The Maine Geologist

August 1995

Newsletter of the Geological Society of Maine

Vol. 21, No.2

President's Message
by
Fred Beck

Summer is well under way now, the black flies are gone and numerous field projects have been started with high hopes and thin budgets. We have a new State Geologist, Dr. Robert G. Marvinney, and the Maine Geological Survey survived the budget process with all programs intact and funded. The GSM has over 300 members, many of whom are up to date with their dues. We enjoyed an excellent selection of student papers and poster sessions at the Spring meeting at Bates College. All of the above suggests that geology is thriving in Maine.

Although there will not be a GSM field trip this summer, there will be a wide variety of trips to enjoy in October at the annual NEIGC field conference. Bowdoin College, Brunswick, will be the headquarters for the conference this year. Any questions about the conference can be directed to Arthur Hussey at 725-3219. Concurrent with the NEIGC we will have our Fall business meeting. Our by-laws state that we must have an election of officers at the Fall meeting. Our nominating committee has recommended that all current officers be re-elected for another term, which will mean that all officers will, if elected, end up serving a two-year term. All of the officers have agreed to serve a second term. Directors still serve three years, with a new director being elected each year. The new director on the slate of officers for next year will be Steve Pinette.

The Fall GSM meeting will be held Friday evening, October 6, at 6 PM at the Smith Union at Bowdoin College. We'll plan to make the meeting short to allow everyone to enjoy the beginning of the NEIGC ice-breaker reception which follows at 6:30 in the same room. I urge you all to attend if possible and to encourage students and others participating in the field trips to come as well. The lifeblood of any organization is a continuing supply of young new members.

There is now a four-drawer file permanently housed in Augusta at the Maine Geological Survey's library, which is and will continue to be a repository for GSM archives. In addition to GSM business related items, a complete set of all our newsletters, bulletins and field guides will be available for review and copying. Bob Johnston is "key keeper" to this file cabinet so be sure to contact him if you are interested in browsing through the records.

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GEOLOGICAL SOCIETY OF MAINE
FALL MEETING

Friday, October 6, 1995
6:00 p.m.
Smith Union, Bowdoin College
Brunswick, Maine

Held in conjunction with the New England Intercollegiate Geological Conference annual meeting.

Reminder: There will be no GSM summer field trip because of the numerous field trip offerings at NEIGC.

GSM Spring Meeting Minutes
Bates College, Lewiston, Maine
April 14, 1995

The Spring meeting began after completion of the student presentations. President Fred Beck conducted the meeting. The items listed below were discussed at the meeting.

1. During the second week of July 1995, Dyke Eusden, Patty Millette and Woody Thompson will teach a course for junior high and high school teachers; cost per participant is $700. The course is designed for teachers to take home materials to use in the class room. If interested, get application forms from Dyke.

2. Treasurer's Report: Marty Yates, $4,321.00 in the bank, 310 members.

3. Comments on Fall Meeting minutes: accept as is.

4. CREST Program: Patty Millette - no official person in charge now, the field book is almost done, videos are all completed, black & white poster is done, color version of poster is to be completed. CREST was an MGS program, therefore, once the materials are all done, it is up to MGS & GSM to decide what to do with the materials.

5. Meeting about Earth Science Teaching in Maine for high school teachers: Patty Millette attended, only 3 people were present. Tried to change the focus.

6. Joe Kelley has agreed to head the compiling of information for a Geology of Maine book at the college freshman level. It could be a resource book for teachers and people taking the geology certification test.

7. GSM Bulletin: Marc Loiselle - the next GSM Bulletin #4 is close to completion. Expect the mock up ready this month and ready for printing this summer.

8. Friends of the Pleistocene: Bob Johnston - Meeting May 13-14, 1995, around Sebago Lake. Registration by May 1, 1995.

9. Short Course: Fred Beck - no course planned for this Spring. Maybe a course this Fall, geared towards the geology certification test areas, possibly in Nov. '95. Receive about 15 applications per quarter to take the certification exam.

10. Fall Meeting: Fred Beck - Fall meeting will be held October 6-8, 1995, in Brunswick, Maine, in association with the NEIGC. Plan is to hold the fall business meeting on Friday (Oct. 6) evening after the field trips and prior to the social.

11. President's box material: Fred Beck - need a permanent place to house this material, Bob Johnston offered a home in the Maine Geologic Survey Office. GSM will purchase a four-drawer filing cabinet to hold the boxed material in the Maine Geologic Survey Office.

