THE MAINE GEOLOGIST

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

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The President's Message

Members,

Greetings and I hope you are enjoying the great weather we have been having recently. Let's hope it continues throughout the summer and especially for the weekend of our summer field trip (see details in this Newsletter).

I am happy to report on another very successful year for GSM. I believe we have had some of the best attended meetings in recent years – at Poland Springs (fall, 2001) and at Colby College (spring, 2002). My sincerest thanks to Kristin Tardiff and the gang at PS and to Bob Gastaldo and his colleagues for these two excellent meetings. It really does make my job ridiculously easy when we have such great organization. Once again I was very impressed with the caliber of the student presentations at the spring meeting. I hope that others might take a leaf out of the Bates' "book," as they now require their seniors do a presentation at one of the spring venues.

I have just recently returned from our May-term field trip to the Pacific Northwest which highlighted for me both the benefit of these types of trips and also the amazing scenery of the US. We visited an incredible array of Geological localities including Lassen Peak, the Lava beds National Monument, Crater Lake, Mt. St Helens and Yellowstone and many other points in between! I was accompanied by Kevin McCartney (UMPI) and Julia Daly (my new colleague here at UMF). I think it would be a great idea to do more joint field trips like this and to include some of our professional members to help out as co-trip leaders.

As always we have some ongoing projects within GSM. We hope to complete scanning the Newsletters onto the web page in the next month. We are, however, in a state of transition with web masters as Seth Barden has just graduated. I hope to have his replacement very soon. It may take a bit longer to get announcements up on the web site as these are presently being handled by the UMF computer center. At the last couple of meetings several members have mentioned having joint meetings with others societies such as the New Hampshire geologists or the Atlantic Geosciences group. This could be a joint summer field trip or perhaps a special meeting in addition to our normal schedule. Given the enthusiastic response of the membership this is something I hope we will be able to work this into our plans in the near future.

The summer field trip plans are well advanced, as you will see elsewhere in this issue. I hope we will have a large turnout for this great trip and I look forward to seeing you all there the first weekend of August.

Cheers,

Dave Gibson, President, Geological Society of Maine
<dgibson@maine.edu>

The Editor's Message:

Please take a moment to scan the Treasurer's Report. Although we are a large and vibrant organization, the trend of recent years has been a slow decline in assets and stagnant growth, particularly in the number of students. Please think about ways to involve more students and associates in the GSM, and bring them up at the next meeting. Inviting associates and students to the summer field trip is a great place to start. In terms of cash on hand, nothing has proven to be better for us than the short courses. Anyone with ideas along these lines, please come prepared for discussion at the fall meeting.

Once again, I call for all student geology clubs to submit items for inclusion in the Newsletter. And thanks to the loyal contributors, whose by-lines appear within, who make the editing a pleasure.

Dan Belknap, Newsletter Editor
<belknap@maine.edu>

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Geological Society of Maine Summer Field Trip

Organizer: Doug Reusch, UMaine Farmington

Dates: Friday, August 2 – Sunday, August 4

Location: Lamoine State Park

Drive to Ellsworth, ME. At the south end of town on Route 3 (Bar Harbor Road) turn east on coastal Route 1 for 1 mile, then right (south) on Route 184 approximately 8 miles to Lamoine State Park. We will camp here starting Friday night or meet early Saturday morning. The group campsite is ours for the weekend of August 2 and 3. It will be $3 per

person, per night and the group campsite will hold a large number of people.

This summer, we will explore the area between eastern Penobscot Bay and Frenchman's Bay. Spectacular coastal exposures display a great diversity of bedrock and surficial features.

Cambrian volcanic rocks (Ellsworth, North Haven, Castine), variably deformed and metamorphosed, and serpentinized mantle of the Ellsworth terrane structurally overlie Ordovician black shales of the St. Croix terrane. Silurian conglomerates, volcanic rocks and plutons are weakly deformed and intruded by Devonian granites.

A current working hypothesis invokes a pre-Silurian cycle of extension and convergence, which led to emplacement of the Ellsworth terrane over the northwesterly St. Croix terrane long before Siluro-Devonian igneous activity and Acadian convergence. Records of Early Paleozoic global change ($^{13}C/^{12}C$, $^{87}Sr/^{86}Sr$, sea level) may afford insights into the local stratigraphy. Cooling episodes in the Late Ordovician -Silurian and Late Cambrian invite comparisons between this time in earth history and the Late Cenozoic.

Surficial features document Pleistocene glaciation and deglaciation in esker fans and glaciomarine deltas. Regressive shorelines and erosional features document the isostatic uplift-dominated phase of sea-level fall. Transgressive shorelines with eroding bluffs, mudflats, salt marshes, and sand and gravel beaches are predominant features of the ongoing Holocene rise in sea level.

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GSM Web Site

www.gsmmaine.org
Webmaster, UMF
< to be announced soon>

If you have not yet done so, please visit the website. It is a great place to keep up with the happenings of the Society, but also has links to Maine geology resources, educational institutions and governmental agencies. With just a few clicks you can find anything posted on the web concerning Maine Geology. Have a great time surfing.

