The Maine Geologist

July 1992

Newsletter of the Geological Society of Maine

V.18, No.2

President's Message

by
Olcott Gates

I'll be away on a trip to Newfoundland during August and most of September so I've been trying to get the Fall meeting set up as much as possible. The tentative date is November 6 or 13, 1992. Art Hussey has generously (as usual) agreed to Bowdoin. We haven't looked at metal exploration and mining in Maine for several years so I thought that might be a good topic which I at least would like to know more about. With the OK of our directors, I've been exploring with Mike Scully, President of Maine Mineral Resources Association, the possibility of a joint GSM-MMRA meeting. The talks will be strictly on geology and exploration. Regulatory and environmental problems were fully covered at a UMO organized meeting at Orono last fall. The fall newsletter will have the final announcement.

A subject members might be thinking about is the possibility of following the Vermont Geological Society's lead in developing a research grant program to promote and support original research on the geology of Maine. The VGS program is aimed at undergraduate and graduate students and grades 7-12 teachers. The grant program does not try to cover all of a researcher's expenses but is viewed as an endorsement of the research endeavor, and is awarded on a competitive basis. Tom and Susan Weddle have given me the basic information. More detail will be in the Fall newsletter.

The Educational Committee has finished a very successful first year and is gearing up for doing as well next year. Pat Seaward, Bill Berry, Glenn Black, Marianne Dubois, Art Hussey, and Patti Millette are owed a many thanks by GSM for a job well done on its behalf.

***** Notice *** Notice *** Notice*****

The Society year starts August 1, 1992. Please pay your dues.

If your mailing label is RED and we do not receive your dues by the next newsletter, you will be dropped from the mailing list and will have to pay the $2.00 processing fee to resurrect your membership.

Send your dues to:

Geological Society of Maine
c/o Marc Loiselle
Maine Geological Survey
State House Station 22
Augusta, ME 04333

Coastal Land Loss Short Course

The Geological Society of Maine and the Department of Geosciences of the University of Southern Maine recently cosponsored a short course on coastal land loss. The course was held on the GSM campus on April 10, 1992. Over 50 people registered for the one-day course and optional field trip. The attendees included undergraduate and graduate geology students, staff from the Maine Department of Environmental Protection, Maine Geological Survey and other agencies, members of the press, consulting engineers and geologists, and representatives from environmental organizations. The course instructors were Dr. Joseph Kelley (Maine Geological Survey), Dr. Robert Morton (Texas Bureau of Economic Geology), and Dr. Orrin Pilkey (Duke University).

Dr. Morton began the technical presentations with an overview of the factors affecting land loss along coastal areas. These included storm events, sea level rise, compaction of sediments, and loss of sediment supply. Dr. Morton compared the effects of tropical versus extratropical storms. While the wave energy from a hurricane may be much greater in terms of wave and storm surge height, the effects of extratropical storms may be experienced along a much greater length of coastline over a significantly greater period of time. Sediment supply can be diminished as sand is deposited in washovers, spit extensions, ridge accretions or through aeolian transport. Sediment may also be effectively removed from the system by mining or subsidence, or supplies cut off by levees, dams, and other up-stream impediments.

Next, Dr. Kelley discussed sea level rise. He pointed out that survey data indicates that "sea level" is rising at different rates along the coastline, depending on if the area is undergoing crustal subsidence. In terms of predicting future sea level trends, Dr. Kelley said that the real records have alot of "noise", making it difficult to separate cause and effect. He was skeptical of projections of major sea level rise in the immediate future, and suggested that a better estimate would be to look at this year's data to predict sea level rise for next year, look at data for the past ten years to predict the next ten years, etc.

Dr. Pilkey continued with a description of the effects of sea walls and beach nourishment. He pointed out that sea walls typically destroy beaches in several ways. Beach area is lost where a sea wall is constructed on a recreational beach. The sea wall then enhances active degradation when wave energy is concentrated at the wall, rather than being dissipated over the beach face. Beach nourishment or replenishment projects are extremely expensive and typically

do not last very long. Approximately 25% of replenished beaches disappear in less than one year. To have any hope of being successful, replenishment must be continued on an on-going basis. While not arguing against beach replenishment projects, Dr. Pilkey stated that society needs to know the immediate and long-term costs in order to make a decision to fund these projects. He pointed out that estimates of the lifespan, and therefore investment costs, for these projects are often woefully unrealistic. He cited Miami Beach as the only U.S. Army Corps of Engineers beach replenishment project that is still relatively "healthy".

