee formed at Bowdoin (fall meeting) to look into the certification exam/geologist training. The committee members do not want the materials to be used only to help people pass the certification exam, but to "use (the) course to help people be better geologists in Maine." They proposed making up outlines, bibliographies, and short descriptions (two to three pages) on specific specialty topics. Some of the topics that Marc mentioned were hydrogeology, Quaternary geology, marine geology, igneous petrology, and geochemistry. These topics should be prepared by experts in that field who could be asked to lecture or discuss their specialty with the study groups. The GSM members would be encouraged to participate and share their knowledge of Maine geology with the interested parties through the preparation of and review of the materials. The Society could help financially in the preparation and copying of the paperwork but the costs should be recouped by fees and sales. Marc requested a volunteer group of 8-10 interested (preferably certified) geologists form to put together the materials and study sessions. Notices of materials and events will appear in the newsletter.

Discussion followed with Bill Berry saying the GSM is supposed to educate people and the idea of a forum is a good place to share ideas between disciplines. Geologists would be able to look at and keep abreast of what is going on in the geologic community in Maine. Ollie Gates offered that it would be perceived as certification exam preparation. Carol White brought us up to date on past discussions on the topic. The idea grew out of a need for exam preparation. She said it should be an aid for people taking the exam. It should not answer the questions on the exam but be an overall preparation for it. Irwin Novak said it should be a continuing education program for geologists and suggested that it may someday be mandated to have additional training as it is in other professions. It was suggested that honorarium be provided for the speakers at the training sessions.

It was finally agreed that GSM should go ahead and support the idea, with Marc as the lead person. Experts in each field will be sought out and coerced into helping. Draft outlines and a bibliography should be available by the summer meeting. Contact Marc Loiselle at the Maine Geological Survey (289-2801) if you are interested in helping out.

The annual summer fieldtrip was announced. Dee Caldwell and Steve Pollock will lead fieldtrips in the northern part of Baxter State Park on July 28 and 29. Lodging will be at a group campsite at Trout Brook Farm Campsite in Baxter State Park. For further information contact Bob Johnston at 289-2801.

In more old business the GSM hydrogeology bulletin was discussed. Eight or nine abstracts have been submitted to the reviewers (Carol White, Art Hussey, and John Tewhey) and manuscripts are due on June 1, 1990. Drafts should be on diskette. It is hoped that Bulletin 4, as it will be numbered, will be published by the end of the summer. A new cover design and type of binding is being sought.

New Business:

Carolyn began discussion of the Consulting Engineers of Maine (CEM) and a DEP Task Force Committee and the role that the Society should play in that DEP Task Force Committee. Bill Fisher, chairperson of the Consulting Engineers of Maine was introduced to make a pitch for GSM participation in the DEP Environmental Task Force.

Bill described a process in which the GSM can participate in the Task Force formed by the CEM and the DEP. The flow of information from engineers to the DEP is not always smooth so the Task Force will attempt to work out those problems in communications. The focus is "to effect productive dialogue between consulting professionals and the DEP, to create a positive atmosphere to resolve technical issues in a timely manner." Objectives are: to finalize a mission and a plan; establish an agenda; meet the DEP Commissioner; establish contact with the DEP; establish periodic meetings; begin interaction by 12/89 (Bill mentioned they are already behind schedule); and report back to the CEM Task Force.

A implementation plan is to be put into effect from the findings of the Task Force. DEP staff development (training programs) will be addressed, as will salary issues with the DEP professional staff. The need for a constructive forum for communication and technology transfer, between consulting engineers and scientists and DEP staff was described.

The Society's role in the DEP Task Force Committee would be to participate, contribute and share knowledge with the DEP and CEM and to help in the technology transfer.