The State Geologist's Message:

Impacts of budget shortfall at the Maine Geological Survey

All of you have heard much in the news about Maine's budget shortfall. To any of us with mutual funds or other stock investments, it seemed fairly obvious that 2001 would be a down year with reduced capital gains. Somehow the state's revenue forecasting committee lacked clear vision on this and over-estimated tax revenues from capital gains. Tax revenue forecasting is complicated, but it is still surprising to many that this particular aspect of reduced tax revenue was overlooked. The revenue shortfall has an immediate impact on the remainder of our FY 02 budget that ends June 30, and a continuing impact on our FY 03 budget.

Since this news broke in April, all of us involved in state budgets have been playing a game of "Calvin Ball" of sorts – we're in the middle of the game and the rules keep changing. In the last few weeks the magnitude of the problem has stabilized to about $180 million over two years. Projections at this time indicate that the problem is a short-term one, but if it's the same group of forecasters making this proclamation, hold onto your wallets! For FY 02, Governor King is covering the shortfall with the Rainy Day Fund. The problem with this strategy is that the FY 03 budget approved by the Legislature in early April already used some of those funds to fix a then-projected small gap in FY 03. A couple of contractual salary increases of a few percent in FY 03 compound the problem.

The immediate impacts at the Maine Geological Survey have been a curtailment of spending for the remainder of FY 02. Since we are a field-based organization, this has been particularly painful because our summer program gets underway during the last quarter of the fiscal year that usually has substantial start-up funds. We have been unable to do some contracts for assistance with our groundwater quality program, for some student interns, and for basic mapping. Fortunately, much of our summer program uses federal and dedicated funds. Our STATEMAP funded programs of bedrock and surficial mapping will move forward. Mapping of coastal bluffs in eastern Maine continues. With some shifting of staff and resources, our groundwater quality program will continue at a somewhat reduced scope. If we had not been successful in the past five or six years in shifting some of the programs to these other funds, the immediate spending curtailment could have been disastrous to our summer program.

State government is still working on the details of a plan to address the FY 03 problem. At this time, we are not contemplating any personnel cuts. Such cuts would have lasting impact since it has been nearly impossible for any state agency to justify additional positions for worthy programs in the past seven years. To put this in perspective, the last new position at the Maine Geological Survey was approved in 1989. Since the budget crisis of the early 90's we have lost six positions. Fortunately with our increased revenues from federal and dedicated funds we have been able to keep most of the programs going and have still had resources to address important new issues like drought impacts

and sustainable water use. Hope for a good 2002-2003 and a new group of tax revenue forecasters!

Robert G. Marvinney, Maine State Geologist:

<Robert.G.Marvinney@state.me.us>

[Editor's note: as most of you realize, in the fast-changing world of Maine revenue projections, Bob's column (6/02/02) has been overtaken by events, including the addition of State worker furlough days. Please check the newpapers for these painful changes that we can't keep up with in these pages.]

GSM MEMBER NEWS

Lisa Churchill-Dickson gave a presentation on the Maine fossil record to the Kennebec Naturalist Society on March 26, 2002.

Julia Daly and **Doug Reusch** have been chosen share the new tenure-track faculty position, the Forrest P. Dexter Jr. Chair in Geology at UMF

Please send member news to:

Carolyn Lepage <clepagegeo@aol.com> or
PO Box 1195, Auburn, ME 04211-1195 or
by fax to 207-777-1370 or just call 207-777-1049

SECRETARY'S REPORT

Geological Society of Maine
Spring Meeting

Colby College, April 5, 2002

The business meeting was called to order at 5:20 p.m.

David Gibson, President, presented a summary of what was discussed during the executive session held earlier in the afternoon.

Geology of Maine book: The committee of Bob Marvinney, Lisa Churchill-Dickson, and Dave Gibson has made some progress. An outline of chapters is complete. The committee is looking for contributors to write and edit text, figures, maps, etc. Dave Gibson will look into contracting with a publisher as this book has the potential for long-term income for the Society. The target audience is the informed public and would be suitable supplement at the undergraduate level. It may also be the basis of a short course.

Summer Field Trip: Unanimous to ask Doug Reusch to lead a field trip in the Deer Isle area looking at the tectonic setting. Joe Kelley and Dan Belknap will be asked to provide the Quaternary flavor for the trip. No date was set.

Student Representative: Dave Gibson brought up the idea of having a student representative on the GSM Executive Committee. It would be another way to foster student involvement and possibly encourage interaction among the State's geology clubs. There was no discussion.

Geology Club News: Dan Belknap, again, encouraged geology clubs to submit news of their activities for publication in the Newsletter.

New Hampshire: Woody Thompson has communicated with Lee Wilder of the New Hampshire Geological Society regarding some sort of joint venture. Among the possibilities are a joint meeting, joint student presentations, or joint field trips. The summer of 2003 was suggested.

Reminders to attend NEGSA in Springfield and Friends of the Pleistocene were noted.

Dan Belknap distributed information for anyone wishing to be grandfathered for New Hampshire certification. Applications must be submitted before June 30, 2002.

Local news: Lisa Churchill-Dickson informed us that the State Museum is looking for a Curator of Natural History, someone with a geological background. The application deadline is May 24, 2002.

Also, Lisa noted that the Kennebec Naturalist Society is being formed. This Society is open to anyone with an interest in the biological/geological sciences. They meet on the fourth Tuesday of each month, from 6:00-8:00 p.m., at the Lithgow Library in Augusta. Tuesday April 23rd the topic will be Vernal Pools and June 25th, fossils. No topic was indicated for the May meeting.

Winners: The Walter Anderson Student Awards were presented.