The three instructors presented a geographic overview of coastal land loss during the afternoon session. Dr. Kelley pointed out that the coast of New England was quite different from the southeast and gulf coasts described earlier in the afternoon. The highly irregular rockbound coast makes it difficult to model. In addition, a single storm will affect areas of the coast quite differently because of the shore's irregular shape. In terms of sediment supply for Maine's beaches, he said that he did not find any evidence of rivers currently supplying sediments. He mentioned the importance of eroding bluffs as a sediment source, and that "armoring" eroding bluffs means that the public intertidal zone becomes more limited.

Dr. Pilkey concluded the course by pointing out that shorelines are eroding in places where humans have had no impact. He feels that, even if sea level rise stopped, we would still have problems. One difficulty we have is that we can not predict quantitatively what changes in the shoreline will be. He suggested we need to shift from entirely engineering solutions to coastal land loss problems to a more scientific approach. In the future, we may also be concerned with the affects of sea level changes on major coastal cities, such as Manhattan or Galveston.

TO: Geological Society of Maine

FROM: Joe Kelley

RE: Short Course

I want to express my thanks to the Geological Society of Maine for the successful short course we ran at USM last month. Mark Loiselle tells me that we had 57 enrollees, a large number given the short lead time and inclement weather.

I would especially like to thank Carolyn Lepage for organizing most of the affair and handling logistics (and nagging me to get things done). Thanks are due to Mark as well for handling all the money, and to Steve Pollock and USM for providing space for our meeting.

Finally I must acknowledge the strength of all the participants who made the field trip on Saturday. I have led a lot of trips over the years, but I have never led a trip in such bad weather... heavy rain, sleet and snow! Thanks for not complaining.

GSM SPRING MEETING MINUTES
APRIL 3, 1992

The following decisions were made by the Executive Committee and presented to the membership at the business meeting. As there were no objections, these decisions now represent GSM administrative policy.

1. The President shall maintain a file of correspondence both within and without the Society and of any other matters considered important enough to become part of the Society's permanent record, including a copy of each issue of **The Maine Geologist**. Annually, prior to the fall meeting, other officers except the Treasurer shall add their correspondence to the file. The file shall be passed on to each succeeding President. The Treasurer, however, shall maintain a separate file of all financial transactions.

2. Part of the duties of the officers include the following: The Vice President shall be responsible for arranging and publicizing the annual summer field trip. The Treasurer shall handle publication sales and inventory. The Secretary shall keep minutes of the meetings, including brief summations of talks by guest speakers. The official version of the minutes are those published in **The Maine Geologist**.

3. The summer **Maine Geologist** shall have an appropriate box in which any member in arrears on dues shall be notified by a red check. Those who have not paid by the date of publication of the next **Maine Geologist** will be removed from the mailing list.

4. The President shall decide what organizations may be given the Society's mailing list for a one time use only, provided the organization is nonprofit, scientific, or educational.

5. The President in consultation with the Executive Committee shall decide to what activities of other organizations the Society will lend its name as a cosponsor, provided there are no financial or other potential liabilities involved, and the activity is nonprofit, scientific, or educational.

6. Announcements of meetings of other nonprofit, scientific, or educational organizations in **The Maine Geologist** shall be at the discretion of its Editor.

7. Tape recordings of the Society's meetings shall not be permitted. This is not meant to exclude the press.

8. The following are permitted administrative expenses when incurred while doing the Society's business: postage, stationary, copying of correspondence, and phone calls. Such expenses may be incurred by members of the Executive Committee, chairpersons of committees, Bulletin editor, **Maine Geologist** editor, postal chairperson, short course chairperson. Bills with receipts shall be submitted monthly to the Treasurer for reimbursment.

The problem of how much money may be expended at the discretion of the President with or without consultation with the Executive Committee; policy towards applying for and receiving grants; and whether or not the President with or without consultation with the Executive Committee or approval by the membership should be empowered to approve the short course and its financial obligations or to advance funds to committees for whom funds were not specifically allocated when the committee was approved by the membership were deferred to await a year's experience.

The Executive Committee decided without dissent from the membership to reduce publication of **The Maine Geologist** from four to three issues annually and to omit the winter meeting, to be reserved for "by request" meetings on a particular topic.

How to make the Society of interest to a wider membership is a problem to be worked on during the coming year. In addition, the President will look into liability insurance options for the Society's field trips. The status of the hydrogeological Bulletin is unknown as of this meeting.

The evening's guest speaker was Dr. Mary Hubbard of University of Maine at Orono, who discussed orogen-parallel deformation in the Himalayas, Alps, and Appalachians and its implications.

The first study area was a portion of the Himalayas where island arcs had been trapped in the collision of India with Asia. A strong E-W stretching lineation with a W to SW plunge as well as a dextral sense of shear in rocks on both sides of the Main Mantle Thrust (MMT) suggested movement of the Kohistan island arc to the WSW relative to the Indian Plate. In addition, right lateral strike-slip faults on the India-China border supported the idea of a "continental escape" model for the Himalayan orogeny, suggesting that as the Indian Plate moved north into Asia, outward movement of continental slivers along strike-slip faults accomodated the convergence.