The floor was open to discussion with GSM members after Bill Fisher's remarks. Ollie Gates questioned whether or not the press and others would consider it collusion between the DEP and engineers? Is it a conflict of interest problem? Bill Fisher replied that the Task Force would try to stay away from specific issues - "there will be no hidden agenda." Ollie asked if technology transfer on landfills would be passed back and forth? Bill replied that the Task Force would be more involved with training processes. Ollie mentioned that the GSM is apolitical - are the Consulting Engineers of Maine? Bill replied that the CEM does lobby and comment on legislation but that Task Force that will meet with the DEP is not too closely associated with the CEM. Jack Rand asked Bill why the problem came up in the first place? Bill said the ability to communicate effectively and the technology transfer with the DEP was not there. He wants to encourage the engineers and scientists and DEP to share information. Jack Rand sometimes has problems with the Maine Department of Human Services. Should all the problems with state government regulators and regulations be looked at by CEM in the same way as with the DEP? Bill's reply to this and other similar questions was that the public meeting process is more important to the CEM Task Force than specific issues. Ollie Gates moved to have Carolyn attend the initial Task Force meetings and report back to the GSM membership. Some GSM members expressed concerns about the Society distancing itself from CEM.

The GSM members are a group made up of educators, interested citizens, and students, not just consulting geologists; but she agreed the Society should participate in the discussion of issues with the Task Force. Walter Anderson seconded Ollie's motion. Bill Fisher said that GSM needs a participant in consulting professional task force with DEP. The Committee will focus on professional/technical issues - education will be important part - it will not be a forum to get frustrations out on the DEP. Walter claimed it could be a forerunner to "an academy of science and engineering" to address technical issues ("get good information on track"). It could represent all organizations to bring credibility and common sense about technical issues. Steve Pinette suggested the idea is to bolster technical knowledge of DEP staff. Bruce Hunter (a DEP member of the Task Force) welcomes the forum. He claims a staff retention problem might be helped and the open discussions would be beneficial. Irwin Novak strongly suggested each individual should be responsible for their own education. Ollie Muff asked why CEM is looking for GSM help? Bill Fisher said he has solicited other professional organizations. Motion was voted on and passed: Carolyn will go to Task Force meetings and report to the membership through the newsletter.

Other New Business:

Carolyn encouraged members to send newsletter contributions to Susan Corderman Weddle. GSM annual dues are now due by August 1, which is the beginning of the Society fiscal year. A symposium on nitrates is in the works - more later. Ralph Heath will speak at Bates in conjunction with NWWA, on September 7th.

Walter Anderson announced that AIPG representative, William Knight, will be in Augusta on April 5th.

Andy Tolman, Maine Geologist's Certification Board Chairperson, needs help correcting certification exams and also needs new exam questions. Contact Andy through R. G. Gerber, Inc. in Freeport.

Adjourn 5:58 to happy hour!

GSM Spring Meeting

Student Abstracts

SEDIMENTARY FRAMEWORK OF THE INNER CONTINENTAL SHELF OFF MT. DESERT ISLAND AND THE PRODUCTION AND ACCUMULATION OF CARBONATE SANDS

BARNHARDT, Walter A., Department of Geological Sciences, University of Maine, Orono, ME, 04469

The extremely irregular bathymetry of nearshore areas south of Mt. Desert Island and in the vicinity of the Cranberry Islands mimics the rugged topography onshore. Approximately 60 km of seismic reflection profiles and 75 km of sidescan sonar were collected and used to examine the stratigraphic framework and surficial sediment distribution of this complex region. The shallow (<36 m) inner continental shelf is characterized by bedrock outcrops of high local relief and extensive areas covered by till. A series of arcuate submarine (moraine?) ridges lies seaward of the bedrock sill at the mouth of Somes Sound. Beaches of modern carbonate sand, anomalous in this high latitude setting, exist in Newport Cove and on Little Cranberry Island, suggesting high carbonate production in the surrounding waters. Well-sorted shelly sands and gravels fill depressions between bedrock pinnacles particularly off the more exposed southeastern shoreline of MDI as well as seaward of Baker, Big Cranberry and Little Cranberry Islands. Large ripples (wavelength = 1.0 - 1.5 m) indicate shore-normal transport of carbonate debris from the boulder-strewn seafloor. Analysis of 124 bottom samples shows high concentrations of CaCO₃ (90-100%) in these mobile sediments. The low terrigenous sediment input from the granitic islands of this rocky coastal compartment, and local, high energy hydrodynamic conditions combine with abundant hard substrate to favor a highly productive, calcareous epifauna. The primary contributors of shell material are echinoderms, mussels (*Mytilus*) and barnacles.