12. Newsletters: Fred Beck - sources of all newsletters have been identified, therefore, copies can be obtained and a complete set can be created and placed in the filing cabinet housed at the MGS office.

13. Future Spring Meetings: Spring Meeting 1996; Colby College will be the host. Spring Meeting 1997; may be held at Orono's new Geology Building.

14. No Summer Field Trip, field trip will be held in the fall, in association with NEIGC.

15. Mineralogy of Maine: New book, on sale now at the Maine Geologic Survey.

Following the social hour and dinner, Dr. Tom Eastler of the University of Maine at Farmington gave a presentation titled "Geology in the Military: Geologic Assessment of Military Underground Facilities as Effective Barriers to Conventional Weapons Attack." Dr. Eastler spoke to a captivated and enthralled audience for about 70 minutes, showing more than a carousel of slides. As Dr. Eastler spoke in high gear, I tried hard to take notes in order to prepare a summary for the newsletter. Below are excerpts jotted down during Dr. Eastler's presentation.

Dire situation exists today since we do not know who our enemies are.

Weapons of mass destruction are put underground. If on the surface, they are visible and can be destroyed.

What do you use against 20th century nuclear weapons and underground weapons? Conventional weapons.

Nature's own brittle deformation is what protects against weapons.

Photo interpretation can be used to tell you what is going on underground (spoil piles).

Studies of the rock penetration ability of weapons on rock are conducted.

Look for a single point that will incapacitate an underground facility and not blow the whole underground facility up (shut the place down with minimal damage to people).

Many slides were shown of the different underground facilities, from munitions storage, to tunnels, to petroleum storage chambers, to aircraft storage facilities, etc. In building and using underground facilities, several properties, such as, Intact Mechanical Properties, Weight/Volume Properties, Interpreted In-situ Properties, Penetrability Properties, and Tunnel Response to Conventional Munitions Detonation need to be looked at. Dr. Eastler concluded his presentation by saying that strategic geologic intelligence is vital for the future.

Respectfully submitted,
Rebecca Hewett, Secretary

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Walter Anderson Fund
of the Geological Society of Maine

Walter A. Anderson retired from the Maine Geological Survey on May 12, 1995 after more than 27 years with the Survey and 17 years as State Geologist. Walter has specifically requested that he not be showered with gifts to commemorate his retirement. Instead, Walter requests that contributions be made to the Geological Society of Maine, specifically the Walter Anderson Fund currently being initiated.

The Walter Anderson Fund will be used to support student activities, such as recognition of outstanding student papers at the annual spring meeting of the Society. Contributions can be made by check, made out to the Geological Society of Maine, and mailed to Martin Yates, Department of Geological Sciences, 5711 Boardman Hall, University of Maine, Orono, ME 04469-5711. *Contributions are tax deductible.*

The Society and the geological community thank Walter for all his contributions to Maine geology, and we wish him all the best in the future. We know we'll see him around!

GSM Treasurer's Report
July 19, 1995

Balance on hand 2/16/95	**$4,600.58**
Receipts Subtotal	**$3,952.00**
Dues	193.00
Education Fund	29.00
Walter Anderson Fund	3,730.00
Expenses Subtotal	**$ 592.50**
Postage	127.52
Fall Meeting	48.15
New Filing Cabinet	181.83
Balance on hand 7/19/95	**$7,960.08**

Submitted by
Martin Yates, Treasurer

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Meet the New Maine State Geologist
Dr. Robert G. Marvinney

A native of New Jersey, Bob attended Cook College of Rutgers University and graduated with a B.S. in geology in 1978. In the fall of 1978, he enrolled in the graduate program at Syracuse University and pursued his interest in northern Appalachian geology. This was first through a Master's thesis project involving bedrock mapping along a segment of the Kennebec River in west-central Maine, the Master's degree in geology being conferred in 1982. Prior to completion of the Master's work, he began a more advanced project mapping metasedimentary and metavolcanic rocks of the Connecticut Valley-Gaspe trough north of Jackman, Maine, which was eventually worked into a Ph.D. dissertation, completed in 1986. During these summers, Bob was a contract geologist with the Maine Geological Survey, and worked under Professor Gary M. Boone of Syracuse University, also a long-time contract geologist with MGS. In the fall of 1983, prior to completion of the Ph.D., Bob accepted employment with Exxon Production Research Co., Houston, Texas, and put his computer expertise developed at Syracuse University to work developing geographic information system (GIS) applications for the oil industry. The Ph.D. was completed while employed full-time. In early 1987 a position became open at the MGS for an individual with bedrock mapping and GIS skills for which Bob applied. In April of 1987, he and his wife Cheryl (also a geologist and Syracuse grad) moved to Maine, a week long trip that began in the summer-like heat and humidity of Houston, traversed spring in the Carolinas, and ended in 5 inches of snow in Augusta.