In the French Alps Neogene right lateral strike- slip faulting was found to postdate the S dipping, NNW verging thrust faulting of the Alpine continental collision. The "continental escape" model seemed to work better for the eastern Alps, where dextral displacement was balanced by a measure of sinistral movement. Sinistral displacement has yet to be found in the western Alps, however, it has been suggested that there may still have been some counter-clockwise rotation of the Italian block during the Neogene.

Finally, a look at the Appalachians, in particular the Norumbega Fault Zone in central Maine, revealed a dextral sense of shear with a strong component of orogen-parallel, ductile deformation. This raised numerous questions, such as why the difference in the width of the NFZ from SW to NE? Does temperature represent different levels, that is depths of deformation and might the NFZ resemble the San Andreas at 15 km depth?

GSM SUMMER FIELD TRIP UPDATE

The East Penobscot Bay GSM summer field trip led by Bob Gerber and Steve Pinette is filled to capacity. Bob Johnston is coordinating trip registration and may be contacted at (207) 289-2801 to see if there are any vacancies due to cancellations. Participants should park at Deer Isle High School on Saturday, July 25 and will meet the boat at Sylvester's Cove.

NEW PROFESSIONAL SOCIETY

A new professional society focusing on the application of geophysical tools to solve environmental and engineering problems is being considered nationally. Contact Don Robbins (Maine DEP 207-289-2651) for information on membership.

MAINE MINERAL SYMPOSIUM

Woodrow Thompson
Maine Geological Survey

The third annual Maine Mineral Symposium was held in Augusta on the weekend of May 15-17. This year's meeting was co-sponsored by the Federation of Maine Mineral and Gem Clubs and the Maine Geological Survey. The purpose of the symposium is to stimulate interest in mineral collecting and the study of minerals through lectures and exhibits. Though it is not a commercial show, mineral dealers from throughout New England are invited to attend and sell specimens in their motel rooms during the evening. The Senator Inn was the headquarters for the 1992 meeting, while the lectures where held on Saturday at the UMA campus.

The scope of this year's meeting was broadened to include New Hampshire mineral localities, with talks by Dyke Eusden on the crystal pockets of the Conway Granite, and Bob Whitmore on the history of pegmatite mining in Groton, N.H. Maine topics included Van King's lecture on apatite localities, Duane Leavitt's discussion of calc-silicate deposits, and Michael Wise's research on pegmatite genesis. These speakers gave outstanding presentations and set a high standard for future symposia. A new feature of the program was the Friday night mineral auction, which was attended by an enthusiastic crowd. Thanks in large part to Van King's auctioneering talents, the event was a financial success, with all proceeds going to benefit the symposium. A field trip was held on Sunday to the Bennett Quarry in Buckfield, where Sugar Hill Minerals has been mining since 1989.

Nearly 200 people participated in the 1992 Maine Mineral Symposium, and planning is underway for next year's meeting. It is hoped that more GSM members will be able to attend in the future so that we can promote mutual interest and communication between professional geologists and Maine mineral collectors.

DEP Task Force Update

by
Carolyn Lepage

The DEP Task Force has continued to meet on a monthly basis since the beginning of the year. The focus of the Task Force in recent months has been on the quality of applications and other materials submitted to the DEP. The goal is to identify issues or recurring problems that inhibit the timely completion of DEP technical reviews. DEP staff has been gathering deficiencies in the various types of submittals received by the DEP bureaus, as well as the clarity of DEP guidelines and application forms and instructions. Private sector representatives on the Task Force will now be polling members of their respective organizations for their perspectives concerning the DEP's application or technical document review process. CEM (Consulting Engineers of Maine) will be sending out a questionnaire in mid-August to their members and have offered to share the survey form with other organizations represented on the Task Force. **If you are interested in providing feedback on your experience with the DEP application and review process, please contact Carolyn Lepage at (207) 865-6138 for a questionnaire.**

MMRA Field Trip Announcements

The Maine Mineral Resources Association would like to invite GSM members to participate in two mine trips planned for 1992. The first trip will be Saturday, August 1, to Thetford Mines, Quebec. In the morning we will tour LAB Chrysotile, Inc.'s open pit asbestos mine and mill facilities. After lunch we will get a geology/outcrop tour of Coleraine Resources Inc.'s chromite deposit. Apparently there are some excellent outcrops and sampling will be allowed. We are assuming that people will drive to Thetford Friday evening and stay in a local motel. MMRA will make the motel arrangements. Rates are approximately $42.00 single, $45.00 double including tax (Canadian). The tour will leave from Balmoral Motel at 9:00 am Saturday. A small fee on the order of $5.00 may be charged to all participants depending upon the number of people involved. Please contact Mike Scully by July 22 if interested (address and phone listed below).