A LABORATORY STUDY OF EOLIAN SEDIMENTATION

CHILD, Jon, Geology Dept., Bates College, Lewiston, ME 04240. Eolian sedimentation is observed under controlled conditions in a 3.66 meter long wind tunnel modelled after a flume designed by Fryberger (1983). Sand sized sediment (ave. 0.25 to 0.125 mm) introduced through the roof at the head of the tunnel, is blown along the length of the flume at constant and/or varied speeds (2.0 to 7.0 m/s). In this manner, "sedimentation events" are designed to study the effects of wind speed, grain size, and grainfall amounts on the frequency, amplitude, and migration of bedforms. Variations in wind velocity throughout an event (events range from 0.5 to 2.0 hours in duration) produce graded beds, reverse graded beds, and scour and reactivation surfaces that separate distinct sedimentation events. Individual bedforms generated include 0.1 to 0.5 cm high ripples at frequencies of 4.0 to 7.0 cm.

RECONSTRUCTION OF THE LATE QUATERNARY PALEOENVIRONMENTAL EVOLUTION OF THE NORTHWESTERN GULF OF MAINE USING BENTHIC FORAMINIFERA.

FRIEZ, Julie K., Dept. of Geological Sciences, Univ. of Maine, Orono, ME 04469

Cores were collected from the northwestern Gulf of Maine to investigate glacial and postglacial changes in ocean dynamics, paleoproductivity, and climate. Sixteen samples from a shallow water vibrocore (-20 meters, CB-VC-1) and fifteen samples from a basal piston core (-175 meters, PB-PC-16) were analyzed for their benthic foraminifera content. Standard techniques for foraminifera collection and identification were applied. Preliminary results show CB-VC-1 fauna is dominated by *Elphidium excavatum* (Terquem) forma *clavata* Cushman and *Protelphidium orbiculare* (Brady), indicative of a cold, euryhaline, nearshore environment. PB-PC-16 is characterized by arctic-subarctic deeper water species *Bolivina subaenariensis* Cushman, *Globobulimina auriculata* (Bailey), *Islandiella helenae* Feyling-Hanssen and Buzas, and *Nonionella labradorica* (Dawson) suggesting prevalence of normal marine conditions. Twenty-four foraminifera samples were analyzed for amino acid racemization. D/L ratios of aspartic acid increase from 0.05 to 0.22-0.25 within the upper 1, 2 meters (respectively) in both CB-VC-1 and PB-PC-16, reaching a plateau at these higher values. Relative dating by this method suggests a marked change in late Quaternary sedimentation rates for both cores. Forthcoming radiocarbon dates will enhance preliminary results and allow correlation of CB-VC-1 and PB-PC-16 with pre-existing core data.

SEDIMENT PROVENANCE AND DISTRIBUTION IN A HIGH ARCTIC MEROMICTIC LAKE

HALL, Brenda L., Department of Geology, Bates College, Lewiston, Maine 04240

Sophia Lake, located on the eastern coast of Cornwallis Island in the Canadian High Arctic, is a deep meromictic and mesothermal lake. The lake is oriented perpendicular to the trend of the local bedrock, which crops out in north-south trending bands parallel to the coastline. Streams entering the lake may discharge lithologically distinct sediments into the lake basin. The goal of this project is to determine the distance and path these sediments travel by tracing materials from their source in the drainage basin to the site of deposition on the lake bottom. The provenance of the lacustrine sediments may be determined by examining the grain size, clay mineralogy, heavy mineralogy, calcite/dolomite ratios, and major element chemistry. Preliminary results suggest that the presence of zircon and the concentration (ppm) of sodium and potassium may be useful in discovering the provenance of the sediments. Finally, sediment transport directions in this unique lake system are compared to existing models for high latitude and glacial lake.