Poster Winner: Terkla, M.G., Allen, J.P., Nelson, R.E. and Gastaldo, R.A., Colby College for LOWER MIDDLE DEVONIAN EURYPTERID REMAINS FROM THE TROUT VALLEY FORMATION OF NORTH-CENTRAL MAINE

Oral Winner: Stiff, George N., Bates College for COMPARATIVE RHEOLOGY OF LAVE FLOWS FROM MORPHOLOGIC CHARACTERISTICS AT ARSIA MONS AND DAEDALIA PLANUM, MARS

Congratulations to you all!

Certified Geologists: Bob Marvinney reported that there are 245 Geologists presently certified. The anticipated "bail-out" because of high fees has not occurred. Certified Geologists are still hoping for a discussion with the Department of Financial Regulation about reducing fees. At the Board Meeting, Bob, Irwin Novak, and Andy Tolman discussed continuing education for geologists.

The meeting was adjourned at 5:30 p.m.

Respectfully submitted,

Patricia O. Seaward, Secretary
<Patricia.O.Seaward@state.me.us>

GSM TREASURER'S REPORT

The Society currently has 377 members: They are distributed as follows:

Associates:	33
Institutions:	14
Regular:	284
Students:	46

Balance on Hand 02/06/02	**$**	**10,282.82**
Anderson Fund (Total)	$	5,024.68
Education Fund (Total)	$	842.70
Checking Account (other)	$	4234.35
Receipts		
Dues	$	551.00
Anderson fund (interest)	$	0.00
Anderson fund (contributions)	$	0.00
Education fund	$	0.00
Publications	$	-
Subtotal	$	551.00
Expenses		
Printing, mailing, stamps	$	421.72
Anderson Fund Awards	$	200.00
Deposit on Lamoine State Park	$	10.00
Sales Tax	$	0.00
Nature Conservancy – Memorial Jack Tardiff	$	100.00
Bank Charges	$	0.37
Subtotal	$	732.09
Balance on Hand 06/19/02	**$**	**10,101.73**

Note: Key Bank is now assessing $ 0.90 for every $1000 we deposit, hence the bank fees. We transferred the money in the CD to a 2-year account at a rate of 3.55%.

Respectfully submitted,
Elizabeth A. Champeon, Treasurer
< Lchampeon@aol.com>

2002 Annual Spring Meeting

April 5, 2002

Department of Geology Colby College
Waterville, ME 04901

ABSTRACTS

Poster:

TRICHLOROETHYLENE REMEDIATION BY CYCLODEXTRIN FROM SOIL

ALLEN, Laura, Geology Department, Bates College, Lewiston, Maine, 04240 lallen@abacus.bates.edu
and BOVING, Thomas, Geosciences Department, University of Rhode Island, Kingston, RI, 02881

Cyclodextrin is a complexing agent that enhances the solubility of chlorinated solvents such as trichloroethylene (TCE) in aqueous and residual solutions. This property of cyclodextrin gives it great potential for use in groundwater remediation. A field test of TCE removal using a cyclodextrin solution under unconstrained aquifer conditions is being planned at a military site in Virginia Beach, VA. This thesis describes laboratory-scale experiments of cyclodextrin flushing of TCE using soil samples from the site and both neutral and basic cyclodextrin solutions. The soil samples were contaminated with TCE, approximately 15% saturation of the total pore volume, and then flushed with a 10% cyclodextrin solution. Results indicate that addition of cyclodextrin enhances the solubility of TCE when compared to flushing with water alone, thus decreasing the total time of remediation. Mobilization of TCE was observed during the first few pore volumes of flushing in the several trials that utilized basic solutions of cyclodextrin. A fine sediment fraction in the soil samples was also mobilized with basic cyclodextrin solutions. Tailing of TCE concentration in column effluent was observed due to the presence of fine-grained sediments in the soils. Taken together, these results indicate that cyclodextrin can be an effective complexing agent for TCE. Basic solutions of cyclodextrin have the potential to mobilize TCE fine-grained sediments.

Poster:

CHARACTERIZATION OF MEGASPORES FROM A HERBACEOUS CARBONIFEROUS LYCOPOD

CHARLES, Matt, Department of Geology, Colby College, Waterville, ME. <mjcharle@colby.edu>

Megaspores of a Mississippian-aged herbaceous lycophyte have been found in the Hartselle Sandstone, south of Birmingham, Alabama. The Hartselle has been interpreted as a series of stacked barrier islands and barrier bars that were preserved during transgression in a foreland basinal setting. The lycopod is preserved in growth position, three dimensionally cast by fine quartz arenite, with the bases of the casts occurring in a fossiliferous siltstone. The aerial stems are surrounded by the same quartz arenite that casts the plants.

The lycopods consist of a cormose base, ranging in diameter from 6 to 12 cm, from which geopedally produced roots developed and a long, tapering stem grew aerially. In addition to the roots, leaves, sporangia, and spores of the lycopod, the paleosol also preserves pteridophyte and bivalve fossils. The present study is focused on the megaspores within the siltstone, which are circular in outline with a mean diameter of 1.9mm (s.d.=0.3). The proximal side of each megaspore is characterized by punctae, small bumps, or both. For those with punctae, the average density is about 57 punctae per 0.5 mm^2. The distal sides are relatively smooth,

with a trilete mark that extends nearly to the margin of the megaspore. Megaspores of both orientations exhibit long spines protruding from the margins. These spines are up to 600µm in length, relatively wide at the base, taper toward the tip, and may be forked. Some spines displayed a linear thickening within the spine axis, with ridges running parallel to the middle of the spine. Most megaspores found in the fossil record have been disaggregated from the matrix in which they were preserved. Hence, the collection and characterization of *in situ* megaspores allows for assessment of morphological features often lost during preparation.