The second trip will be to Potash Company of America's underground potash mine in Sussex, New Brunswick. This trip is tentatively scheduled for a week day in late September/early October. The mine can only handle 14 people at a time, so we will have to limit the tour to 14. MMRA members will be given preference. Due to the driving distance, this will also be an overnight trip. Full beards are not allowed underground because of the safety apparatus. Please contact Mike Scully by September 1 if interested:

Maine Mineral Resources Association
P.O. Box 1801
Bangor, ME 04402-1801
(207) 772-3994

GSM SPRING MEETING ABSTRACTS

LATE HOLOCENE EXTENT OF THE GRINNELL GLACIER, BAFFIN ISLAND CANADA THROUGH EXAMINATION OF AIR PHOTOGRAMMETRY AND FIELD STUDY

AMES, Heather A., Department of Geology,
Bates College, Lewiston, Maine 04240

The Grinnell Glacier, located on Meta Incognita Peninsula, Baffin Island, N.W.T., is one of the southernmost ice caps in eastern North America. The glacier ranges in elevation from sea level to 840 meters. The goal of this study is to determine the change in extent and elevation the glacier has undergone during the Late Holocene.

Geomorphic evidence suggests that the ice mass has decreased since the Little Ice Age (100-350 years B.P.). The position of the glacier during that time may be determined using air photographs of the glacier from the years 1952, 1959, and 1966 and comparing them in terms of the location of the glacier's margins. The moraines and lichen-free zones seen on these photographs make it possible to map the extent of the glacier during its last maximum, the Little Ice Age. Photographs and expedition accounts describe the glacier at the peak of the Little Ice Age and its retreat since. By using surveying equipment and ablation stakes on the glacier, the elevation of the Grinnell Glacier is compared to the elevation on a map made from the 1959 photograph. These data may be used to assess a change in behavior of other glaciers and perhaps a change in climate in the Arctic region.

PALEOENVIRONMENTAL ANALYSIS OF SUBFOSSIL COLEOPTERAN FAUNA FROM THE TOKLAT RIVER VALLEY, CENTRAL ALASKA

CHURCHILL, Lisa L. and NELSON, Robert E., Dept. of Geolgy,
Colby College, Waterville, ME 04901

The Toklat River, Central Alaska is a glacially-fed river whose terraces are both Pleistocene and Holocene in age. Three sediment samples were collected from different stratigraphic horizons along the Toklat River banks and processed for fossil beetle remains using a 300 micron screen and the kerosene flotation technique developed by Coope. One sample has a 600-700 y.b.p. radiocarbon age. Of the other two samples, one is considered to be sub-modern and the other Pleistocene in age, based on the stratigraphic interpretations of Peter Lea, Bowdoin College. A radiocarbon date for the Pleistocene sample will be obtained later this year.

The fauna identified in the Pleistocene sample is indicative of a relatively dry, well-drained, sand-dominated terrain with sparse and discontinuous vegetation (*Amara sinuosa, Bembidion bimaculatum*). Several modern-day tundra species (*A. alpina, Pterostichus haematopus, Lepidophorus lineaticollis*) and species preferring riparian environments (*A. bokori, B. inequale opaciceps, B. alaskense, Oreodytes alaskanus*) were present. The fauna also consisted of a large number of Aphodiine scarabs (gen. et sp. indet.) which feed principally on the dung from large mammals.

The beetle remains found in the two Holocene samples were dominated by *L. lineaticollis*. Other taxa represented included *P. haematopus, A. alpina and Grypus equiseti* (feeds only on horsetails). A few Aphodiine scarabs were found in the sub-modern sample, but were not as abundant as in the Pleistocene sample.

THE EFFECTS OF VARIED SALINITY CONDITIONS ON THE SEDIMENT RECORD IN HIGH ARCTIC LAKES

FRIEDMAN, P., J., Department of Geology, Bates College, Lewiston, Maine, 04240

Regional glacioisostatic rebound has caused uplift and subsequent isolation of fjords and coastal inlets in many regions of the Canadian high arctic. Evolution of these basins from fjords and coastal inlets to lacustrine system has caused a wide variation in water conditions to exist in these lake basins today. Conditions now range from fresh to saline (35‰) and even to hypersaline (>50‰) waters.