PALEOENVIRONMENTAL ANALYSIS OF SUBFOSSIL COLEOPTERA (BEETLES) FROM SANDY RIVER TERRACE SEDIMENTS IN STARKS, MAINE

HALL, Heather A., and NELSON, Robert E., Dept. of Geology, Colby College, Waterville, ME 04901-4799

The Sandy River in central Maine is flanked along much of its length by terraces, post-glacial in origin. Approximately 100 kg of sediment was wet-sieved in the field from an organic-rich layer on a south-facing cutbank of one such terrace, located in Starks, Somerset County, Maine. Material greater than 0.025 mm was processed to recover subfossil Coleoptera, using the kerosene flotation method as outlined by Coope. The more than 1100 subfossil beetle fragments recovered were then mounted on modified microfossil slides.

The fauna was identified based on literature descriptions and modern specimens, whenever possible, and appears to be dominated by species characteristic of habitats seen in modern central Maine, although research is still in progress. The subfossil assemblage is indicative of a wide distribution of ecological requirements including open ground (e.g., *Harpalus pennsylvanicus*), dense forest (e.g., *Pterostichus honestus*, *Sphaeroderus(?)nitidicollis*), aquatic environments (e.g., *Gyrinus* sp., *Helophorus* sp.), open, sandy, riparian environments (e.g., *Bembidion inaequale*, *Schizogenius* sp.), and moist, organic-rich environments (e.g., *Micropeplus sculptus*). Large numbers of Trichoptera (caddisflies) and other insects were also recovered but not included in the study.

A wood sample submitted for radiocarbon dating has been tentatively identified as *Tilia*, by Donna Christensen at the Forest Products Lab, U.S.F.S. *Tilia* (cottonwood, basswood) reaches its present northern limits in central Maine.

An age of mid- to late-Holocene has been presumed based on the modern characteristics of the assemblage; a radiocarbon date is pending. Evidence suggests that aggradation of the Sandy River Valley did not occur immediately following deglaciation, as commonly assumed, but rather occurred more recently.

THE DISTRIBUTION OF SEAFLOOR POCKMARKS FROM PENOBSCOT BAY, MAINE.
HENDERSON, Mark R., Department of Geological Sciences, University
of Maine, Orono, ME 04469.

Penobscot Bay, Maine's largest coastal embayment, is rocky in its lower reaches, but muddy in the upper, estuarine portion. Numerous seafloor depressions, or pockmarks, have been reported from a 40 Km² area in the upper estuary between Belfast Bay and Sears Island. In 1989, 140 Km of side scan sonar records were used to form a mosaic of the pockmark field. At least 1,942 pockmarks exist in the field, with an average of 50/Km², although pockmark density reaches 160/Km². The largest, 350 m diameter by 35 m deep, occur in water depths of 30 m; while smaller depressions are more common in water as shallow as 5 m. Although the pockmarks are mostly circular in plan view, in the more densely marked area to the south where the largest features are located, many of the pockmarks coalesce into composite features which grade into the main channel of the estuary. In some locations lineations of pockmarks up to 3 Km long occur in a N-S orientation. High resolution seismic reflection profiles reveal natural gas acoustic wipe-out areas in much of the study area, except beneath pockmarks. The pockmarks extend down no deeper than the base of the Holocene, which is underlain by glaciomarine sediment (Presumpscot Formation), and acoustically reflective "eyes" in the center of some pockmarks may represent the unconformity on the surface of the Presumpscot Fm. I favor natural gas and pore water escape as the mechanism of formation. A bedrock fault cutting Quaternary sediment is known on Sears Island, and seismicity may have played a role in release of the gas here, as well as in the pockmark field in Passamaquoddy Bay recently described by Fader (1989).

APPLICATION OF GEOPHYSICAL TECHNIQUES AND FACIES LOGGING IN A GLACIOMARINE SETTING IN LISBON, MAINE
IRELAND, Michael K.D., Bates College.

Seismic refraction and ground resistivity methods were used in conjunction with stratigraphic logging, well logs and mapping to determine the types, thickness, and areal extent of glacially deposited materials west of the Little Sabattus River in Lisbon, Maine. The field site covers an area of 1.0 square kilometer, most of which is within an operating sand and gravel pit. The importance of this location stems from the presence of a groundwater contamination site east of the Little Sabattus River and its proximity to the two Lisbon municipal wells which are found within the study area.