Oral Presentation:

PETROGRAPHY AND GEOCHEMISTRY OF FELSIC DIKES FROM THE EASTERN MARGIN OF THE MT. WALDO PLUTON, COASTAL MAINE

DESPRES, Aaron D. and GIBSON, David, Department of Natural Sciences - Geology, University of Maine at Farmington, 173 High Street, Farmington, ME 04938. <adespr71@maine.edu>

The Mt Waldo pluton (371± 2 Ma, Stewart et al., 1995) crops out over an area of 160 km^2 at the north end of Penobscot Bay, Maine. Petrographic and geochemical evidence suggests a definite role for magma mixing in the evolution of this pluton (Gibson and Lux, 1999). At the eastern margin of the Mt Waldo pluton a number of felsic dikes intrude the country rocks, i.e., the Ordovician age Penobscot Formation. These are observed in a number of roadside exposures along Route 1, south of Bucksport, on the western side of Penobscot Bay. However, it is unclear whether these dikes are related to the intrusion of the Waldo granite or if they represent a different phase of felsic magmatism in the area.

The dikes are a distinctive light blue-gray color and contrast markedly with the black, rusty-weathered sulfidic schists. They have a fine-grained, equigranular texture and are extremely leucocratic (CI< 10). The dikes contain both muscovite and biotite. Tourmaline is common in many hand specimens. They range in thickness from 20 cm to around 1 m and have variable orientations. In some cases they are vertical with a general E – W trend, whereas others have sheet-like forms dipping at variable inclinations to the NE. Crosscutting relationships are not common between the two main forms, though evidence at one locality suggests that there may be more than one generation of intrusion.

There are a number of possibilities regarding the origin of these dikes: 1) They may be offshoots of the chilled marginal facies of the Waldo pluton. Even though there is no direct field evidence that the dikes originate from the Waldo this would be significant as they could represent the felsic end-member of the magma mixing series. 2) Alternatively they could be late stage aplites from the Waldo granite. Some Waldo aplites do contain minor amounts of tourmaline but only secondary muscovite. 3) Another source could be the two-mica Wallamatogus pluton (397±2 Ma, D.R. Lux, unpublished data), which crops out just 2 – 3 km to the east across Penobscot Bay. Geochemical analyses of these various rock types should help us constrain more definitively the origin of these felsic dikes.

Poster:

A STRATIGRAPHIC AND KINEMATIC ANALYSIS OF THE ORDOVICIAN AMMONOOSUC VOLCANICS, NORTHERN PRESIDENTIAL RANGE, NEW HAMPSHIRE

DUPEE, Matt, Geology Department, Bates College, Lewiston, ME. <mdupee@abacus.bates.edu>

The bedrock geology of the northern Presidential Range, New Hampshire was mapped during the summer of 2001 with funding provided by the U.S. Geological Survey's EDMAP Program. This study is a continuation of an ongoing project to map the bedrock geology of the entire Presidential Range. A detailed map of the Ordovician Ammonoosuc Volcanics present on the northern flank of Mount Adams was created with the collected field data. This unit was subdivided into sixteen different members all of distinct compositional and layering relationships. The stratigraphy determined for the study area was then correlated the regional stratigraphy, as determined by previous workers, using lithologic and layering similarities. The southern bound of the local Ammonoosuc Volcanics stratigraphy is mapped here as the Mahoosuc Fault. A kinematic and vorticity analysis of this feature reveals that it is a northwest-directed right-handed reverse fault with dominant shear deformation. Another member of the Ammonoosuc Volcanics, the Cold Brook Member, contains distinct mylonitized amphibolite layers. These Memorial Bridge mylonites exhibit ductile shear deformation sympathetic to that of the Mahoosuc Fault. Evidence from the stratigraphic and kinematic analyses of the Ammonoosuc Volcanics suggests that the Mahoosuc Fault may represent the root zone of the Piermont Allochthon. Timing of this fault in constrained between the Early Devonian and Late Devonian, during the Acadian Orogeny, approximately 355 to 395 million years ago. This interpretation is further supported by consideration of the regional geology.

Oral Presentation:

SILICOFLAGELLATES RECOVERED FROM THE DEEP SEA, OCEAN DRILLING PROGRAM LEG 183, KERGUELEN PLATEAU

ENGEL, Robb, REED, Tracy J. and WILLIAMSON, Rita C., Micropaleontology Undergraduate Research Lab, University of Maine at Presque Isle, Presque Isle, ME 04769. <McCartnk@polaris.umpi.maine.edu>

Silicoflagellates were studied from sediment samples recovered by the Ocean Drilling Program (ODP) Leg 183 from the Kerguelen Plateau in the southernmost Atlantic Ocean near Antarctica. ODP Holes 1138A and 1140A were examined to develop a silicoflagellate biostratigraphy for these cores and a better understanding of the paleocean-ographic history of the region. Silicoflagellates dating from lower Oligocene to Pleistocene were found and documented. An unusual new silicoflagellate skeletal morphology was discovered and is being described.