Bob directed the Mapping and Resource Assessment division of the Maine Geological Survey, personally conducting or directing mapping in many areas of the State, and was a principal author of a statewide gravel aggregate resource assessment completed in 1993. He also managed the Survey's GIS and participated in the development of the State's GIS. Bob was appointed as Director of the Maine Geological Survey on May 15, 1995.

NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL CONFERENCE
October 6, 7, and 8, 1995
Bowdoin College, Brunswick, Maine

A variety of field trips along the Maine coast, inland, and in New Hampshire will be held during this three-day weekend. Conference information can be obtained from Arthur Hussey II, (207) 725-3219 or e-mail address (ahussey@polar.bowdoin.edu). Registrations should be mailed to NEIGC 95 c/o Peter Lea, Dept. of Geology, Bowdoin College, Brunswick, ME 04011.

GSM STUDENT ABSTRACTS
Spring Meeting, Bates College
April 14, 1995

BEDROCK GEOLOGY AND PETROLOGIC HISTORY OF BARTER AND McGEE ISLANDS, MUSCONGUS BAY, MAINE.

BERKOWITZ, L.A., Department of Geology. Bates College, Lewiston, Maine, 04240.

Barter and McGee Islands are part of the Georges Islands in Muscongus Bay, Maine. They lie within the St. Croix Terrane of the Atlantica Composite Terrane. A bedrock geologic map, modal analysis to classify the rocks, and normative analysis using ICP is used to better understand the tectonic environment of emplacement and the relationships of the rocks to each other. Variation and discrimination diagrams show that the light-colored igneous rocks intruded as multiple pulses of a fractionating magma chamber in a subduction zone environment.

Barter and McGee Islands are composed of schist and quartzite interbeds. These beds lie within the Penobscot Formation and were layed down in the Early Ordovician. During the Salinic Orogeny, which extended from the Late Ordovician to the Late Silurian, three phases of deformation related to a subduction zone caused three phases of folding and two phases of metamorphism in the rocks in the field area. The first two deformational events were the result of regional compression, and the third is associated with an igneous intrusion which also caused the second phase of metamorphism. Early Devonian co-mingled basalt and granite dikes, Late Devonian two-mica granite veins, and a Mid-Jurassic basalt dike are minor features of the present structures.

POST-GLACIAL VEGETATIONAL HISTORY OF THE GREAT BOG, BELGRADE, MAINE

DAWSON, John P., Dept. of Geology, Colby College, Waterville, ME 04901

A 6-m vibracore taken from the Great Bog in Belgrade, Maine, was sampled for pollen analysis at 10-cm intervals. Samples were processed and evaluated using standard techniques.

The uppermost 3.8 m of the core is fine peat; this overlies 1.5 m of lacustrine clay below which are additional organic deposits. Three problematic ^{14}C dates from the top of the clay to the bottom of the core are statistically equivalent, suggesting near-instantaneous deposition; the base of the core is about 8,500 ^{14}C years old. Additional work is planned to delimit the areal extent of the clay unit and resolve the dating anomalies in the core.

The pollen record indicates that the Great Bog was an open embayment of Great Pond up until 6,500 b.p., when the *Sphagnum* mat developed. Pine (*Pinus*) dominated the regional vegetation up until 6,500 b.p., when hemlock (*Tsuga*) became abundant. At 0.3 m a peak in ragweed (*Ambrosia*) marks the beginning of the European period.

SEABED DISTURBANCE BY COASTAL MAINE STORMS.

DICKSON, Stephen M., Department of Oceanography, Libby Hall, U. Maine, Orono, Maine 04469-5741.

The University of Maine / Maine Geological Survey marine sedimentology working group has gathered side-scan sonar images of shoreface environments of the inner continental shelf for a decade. Repeated sonar surveys and large-scale GIS mapping of shoreface sand and gravel patches demonstrate a remarkable permanence of acoustic images in recognizable patterns, despite intense winter storms and a hurricane during the last five years. Coastal combined flows from wind, waves, and tides generate: (a) sheet sands that are the modern analogue to hummocky cross-stratification (hcs), and (b) sand and gravel lags with wave-oscillation ripples. These modern deposits are similar to those in the geologic record of ancient, storm-dominated shelves. Unlike published interpretations, we believe that both hcs and gravel beds are produced over many years by multiple sedimentation events and neither is a product of a single storm event. To explain our observations, we developed a three-dimensional storm sedimentation model of shoreface dynamics. This model may help in the interpretation of other side-scan images of coastal New England and yield a better understanding of sedimentary sequences generated by storms and preserved in the geologic record.