The principal landform in the field area is one segment of a beaded esker that trends north-south along the Little Sabattus River valley for over 27 kilometers. The long axis of the esker bead is 1.0 kilometer and the short axis is 0.4 kilometers. The maximum thickness of the esker is 83 meters and is comprised mainly of sand and gravel.

Around the periphery of the landform marine clay constitutes the upper layer in the stratigraphy to a depth of 10 meters. The clay overlies up to 20 meters of sand and gravel. There is no geophysical or well log evidence for the presence of till overlying bedrock throughout the site except for north of Moody Road.

A facies model made from the stratigraphic data can be used to reach two immediate objectives: to model groundwater movement and contaminant transport within the surficial material and to determine the local glacial history and create a model on how ice contact landforms are produced.

STRUCTURE AND BEDROCK GEOLOGY OF THE METASEDIMENTARY ROCKS OF THE WAYNE 7.5' QUADRANGLE, MAINE AND CONTACT EFFECTS RELATED TO THE EMPLACEMENT OF THE ANDROSCOGGIN LAKE IGNEOUS COMPLEX

LATHROP, Alison S., Department of Geology, Bates College, Lewiston, Maine 04240
The Androscoggin Lake Igneous Complex (ALIC) is a Permian bi-modal intrusion centered beneath and bordering Androscoggin Lake in the Wayne and Leeds area of Maine. The complex includes pyroxenite, gabbro, diorite, marginal bodies of syenite grading through quartz syenite to granite, and associated post-emplacment mafic dikes. These rocks intrude first and second sillimanite-grade metasedimentary rocks of the Silurian Sangerville Formation and fine- to medium-grained Devonian biotite-garnet granite, with obvious contact effects limited to injection zones and lit-par-lit textures. The age of sillimanite-grade metamorphism is undetermined, but could be Acadian, Alleghenian or younger. Detailed mapping and structural and petrographic analyses of the metasedimentary rocks surrounding the complex were carried out and four new sub-units or members of the Sangerville were described within the Wayne 7.5' quadrangle. A 1:24000 bedrock geologic map and corresponding stratigraphic column and cross-sections were constructed. Three fold generations were observed within the quadrangle. Regional-scale recumbent F₁ folds are inferred from the presence of uniformly inverted stratigraphy from toppling sense of graded beds. Gently-plunging, isoclinal F₂ folds and associated S₂ axial planar foliation form the dominant structural feature: the NE-plunging synform, the nose of which is cut by the ALIC. F₃ are moderately-plunging, tight folds inferred from F₂ trends and plunges. No S₃ foliation has been observed. The intrusion of the ALIC deflects F₂. A steeply-plunging, sinistral strike-slip fault is mapped to the east-north-east of the ALIC. This fault and the quadrangle map pattern support the conclusion the ALIC intruded along a synmetamorphic, NE-SW, sinistral strike-slip fault. Microprobe analysis of homogeneous garnet and biotite from pelitic schists yield metamorphic pressures and temperatures ranging from 3.5 to 6.2 kbars and 485 to 704 °C. Contouring this data reveals an isobaric thermal spike produced by the intrusion of the ALIC. Monazites were sought in pelitic schists for dating of metamorphism using U-Pb systematics, but extensive searching yielded none. The reason for this absence is unclear.

HEAVY MINERAL ANALYSES OF GULF OF MAINE SEDIMENTS

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The origin of sediment in Maine's estuaries has never been investigated, and preliminary work in the Gulf of Maine is ambiguous or incorrect. A comparison of sandy and muddy sediment mineralogy from 5 Maine embayments and the rivers which debouche into them was made to reveal whether englacial sediment transport during the late Pleistocene was primarily along discrete flow paths with relatively localized dumping of debris or, alternatively, that the sediments are of fluvial origin. Large (2-28 kg) bottom