Poster:

THE CHAIN LAKES MASSIF AND BOIL MOUNTAIN COMPLEX: HYPOTHESES ABOUT THE ORDOVICIAN COLLIDER

GERBI, Christopher and JOHNSON, Scott E., Department of Geological Sciences, University of Maine, 5790 Bryand Global Sciences Center, Orono, ME 04469. <gerbi@umit.maine.edu>

Due in part to the many mutually exclusive interpretations of the Chain Lakes massif and Boil Mountain ophiolite, located in west-central Maine, a driving force for Ordovician deformation in the Maine-Québec segment of the Appalachians remains unidentified. Various interpretations have the massif as an early Paleozoic fanglomerate and as Precambrian basement, as exotic to North America and as derived from Laurentia, as a high-grade metamorphic terrain and as a low-grade metamorphic terrain. Similarly, the Boil Mountain complex has been interpreted as a large nappe thrust from the southeast and as an independent block thrust from the northwest. In addition, although the complex has been labeled as part of an ophiolite, it lacks many characteristic features. Our investigation and regional studies by others (Pinet and Tremblay, 1995; Waldron and van Staal, 2001) have helped us relate two working hypotheses about Ordovician accretion that led to "Taconian" deformation to the bedrock in west-central Maine: (1) The Chain Lakes massif was part of a microcontinent that extended from Massachusetts to Newfoundland. In this model, the Boil Mountain complex (consisting of mafic plutonic rocks) would have been unrelated to overlying low-grade volcanic rocks and juxtaposed against the Chain Lakes massif prior to high grade metamorphism. The composite microcontinent would then have collided with the Laurentian margin to drive Ordovician orogeny. (2) The Boil Mountain complex and overlying volcanic rocks were part of an ophiolite that was emplaced over the Chain Lakes massif after the high-grade metamorphism. In this scenario, the Chain Lakes massif represents an extended portion of Laurentian crust, and ophiolite emplacement would have driven Ordovician deformation.

Poster:

A GIS ANALYSIS OF COASTAL BLUFF EROSION IN MAINE

KEBLINSKY, Corinn C., and KELLEY, Joseph T., Dept. Geological Sciences, University of Maine, 121 Bryand Global Science Center, Orono, ME 04469-5790 <corinn.keblinsky@umit.maine.edu>

Bluffs of glacigenic sediment exist along 53% of the tidal shoreline of Maine. Under the current regime of rising sea level, waves, groundwater, and subaerial processes easily erode these materials. The hazardous nature of the bluffs is not widely recognized by the public, and new homeowners are often shocked to find out that their property is disappearing. To better educate the public, the Maine Geological Survey is mapping the stability of the coastal bluffs. This report utilizes that database along with other available data to determine what controls the relative stability of the bluffs.

A geographic information system (GIS) was used to relate the internal characteristics and the external forcing mechanisms that contribute to erosion of coastal bluffs in the Freeport, ME 7.5' quadrangle. Data sets provided by the Maine Geological Survey include the Coastal Bluffs and Landslide Hazards (CBLH) coverage, which provides information on the relative stability of eroding bluffs; and the Coastal Maine Geologic Environments (CMGE) coverage identifies the subtidal, intertidal, and supratidal environments for the entire coast of Maine. The degree of development in the coastal zone was determined by air photo interpretation and digitized into a useable format for GIS analysis. Initial results show that: (1) mudflats and low-energy beaches in the intertidal zone are most commonly associated with unstable and highly unstable bluffs, (2) those bluffs with a high degree of exposure to incoming waves are more likely to be unstable or highly unstable. We are currently exploring the hypothesis that development on top of a bluff leads to the reduction of bluff stability by clearing vegetation cover, watering the ground, and increasing overburden pressure.

Oral Presentation:

P-T PATHS OF ACADIAN MIGMATITES OF THE PRESIDENTIAL RANGE, NEW HAMPSHIRE

MINOR, J. Jesse, Geology Department, Bates College, Lewiston, ME. <jminor@bates.edu>

The purpose of this study is to come to a greater understanding of the migmatites of the Rangeley and Littleton Formations. Field research conducted during the summer of 2001 indicates that a thrust fault placed rocks of the Littleton Formation atop migmatized Rangeley Formation. This fault was then folded by later deformational events related to compression during the Acadian orogenesis.

Lithological relationships between units were found to closely correspond to what previous researchers have described. The migmatites probably represent both a fertile source region for adjacent plutons, as well as conduits through which magma flowed as a result of compressive stress during the orogeny.

Garnet-biotite-plagioclase geothermobarometry data collected with an electron microprobe and calculated using the program Geothermobarometry 2.0 suggest that the migmatites underwent metamorphism at pressures and temperatures of approximately 425 ºC and between 1 and 3 kbar, far below values at which rocks are generally understood to melt. Mineral back- reactions probably account for this phenomenon, because many of the minerals in thin section demonstrate alteration and resorption, and because chlorite, biotite, and garnet, as well as quartz, muscovite, and plagioclase of the leucosome, are observed to overprint the older minerals. Additionally, although sillimanite is the stable aluminosilicate in the migmatites, the electron microprobe data typically plot within the andalusite field of the aluminosilicate diagram. Retrograde metamorphism may also account for the fact that the peak P-T calculated is far below expected values. Use of the NKFMASH petrogenetic grid suggests that the P-T space in which the migmatites could have been metamorphosed is bounded by the kyanite-sillimanite stability field, the H_2O- saturated pelite solidus, and

the muscovite + plagioclase + quartz + Al_2SiO_5 + K-feldspar + melt reaction line.