The meromictic conditions of four lake basins within the Canadian high arctic, Sophia Lake on Cornwallis Island, and three lakes, Lake C1, Lake C2, and Lake C3 on northwestern Ellesmere Island, produce specific clastic, biologic, and chemical sediments that are indicative of the hydrologic and limnologic conditions of the basins. All cores contained a large quantity of roughly similar compositions of allogenic sediment but the varying hydrologic and limnologic conditions caused a fluctuation of authigenic sediments. Pyrite, gypsum, calcite, aragonite, dolomite, orthoclase, and opaline silica are all present in the fine laminations of the sediment record of meromictic lakes and indicate changes in the lake environment through the sediment record.

In comparison to meromictic lakes throughout a wide variations of environments these four basins are clastic sediment dominated end members. Chemical and biological sedimentation accounts for little of the total sedimentation. It was also found that high inflow rates, turbulence, and water currents disturb the deposition process of authigenic sediments and cause minimal or no deposition of chemical sediments in active lake basins.

GLACIAL HISTORY OF LOWER WRIGHT VALLEY, ANTARCTICA

HALL, Brenda L., Dept. of Geology and Inst. for
Quaternary Studies, UMaine, Orono, ME 04469

At 2.4 Ma, the Earth shifted from extreme global warmth to the ice ages. Here, I test existing hypotheses of dramatic fluctuations in the Antarctic Ice Sheet through this time by a detailed study of a key area in Wright Valley. The ice sheet's response to a warmer-than-present Pliocene climate is relevant to predicted global warming and consequent eustatic sea level rise.

Wright Valley preserves an excellent Pliocene glacial record. Here, clear moraine deposits relate to alpine glacier and ice sheet fluctuations. Geologic mapping, coupled with multiple $^{40}Ar/^{39}Ar$ dates on basalt associated with the glacial drifts, has yielded a detailed chronology of ice advance over the last 4.9 m.y. Buried paleoclimate indicators, such as polar desert pavements, allow interpretation of environmental conditions.

Pliocene ice advance was limited, with the outermost alpine moraines located less than a kilometer from the present glacier margin. Ice has not filled completely the valley since at least 3.9 Ma. Polar desert conditions have persisted through this time.

Evidence for only minor glacial fluctuations contradicts a leading theory, which suggests widespread deglaciation followed by massive expansion of Antarctic ice during the mid-late Pliocene. Rather, results suggest a relatively stable ice sheet in Antarctica since 3.9 Ma.

AN INVESTIGATION OF THE HOLOCENE DEPOSITS WITHIN THE SPRAGUE RIVER SALT MARSH, BATES-MORSE MOUNTAIN CONSERVATION AREA, PHIPPSBURG, MAINE

JONES, Gwyneth
Department of Geology, Bates College, Lewiston, Maine 04240

The Quaternary deposits within the Sprague River salt marsh on the coast of Maine record the area's geologic history since the last glaciation 20,000 years ago. In this study, two coring methods and standard sedimentological techniques were employed to examine the Holocene history of the Morse Mountain area. A network of Eijkelkamp cores was taken to examine the three dimensional stratigraphy in the marsh. The physical and biological contents of these cores were analyzed. Two vibracores were retrieved from the marsh to provide a larger sample for more detailed laboratory analysis and for photographic record. Eijkelkamp sediment cores were logged and subsampled in the field and analyzed in the lab. Sediment samples were analyzed for organic content, structures and color. Plant remains were identified to indicate low and high marsh environments. Shell material, such as bivalves and foraminifera, also aided in the interpretation of former environmental conditions. These geological, botanical, and zoological findings resulted in interpretations of former Holocene marine and marsh environmental conditions, and of relative sea level rise.

Bedrock Location and Low Temperature Bedrock-Water Interaction in Lakes of the Clouds Watershed, Mount Washington, New Hampshire.

PETERS, Stephen C., Department of Geology, Bates College, Lewiston, ME, 04240

Base cations (defined as Ca^{++}, Mg^{++}, Na^{+}, K^{+}) are recognized to have a neutralizing effect on acid precipitation (Driscoll and Newton, 1985; Johnson et al., 1981). Lakes of the Clouds is a watershed located entirely above treeline in the Presidential Range of New Hampshire. Groundwater in the watershed exhibits a pH increase from 4.71 to 5.30. This study attempts to explain the causes behind the increase in pH.

Flame atomic absorption/emission analysis of groundwater samples reveals that concentrations of Ca^{++} and Mg^{++} ions increase with residence time in the groundwater, and strongly correlate with pH. SEM/EDS analysis of the different bedrock types in the watershed indicates high levels of Ca^{++} and Mg^{++} within the Madrid Formation. X-ray mapping places most of this Ca^{++} and Mg^{++} in diopside and tremolite minerals. A ground-based magnetometer survey and outcrop mapping has updated Billings (1946) original map of the region to include the Madrid Formation inside of the watershed. Leaching tests indicate that the Madrid Formation releases Ca^{++} into solution and neutralizes acidity. The other formations in the region either increase or decrease pH slightly.