samples were collected from rivers and adjunct bays (31 samples in all). After initial sieving to remove gravel, the heavy minerals were separated from the rest of the sand sized material using a Humphrey 3-turn Spiral in conjunction with heavy liquids and Frantz Barrier Magnetic Separator techniques. Identification of minerals was made by standard optical, ultra-violet, and electron microscopic techniques; subsequently percentages of major mineral constituents were visually estimated for the entire heavy mineral fraction (4-1300 g) to combat the particle sparsity effect. Mineralogy of silt- and clay-sized fractions was determined by standard x-ray diffraction methods. Previous work on glaciomarine muds indicates more numerous mineral species with increasing grain size, and little variation despite differences in local bedrock. Preliminary observations of the silt- and clay-sized fractions in this study support these conclusions. Previous work on sand in the Gulf of Maine used small point count populations, was based on now-outdated bedrock geology, and illogically linked Casco Bay with the Bay of Fundy. Other previous works are limited in scope to single embayments in southwestern Gulf of Maine. Preliminary observations show the Casco Bay assemblage as similar to previous work in Saco Bay, both are consistent with the bedrock's higher metamorphic grade. The heavy mineral assemblages change to the east with decreasing metamorphic grade.

OXYGEN ISOTOPIC VARIATION IN QUARTZ CRYSTALS FROM MAIROLITIC CAVITIES IN THE CONWAY GRANITE, MOAT MOUNTAINS, NEW HAMPSHIRE.

PETERS, Stephen C., Geology Dept., Bates College,
Lewiston, ME 04240

This study attempts to discern Oxygen isotopic variations of quartz in the smoky quartz bearing mairolitic cavities located in the Conway Granite, in eastern New Hampshire. The goal is to characterize the fluids that formed the crystals lining the pockets.

Smoky quartz samples were taken from Moose Pocket, Winslow Pocket and Peter's Pocket, which are three of the largest known cavities in the Conway, NH area. The samples were prepared at Bates College and analyzed in the Stable Isotope Lab at Dartmouth College.

The quartz crystals were divided into several different categories by shape, color, and growth structure. Several growth phases were distinguished in Peter's Pocket and Winslow Pocket, while Moose Pocket only has one phase. Peter's pocket showed no significant isotopic shift through all of the phases, while the three phases in Winslow Pocket showed a significant shift, from 10.024 in the early phases, down to 9.675 in the middle phase and back up to 10.560 in the late phase.

The formation fluids seem to be of the same origin, and the isotopic shift observed is due to selective crystallization of the lighter isotope.

$\delta^{18}O_{\text{quartz}}$	EARLY	MIDDLE	LATE
Peter's Pocket	11.221	11.213	11.269
Winslow Pocket	10.024	9.675	10.560
Moose Pocket	10.482	(Only one phase)	
Conway Granite	10.391		
Conway Granite	10.705		

STUDY OF ONGOING MICROEARTHQUAKE ACTIVITY WEST OF MILO, ME.

REA, C.D., DOLL, W.E., and BRUGGER, K.A., Department of Geology, Colby College, Waterville, ME 04901; EBEL, J.E., Weston Observatory, Boston College, Weston, MA 02193

With recent earthquakes having magnitudes up to MC = 6.0 such as the Saguenay, Canada earthquake in 1988, there has been growing interest in earthquake activity in eastern North America. Because of the potential destructiveness of these intraplate earthquakes, more research in high seismicity areas is warranted. Data from the Northeastern Seismic Network (NEUSSN) since 1975, indicate that an area approximately 8-16 km west of Milo, Maine is one of high and relatively continuous seismicity. Earthquakes with magnitudes showing MC = 4.5 have been monitored in this area. The epicenters are bounded to the north by a very pronounced line of lakes and bogs. Fault plane solutions from NEUSSN data indicate that a mixture of normal, reverse, and strike slip events have been detected from this locality.

Three PDR-2 three component digital seismographs and five MEQ-800 smoked paper seismographs were deployed from May 31, 1989 through September 31, 1989. The MEQ's were run at 1mm/sec to allow arrival times to be determined to an accuracy of about 0.1 sec. The PDR's were set to operate at an interval of 0.005 sec. This four-month deployment provided data for determining the frequency and magnitude of the microearthquakes in the area and for determining their locations, and possibly fault plane solutions.