Poster:

REORIENTATION ANALYSIS OF DEGLACIAL FEATURES IN SOUTHERN MAINE

NELSON, John B. and BELKNAP, Daniel F., Dept. Geological Sciences, University of Maine, Orono, ME, 04469. <jnelson1@maine.rr.com>

Southwestern Maine was glaciated at the last glacial maximum, and deglaciated between 15 and 13 ka. Glacial retreat was contemporaneous with isostatic uplift and marine onlap. Topography influenced flow during final thinning phases. Three disparate morphologies (multiple till drumlins, large meltwater channels in bedrock, and an isolated rock-cored drumlin of exaggerated length aspect) clustered within an 80 km^2 area on the Mt. Agamenticus upland have nearly identical orientations. We examined flow-parallel orientations for the surrounding area (n =173) to test the hypothesis that these features are closely related to one another and were perhaps created within a coherent drumlinization zone with a specific ice center-of-mass. Orientation data were gathered from Maine Geological Survey Surficial Geology map sets. Student's t-test, which allows the comparison of small samples with normal distribution, was used to test area sub-samples. Results support the interpretation of a single population of flow-parallel orientations, differentially preserved above the limit of marine transgression. This suggests a single upflow center-of-mass, however distant, for the grounded ice that occupied the isostatically depressed coastal zone and which carried out the work of drumlinization. At Mt. Agamenticus, ice thinned and lowered over the peaks. In the basin areas around the uplands ice that had come afloat produced a population of minor recessional moraines with a radically new northerly orientation (changing by ~ 30° azimuth) before disappearing. This analysis identifies a sequence of local deglacial activity: 1) massive grounded ice with upflow connection, 2) thinning grounded ice pinned and isolated on Mt. Agamenticus and 3) reoriented actively receding ice-shelf complex. This work applies to regional models of ice retreat (e.g., Retelle and Weddle, 2001) in a controversial zone between western New England and central and eastern Maine. It also is a link between the terrestrial and offshore records of deglaciation.

Oral Presentation:

HOLOCENE BASIN EVOLUTION AND PALEO-CLIMATE RECONSTRUCTION FROM LAMINATED SEDIMENTS, CAPE HURD LAKE, DEVON ISLAND, NUNAVUT, CANADA

SAENGER, Casey, Department of Geology, Bates College, Lewiston, ME, 04240, <csaenger@bates.edu>

The possibility of significant anthropogenic climate change in the last century has raised a need to fully understand how humans affect climate. Using annually laminated lake sediments, or varves, high-resolution records of climate change through the Holocene are available. Sediment cores recovered from the meromictic Cape Hurd Lake, southwestern Devon Island, Canada, in June, 2001, show 8 zones of variation in sediment characteristics that may record basin evolution and climate fluctuation. Constraining sediment variation with ^{14}C ages suggests a transition from massive to laminated sediments ca. 8,500 yrs B.P. Sediments indicate warming through the middle Holocene with maximum temperatures occuring near 5,000 yrs B.P., followed by gradual cooling toward the present. Cape Hurd cores may indicate warming since ca. 700 yrs B.P., but anthropogenic links cannot be confirmed. Climate trends match reasonably closely with other high arctic proxy records including the Agassiz Ice Core percent melt record and Devon Ice Cap $\delta^{18}O$ signal. Paleomagnetic corrletions also exist between the Cape Hurd basin and other arctic lakes, but are less obvious over larger distances. In addition, within the same paleomagnetic event, ^{14}C ages are slightly older than their corresponding varve-counted date. Further analysis of basin sedimentation, and more complete ^{14}C and paleomagnetic dating will provide a higher resolution image of paleoclimate fluctuation.

Poster:

RECONNAISSANCE GEOLOGY NORTH OF CAMP 32

SIMPSON, William R., KRATT, C., ROTH, L., and WOOD, S., Department of Geology, Colby College, Waterville, ME. <wrsimpso@colby.edu>

In the summer of 2001 a reconnaissance geological investigation was performed on Sloko ridge, Juneau IceField, Atlin Wilderness Provincial Park, B.C., latitude 59°N, longitude 134°W. A range of nunataks with steep scree slopes characterizes this area. Bedrock outcrops were easily accessible in the elevations recently deglaciated, whereas the mid-level slopes were covered with scree.

Three main suites of rock were mapped and described. A suite of basalt and intermediate volcanics overlies a basal unit consisting of breccias and volcanic tuffs. Thrust over these suites is a series of highly deformed metamorphic rock. These three suites were examined initially in the field and subsequently in the laboratory using XRD and microscopic thin-section analysis.

One particular aspect of the volcanic tuffs is a microstructure recognized as “enigmatic epidote clasts.” The present study attempts to unravel some of the mysteries of their origin. To date, thin section analysis has revealed that the clasts originated from a provenance other than the volcanic tuff in which they reside.