In a region of little or no soil development and little vegetation, bedrock exerts a strong control over groundwater chemistry. Calcium predominantly weathering from the diopside and tremolite minerals of the Madrid formation has been shown to neutralize acidity at Lakes of the Clouds.

The Hydrogeology of Seawall Beach, Phippsburg, Maine

Robbins, Luke, Bates College.

This is a study of the hydrogeology of Seawall Beach, a barrier spit located near Small Point in Casco Bay, Maine. Wenner array configuration D.C. electrical resistivity lines were conducted parallel to the coastline on the backdune and berm crests. Fixed electrode spacing E.R. was used in order to detect changes in electrical resistivity over time. Shallow wells were installed and monitored for approximately two tidal cycles. Piezometric surface data was correlated to simultaneously collected ocean tide elevation and fixed electrode spacing E.R. data. Land surface, watertable, and salinity profiles were conducted on a line perpendicular to the shoreline.

Wenner Array E.R. models suggest a stratigraphy of dry sands, wet sands, a marine clay layer of the Presumpscot formation at a depth of 10 meters, glacial outwash, and bedrock at a depth of 50 meters. Cyclic fluctuations in piezometric surface occur in berm and dune wells. Well monitoring shows that tidal effects diminish exponentially with increased distance from the ocean. Cyclic fluctuations in apparent resistivity are delayed with respect to piezometric surface. All cyclic fluctuations had a period of approximately one tidal cycle. Salinity and groundwater surface profiles show that freshwater is present in the beach aquifer, and that it discharges on the beach near the fresh/salt water interface.

Costly installation and monitoring of wells may not be necessary where the magnitude of tidally induced fluctuations of groundwater elevation are in question. Fixed spacing E.R. survey may be used to investigate the magnitude of the tidally induced watertable fluctuations in the coastal environment.

A STRUCTURAL ANALYSIS OF THE DUCTILE DEFORMATION IN THE MT.WASHINGTON QUADRANGLE, PRESIDENTIAL RANGE, N.H.

ROSBROOK,Jonathan
BATES COLLEGE,LEWISTON,ME. 04240

During the 1991 summer field season, detailed mapping was done of the metasedimentary rocks within the Mt. Washington Quadrangle of the Presidential Range in northern New Hampshire. An in-depth study of the stratigraphy, structural geology, metamorphism, and geochronology of Mt. Washington resulted during the course of the academic year. The attempt was made to integrate the studies of structure, metamorphism, and geochronology, to come to a better understanding of local and regional tectonic models of the northern Appalachian mountains and to generate a model of the deformation mechanisms and the amphibolite facies metamorphism. This aim was accomplished through a five fold study consisting of: 1) detailed mapping at a scale of 1:3,048(1cm~100ft.) and the compilation of a geologic map and cross-sections through the quadrangle; 2) structural analysis of the field data, to determine relative fold sequences and sense of fold vergences; 3) a mineral chemistry study of the pelitic schists through the use of an electron microprobe; 4) the determination of the conditions of the synkinematic metamorphism by obtaining the pressures and temperatures of metamorphism; and 5) a geochronological study of muscovite and biotite from sillimanite grade schists, to determine the rate of uplift, the timing of orogenic events, and a cooling history of the mountain.

PALEOFLORISTIC TRENDS IN DEVONSHIRE MARSH, BERMUDA.

VONWALLMENICH, Theodore N., RUEGER, Bruce, and NELSON, Robert E., Dept. of Geology, Colby College, Waterville, ME 04901

Devonshire Marsh is a peatland on Bermuda. A 3 cm diameter core was taken for palynological analysis to determine the vegetational history of the marsh, and paleoenvironmental indications toward the island. 8.9 m of continuous core was obtained and treated with a modified acetolysis procedure to extract fossil pollen/spores. Slides were prepared from sample residues at 20 cm intervals. On each slide the first 300 pollen grains/spores viewed were identified and scored.

Changes in the distribution of Myrica, and Poaceae near the base of the core correlate to a 'thermal maximum' hypothesized to have occurred in the Northwest Atlantic ca. 9-2.6 Ka. A significant drop in Juniperus and an increase Myrica is observed near the top indicating a change in the dominant shoreline flora. A cyclical rise and fall of Cyperaceae is concommitantly observed with a rise and fall of Poaceae. The stratigraphy of the marsh is predominantly woody peat. One compact peat unit occurs at 5.5-6.0 cm. Previous basal radiometric dates from other Bermuda wetlands yielded dates from 9-6 Ka. Radiocarbon dates are still pending, but Devonshire Marsh is likely to be of similar age.