Microearthquakes occurred at a relatively constant rate of 3-4 per week throughout the four-month deployment. The magnitudes ranged from MC = -1.6 (2s coda) to MC = 1.3 (40s coda). S to P times ranged from 0.3 to 0.8s for all stations with the average time being 0.5s indicating shallow depths of 0.9 km to 3.2 km. All recent incidents occurred on or south of the pronounced lineament of lakes and bogs in agreement with earlier lower resolution locations provided by the NEUSSN. Further geologic field work is planned in order to determine whether this lineament is a fault scar. More seismic monitoring is also planned.

DELINEATION OF A #6 FUEL OIL CONTAMINANT PLUME ON THE UNIVERSITY OF SOUTHERN MAINE CAMPUS, CUMBERLAND COUNTY, MAINE.

TIPTON, Stephanie, Department of Geosciences, University of Southern Maine, Gorham, ME 04038
 Seven years ago, on the University of Southern Maine Gorham Campus, an underground storage tank leaked an undetermined amount of #6 fuel oil. The tank was cleaned and abandoned in situ. Due to concern over groundwater contamination, in the winter and spring of 1989, eight monitoring wells were installed near and around the tank. Water samples were taken from the wells and Tannery Brook, located about 120 m downslope from the tank. The concentration of #6 fuel oil in the well samples ranged from 270 ug/l to 37,000 ug/l and was less than 50 ug/l in the brook. The minimum affected area is approximately 7225 m².

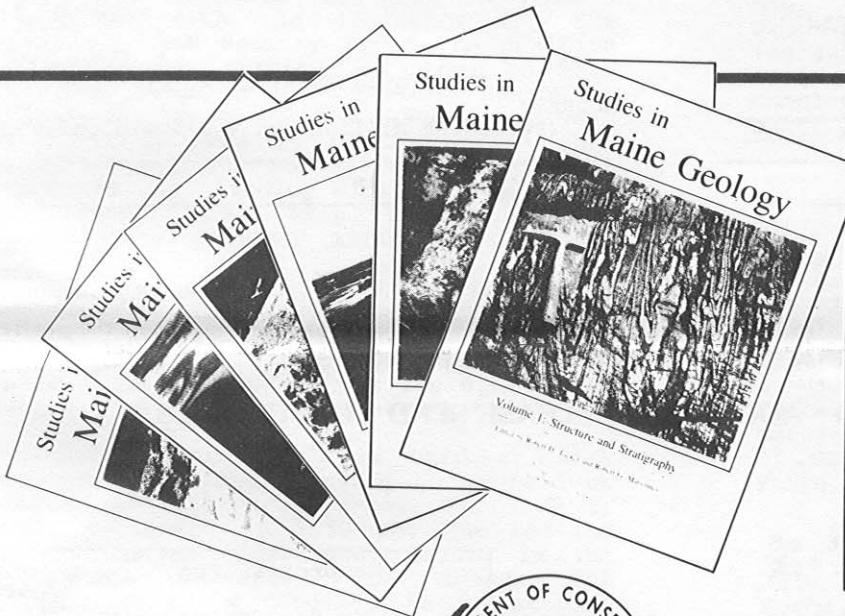
The average linear velocity of the groundwater flow is 2.45×10^{-5} cm/sec based on a hydraulic conductivity of 6.96×10^{-4} cm/sec, a gradient of 1.34×10^{-2} , and an effective porosity of 38%. The flow is toward Tannery Brook based on a series of water table maps. This places the plume about 54 m downslope from the leaking tank. At the current rate of flow, the plume will reach the stream in about nine years.

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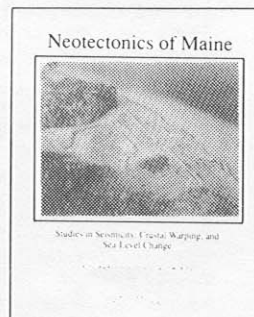
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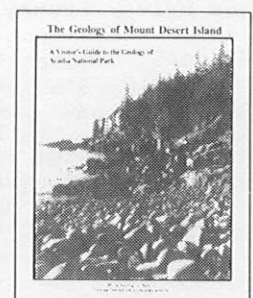


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