Oral Presentation:

COMPARATIVE RHEOLOGY OF LAVA FLOWS FROM MORPHOLOGIC CHARACTERISTICS AT ARSIA MONS AND DAEDALIA PLANUM, MARS

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Morphologic dimensions of twenty-six flows off the southwestern flanks of the Martian volcano Arsia Mons and the associated plains of Daedalia were measured. These measurements were then applied to a suite of equations dealing with flow rheology of a non-ideal Bingham fluid, leading to model estimates of yield strengths, effusion rates and viscosities of the flows, all three being indicative of the

original environment into which these flows were first erupted. The purpose of the project was to determine the relationship between three apparent flow fields, each zone being characterized by width variations. Comparison between each zone reveals no great variation of underlying slope, at most 3º of slope in parts of the proximal region on the flow apron, while flattening out to less than a degree in the plains. Though flow dimensions do generally parallel expected trends (flow width inversely proportional to underlying slope and thickness proportional to slope), the gradient appears to have played a minimal role in determining those dimensions. Instead, the use of models associated with Bingham fluids reveal that the narrow proximal flows had lower effusion rates but higher yield strengths and viscosities than the tabular medial flows, which in turn had a similar relationship to the broad distal flows. Depending on the models utilized, yield strengths for all three zones ranged from 10^2 to10^7 Pa, effusion rates between 10^3 and 10^5 m^3/s, and viscosities of 10^3-10^9 Pa·s. Regardless of model and absolute value, the relative relationships between flow fields is preserved, in that the division of the proximal, medial, and distal zones from one another seems valid based on their differences of eruption conditions as determined from these fluid dynamics models.

Poster:

CORRELATION AND STRATIGRAPHY OF EXOTIC BLOCKS IN THE VINALHAVEN PLUTON, MAINE, COMPARED TO THE SEAL COVE FORMATION

SZRAMEK, Lindsay Ann, Geology, Bowdoin College, 673 Smith Union, Bowdoin College, Brunswick, ME 04011, <lszramek@bowdoin.edu>, BEANE, Rachel J., Geology, Bowdoin College, 6800 College Station, Bowdoin College, Brunswick, ME 04011, and WOBUS, Reinhard, Geosciences, Williams College, 947 Main Street, Williamstown, MA 01267

Vinalhaven Island, located in lower Penobscot Bay, Maine, is a bimodal pluton rimmed by stratified sedimentary and volcanic rocks. The island is ideal for exploring questions related to magma chamber dynamics, because its coastal exposures and granite quarries offer a nearly complete cross section from the bottom of the chamber in the south to the top of the chamber in the north. To better define the chamber dynamics, exotic blocks in the pluton were examined and compared to the stratified rocks that rim the island. Blocks of metamorphosed bedded tuffs in the pluton correlate well with the Seal Cove Formation exposed on the north-central coast of Vinalhaven. The exposed Seal Cove Formation is composed primarily of 0.1-2.0 meter thick layers of quartzite and calc-silicate, and also includes a garnet-rich rock (80% garnet) and tuff breccia. The exposure is cut by a granitic sill. Blocks of the Seal Cove Formation, sized from a few meters to tens of meters, are located at Round Neck, on the south-central coast, and on Greens Island, southwest of Vinalhaven. Similar to the in-place exposure, these blocks contain 0.1 to 1.7 meter thick layers of quartzite and calc-silicates, and are locally intruded by granite from the surrounding pluton. Both the blocks and the exposed Seal Cove Formation show evidence of contact metamorphism. Garnet compositions with a high andradite component (and45-68, gro41-18) provide supporting evidence to suggest that the protolithic tuff was calcic, possibly andesitic in nature, and underwent metasomatism resulting from thermal metamorphism related to the emplacement of the Vinalhaven pluton. The position and attitudes of the exotic blocks seem to support suggestions that the magma chamber underwent convection; however, the large, coherent nature of the blocks provides convincing evidence that the magma in the chamber was not turbulent.

Poster:

LOWER MIDDLE DEVONIAN EURYPTERID REMAINS FROM THE TROUT VALLEY FORMATION OF NORTH-CENTRAL MAINE

TERKLA, M. G., ALLEN, J.P., NELSON, R.E. and GASTALDO, R.A., Dept. of Geology, Colby College, Waterville, ME 04901. <bfrueger@colby.edu>

The fossiliferous terrestrial to transitional Trout Valley Formation of early Middle Devonian age lies entirely within Baxter State Park in north-central Maine. This study's objective was to explore evidence of early terrestrial arthropods. Samples were collected from twelve sites; materials from two sites have been studied intensively. Broken rock samples were inspected over all surfaces with a dissecting microscope, then dissolved in 48% HF, and residues dry-sieved into 0.25-0.5 mm, 0.5-1.0 mm, 1.0-2.0 mm and >2.0 mm size ranges. All sample residues were picked under a microscope at 3.5X; recovered arthropod remains were mounted on modified microfossil slides. Paleoenvironments for the two study sites represent estuarine and braidplain settings. The estuarine facies consists of siltstone and fine to coarse sandstone cycles of various scales. Braidplain facies consists of a basal conglomerate of an undetermined thickness, overlain by cycles of granule conglomerate, very coarse sandstone, coarse to medium sandstone, and sandy mudstone. The estuarine sample yielded the only arthropod fragments thus far identified, while the braidplain sample had the greatest density of fossils and best preservation, although these were solely of plant material. All fossil remains recovered have been graphitized; arthropod remains are three-dimensional and only slightly flattened. All recovered arthropod remains were material within the 0.25-0.5 mm sieve range. The parts are so small, however, that accurate identification is difficult. At least one body fragment apparently is derived from the Eurypterid family Stylonuridae, based on well-developed sculptural tubercles and knobs. A terminal tarsal (leg) segment bearing a single ancillary spine, and a stout intermediate leg segment, are more consistent with the leg structure of *Grossopterus* of the family Hughmilleridae. Both are consistent with the known age of the Trout Valley Formation. To date, the braidplain facies has only yielded large quantities of plant remains. Based on other Paleozoic studies of terrestrial arthropods this setting may yet yield early terrestrial arthropods. Further macerations are planned.