Structural Geology of the Mt ClayQuadrangle, Presidential Range, NH

WIDMANN, BETH L. Bates College, Lewiston, ME 04240

This study involves mapping the bedrock geology of the Mt. Clay quadrangle in the Presidential Range, New Hampshire. A major discontinuity in the stratigraphy, structures, and metamorphism, is interpreted to be an early nappe stage thrust fault that divides the quadrangle into an upper and lower plate. Four stratigraphic units are mapped on the upper plate that may correlate to the Silurian Rangeley, Smalls Falls, and Madrid formations, but stratigraphic sequence is uncertain. In the lower plate, six stratigraphic units are recognized, and all are assigned to the Devonian Littleton formation.

A macroscopic fold in the upper plate is defined by bedding and foliation. Smaller, asymmetric folds are visible at the outcrop scale. A macroscopic F1 fold, defined by bedding and axial planar schistosity, dominates the lower plate. Psuedoandalusite lineations parallel the F1 fold axis. Both folds are truncated by the inferred thrust fault. Abundant asymmetric F2 folds have a west over east orientation. The S2 axial plane strikes north and dips moderately to the west. Late folds in the upper plate may not be related to the F2 folds of the lower plate.

Low pressure metamorphism in the lower plate is characterized by psuedoandalusite lineations and is overprinted by staurolite-sillimanite metamorphism. Partial melting and granite injections characterize metamorphism in the upper plate. Prograde metamorphism may have occurred in the cooler lower plate due to the emplacement of the hotter upper plate. The tectonic event related to the structures and metamorphism is presumably the Acadian orogeny.

AN INVESTIGATION OF THE HOLOCENE DEPOSITS WITHIN THE SPRAGUE RIVER SALT MARSH, BATES-MORSE MOUNTAIN CONSERVATION AREA, PHIPPSBURG, MAINE

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PETERS, Stephen C., Department of Geology, Bates College, Lewiston, ME, 04240

Base cations (defined as Ca^{++}, Mg^{++}, Na^{+}, K^{+}) are recognized to have a neutralizing effect on acid precipitation (Driscoll and Newton, 1985; Johnson et al., 1981). Lakes of the Clouds is a watershed located entirely above treeline in the Presidential Range of New Hampshire. Groundwater in the watershed exhibits a pH increase from 4.71 to 5.30. This study attempts to explain the causes behind the increase in pH.

Flame atomic absorption/emission analysis of groundwater samples reveals that concentrations of Ca^{++} and Mg^{++} ions increase with residence time in the groundwater, and strongly correlate with pH. SEM/EDS analysis of the different bedrock types in the watershed indicates high levels of Ca^{++} and Mg^{++} within the Madrid Formation. X-ray mapping places most of this Ca^{++} and Mg^{++} in diopside and tremolite minerals. A ground-based magnetometer survey and outcrop mapping has updated Billings (1946) original map of the region to include the Madrid Formation inside of the watershed. Leaching tests indicate that the Madrid Formation releases Ca^{++} into solution and neutralizes acidity. The other formations in the region either increase or decrease pH slightly.

In a region of little or no soil development and little vegetation, bedrock exerts a strong control over groundwater chemistry. Calcium predominantly weathering from the diopside and tremolite minerals of the Madrid formation has been shown to neutralize acidity at Lakes of the Clouds.

The Hydrogeology of Seawall Beach, Phippsburg, Maine

Robbins, Luke, Bates College.

This is a study of the hydrogeology of Seawall Beach, a barrier spit located near Small Point in Casco Bay, Maine. Wenner array configuration D.C. electrical resistivity lines were conducted parallel to the coastline on the backdune and berm crests. Fixed electrode spacing E.R. was used in order to detect changes in electrical resistivity over time. Shallow wells were installed and monitored for approximately two tidal cycles. Piezometric surface data was correlated to simultaneously collected ocean tide elevation and fixed electrode spacing E.R. data. Land surface, watertable, and salinity profiles were conducted on a line perpendicular to the shoreline.

Wenner Array E.R. models suggest a stratigraphy of dry sands, wet sands, a marine clay layer of the Presumpscot formation at a depth of 10 meters, glacial outwash, and bedrock at a depth of 50 meters. Cyclic fluctuations in piezometric surface occur in berm and dune wells. Well monitoring shows that tidal effects diminish exponentially with increased distance from the ocean. Cyclic fluctuations in apparent resistivity are delayed with respect to piezometric surface. All cyclic fluctuations had a period of approximately one tidal cycle. Salinity and groundwater surface profiles show that freshwater is present in the beach aquifer, and that it discharges on the beach near the fresh/salt water interface.

Costly installation and monitoring of wells may not be necessary where the magnitude of tidally induced fluctuations of groundwater elevation are in question. Fixed spacing E.R. survey may be used to investigate the magnitude of the tidally induced watertable fluctuations in the coastal environment.

A STRUCTURAL ANALYSIS OF THE DUCTILE DEFORMATION IN THE MT.WASHINGTON QUADRANGLE, PRESIDENTIAL RANGE, N.H.

ROSBROOK,Jonathan
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During the 1991 summer field season, detailed mapping was done of the metasedimentary rocks within the Mt. Washington Quadrangle of the Presidential Range in northern New Hampshire. An in-depth study of the stratigraphy, structural geology, metamorphism, and geochronology of Mt. Washington resulted during the course of the academic year. The attempt was made to integrate the studies of structure, metamorphism, and geochronology, to come to a better understanding of local and regional tectonic models of the northern Appalachian mountains and to generate a model of the deformation mechanisms and the amphibolite facies metamorphism. This aim was accomplished through a five fold study consisting of: 1) detailed mapping at a scale of 1:3,048(1cm~100ft.) and the compilation of a geologic map and cross-sections through the quadrangle; 2) structural analysis of the field data, to determine relative fold sequences and sense of fold vergences; 3) a mineral chemistry study of the pelitic schists through the use of an electron microprobe; 4) the determination of the conditions of the synkinematic metamorphism by obtaining the pressures and temperatures of metamorphism; and 5) a geochronological study of muscovite and biotite from sillimanite grade schists, to determine the rate of uplift, the timing of orogenic events, and a cooling history of the mountain.

PALEOFLORISTIC TRENDS IN DEVONSHIRE MARSH, BERMUDA.

VONWALLMENICH, Theodore N., RUEGER, Bruce, and NELSON, Robert E., Dept. of Geology, Colby College, Waterville, ME 04901

Devonshire Marsh is a peatland on Bermuda. A 3 cm diameter core was taken for palynological analysis to determine the vegetational history of the marsh, and paleoenvironmental indications toward the island. 8.9 m of continuous core was obtained and treated with a modified acetolysis procedure to extract fossil pollen/spores. Slides were prepared from sample residues at 20 cm intervals. On each slide the first 300 pollen grains/spores viewed were identified and scored.

Changes in the distribution of Myrica, and Poaceae near the base of the core correlate to a 'thermal maximum' hypothesized to have occurred in the Northwest Atlantic ca. 9-2.6 Ka. A significant drop in Juniperus and an increase Myrica is observed near the top indicating a change in the dominant shoreline flora. A cyclical rise and fall of Cyperaceae is concommitantly observed with a rise and fall of Poaceae. The stratigraphy of the marsh is predominantly woody peat. One compact peat unit occurs at 5.5-6.0 cm. Previous basal radiometric dates from other Bermuda wetlands yielded dates from 9-6 Ka. Radiocarbon dates are still pending, but Devonshire Marsh is likely to be of similar age.

Structural Geology of the Mt ClayQuadrangle, Presidential Range, NH

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This study involves mapping the bedrock geology of the Mt. Clay quadrangle in the Presidential Range, New Hampshire. A major discontinuity in the stratigraphy, structures, and metamorphism, is interpreted to be an early nappe stage thrust fault that divides the quadrangle into an upper and lower plate. Four stratigraphic units are mapped on the upper plate that may correlate to the Silurian Rangeley, Smalls Falls, and Madrid formations, but stratigraphic sequence is uncertain. In the lower plate, six stratigraphic units are recognized, and all are assigned to the Devonian Littleton formation.

A macroscopic fold in the upper plate is defined by bedding and foliation. Smaller, asymmetric folds are visible at the outcrop scale. A macroscopic F1 fold, defined by bedding and axial planar schistosity, dominates the lower plate. Psuedoandalusite lineations parallel the F1 fold axis. Both folds are truncated by the inferred thrust fault. Abundant asymmetric F2 folds have a west over east orientation. The S2 axial plane strikes north and dips moderately to the west. Late folds in the upper plate may not be related to the F2 folds of the lower plate.

Low pressure metamorphism in the lower plate is characterized by psuedoandalusite lineations and is overprinted by staurolite-sillimanite metamorphism. Partial melting and granite injections characterize metamorphism in the upper plate. Prograde metamorphism may have occurred in the cooler lower plate due to the emplacement of the hotter upper plate. The tectonic event related to the structures and metamorphism is presumably the Acadian orogeny.

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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 four times a year (more or less), approximately on a quarterly basis starting in September. The Society year runs from August 1st to July 31st. Annual dues and gift contributions to the Society are tax deductible. There are three classes of memberships:

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