Evening Speaker:

Bob Marvinney, Maine State Geologist

GIS Applications in Geology

The evening presentation was a very interesting talk by State Geologist Bob Marvinney on GIS (Geographic Information Systems) Applications in Geology. Bob reviewed the history of GIS and illustrated how far computing power and map output capabilities have come over the past two decades. He emphasized that GIS is more than map-making software. The real strength of GIS is in data analysis and interpretation. One can plot different types of information together, such as bedrock and overburden geology on the same map, or query to determine where mapped sand and gravel overlie granitic bedrock. The strength of GIS was shown a decade ago when it was used in the search for a low-level radioactive waste repository site. Ninety-five percent of the land area in the state was quickly eliminated from consideration for violating one of the site selection criteria, greatly narrowing the search. Many State agencies now use GIS routinely in their daily business, including E911, DEP, LURC, DOT, the Forest Service, Marine Resources and Human Services. These agencies pass data layers to the Office of GIS who will maintain it as a public-access GIS library.

The Maine Geological Survey (MGS) uses GIS for map production, monitoring coastal processes, spatial analysis and ground water studies. MGS now has a menu-based standardized process for map production using standardized annotation. Rather than painstakingly plotting geological information by hand and printing hundreds of copies of each color map for several years' supply, all MGS maps are now produced on GIS and are printed one at a time with the most recently up-dated information.

Coastal geology applications include analyzing sand migration at Camp Ellis using bathymetry, topography and aerial photography, bluff maps for quantifying erosion and landslide hazards, and monitoring the long-term effects of dredging in Wells Harbor.

MGS uses the spatial analysis capabilities of GIS to manage and analyze the data from the annual snow pack survey to estimate the risk of major flooding. Bob compared the 2001 and 2002 April snow pack maps as a dramatic illustration of the precipitation deficit that resulted in the recent drought.

MGS used GIS to evaluate the relationships of elevated arsenic in homeowner wells in the Buxton-Hollis area to variables such as transportation, land use and mapped geology. No strong correlations were discovered. Other ground water applications of GIS include the ongoing survey of bedrock ground water quality in drinking water wells near Maine State Parks and an attempt to map the vulnerability of bedrock aquifers to anthropogenic contamination using existing data layers.

Finally, Bob discussed the advantages and disadvantages of GIS. He felt that the greatest advantage is the availability of data to a broad range of users and the greatest disadvantage is the unevenness in data quality and resolution. He emphasized that it takes understanding to properly interpret GIS data. He gave several examples that highlighted common mistakes in the interpretation of GIS data. One study that compared water quality in wells to mapped bedrock protolith lithology compared wells that were located to within about one meter and geological contacts that were only located to within about 1000 meters. Another was a shaded relief map of the USA with a bedrock geology overlay. It depicted much of northern Maine as Permian age rock formations. In one last example he told of a map that was produced in an attempt to locate karst regions near National Parks. The map showed about one third of Maine as having potential for karst development, presumably because of the use of the word "calcareous" in the unit descriptions on the state bedrock map.

Notes by John Beane (for Pat Seaward)

Grand Manan, GSM Summer Field Trip 2001, Stop 2 8/04/01, The Dock, debris-flow conglomerate, Grand Manan sequence. See how many of the GSM geologists you can identify (hint: Spike Berry is engrossed in the rocks, hammer in belt, Dee Caldwell is networking, while Walt Anderson is playing to the camera).

MEMBERSHIP DUES STATEMENT

The GEOLOGICAL SOCIETY OF MAINE, INC. is a non-profit corporation established as an educational Society to advance the professional improvement of its members; to inform its members and others of current and planned geological programs in Maine; to encourage continuing social contact and dialog among geologists working in Maine; and to further public awareness and understanding of the geology of the State of Maine; and of the modem geological processes which affect the Maine landscape and the human environment.

The Society holds three meetings each year, in the late fall (Annual Meeting), early spring, and mid-summer (usually field trips). A newsletter, ***The Maine Geologist***, is published for all members three times a year. The Society year runs from August 1 to July 31. Annual dues and gift or fund contributions to the Society are tax deductible. There are three classes of memberships:

$7.00	REGULAR MEMBER	Graduate geologists, or equivalent, with one year of practice in geology, or with an advanced degree.
$6.00	ASSOCIATE MEMBER	Any person or organization desirous of association with the Society.
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A $2.00 APPLICATION FEE is a one-time fee for all new members, payable when applying for membership.

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(Geological Society of Maine funds include the Walter Anderson Fund, the Education Fund, and discretionary gifts as noted by contributor)

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2002/2003 SOCIETY YEAR BEGINS AUGUST 1 - PLEASE SEND DUES TO TREASURER

THE GEOLOGICAL SOCIETY OF MAINE
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