GIS APPLICATIONS FOR RECREATIONAL LAND DEVELOPMENT: A STUDY OF SUGARLOAF/ USA

DOYLE, Michael R. Univ. Maine, Farmington.

Geographic Information Systems (GIS) applications allow for a complete analysis of an area at a fraction of the cost and in a fraction of the time previously required. The ease of linking database features to map entities, and the ability to integrate maps of different scales at the same time allow for rapid generation of meaningful maps which may depict a wide range of environmental conditions in a given study area. These maps, which can be changed rapidly as new data appear, are very useful for the development of Environmental Impact Statements (EIS).

The land around Sugarloaf/USA was studied using GIS techniques which integrated topography, soils data, and solar aspect. Appropriate buffers were applied to exclude areas proximal to water bodies and proximal to the habitat of the Yellow-Nosed Vole (an endangered species). A proposed layout for an expansion to the Sugarloaf/USA ski area, which would provide the best skiing at the least cost to the environment, was developed. The final product was not commissioned by Sugarloaf/USA and does not necessarily represent an option being considered by them.

PALEO-TECTONIC RECONSTRUCTIONS OF MAINE

Eden, J., Lasca, A., Pavlik, R., and Waskiewicz, J., Dept. of Geology, Bates College, Lewiston, Maine 04240

The purpose of this study was to attempt paleo-tectonic reconstructions of Maine through geologic time. Paleo-tectonic maps were drawn for the Precambrian, Cambro-Ordovician, Siluro-Devonian, and Carboniferous-Mesozoic.

The Chain Lakes Massif represents rifted Grenville basement with younger rift clastics. Much of the coast of eastern Maine is interpreted as a composite of peri-Gondwanan Precambrian basements with Paleozoic overlap sequences that did not accrete with N. America until after the Precambrian.

The Penobscottian Orogeny, involved the outboard collision of the Central Maine and Brompton-Cameron Terranes during the Ordovician. The Taconic Orogeny was the collision of Laurentia with the Central Maine/Brompton-Cameron composite during the Middle Ordovician. The collision of the Miramichi island arc with composite N. America followed in the Ordovician.

The effects of the Late Ordovician to Silurian Salinic Orogeny are exposed along the central and eastern Maine coast within the peri-Gondwanan terranes. The effects of the Devonian Acadian Orogeny dominate the Central Maine terrane and appear less extensive in the regions effected by the Salinic.

The Carboniferous-Permian is documented by strike-slip faulting, rare clastics, and large plutons; a result of the Alleghanian closure of Meguma/Avalon with North America. Mesozoic rifting and extension significantly pulled apart the latest Paleozoic landscape along brittle structures synchronous with the intrusion of mantle derived plutonic/volcanic rocks.

LATE QUATERNARY EVOLUTION OF THE LOWER KENNEBEC RIVER, MAINE.

HANNUM, Matthew, B., Univ. of Maine, Dept. of Geology, Orono, ME 04469.

The Kennebec River estuary in central Maine is an excellent laboratory for the study of estuarine sediment transport and deposition. It is a north-south-orientated(land to sea), bedrock controlled, fluvially dominated, partially mixed embayment. Influx to the estuary from the Androscoggin and Kennebec Rivers varies seasonally with highest flow rates in the Spring. Seismic and sidescan sonar imaging, bridge borings, and sediment grab samples provide data for the interpretation of sediment patterns. The most seaward 25km of the Kennebec river is divided into two major depocenters separated by bedrock highs. The geometry of the bedrock narrows controls the degree of sediment preservation within the estuary. Seismic surveys indicate that greater than 50m of Quaternary age sediments have accumulated within Long Reach basin. Glacial-marine sediments deposited in Long Reach have remained relatively unscoured. Overlying the glacial-marine sediments are nearly 20m of sand that has been reworked into a four-fold hierarchy of bedforms with juxtaposed flow directions. Bedforms within the estuary range from 0.6 to 1.2km wavelength ebb-orientated sandwaves to 2 to 6m wavelength ebb-orientated megaripples and 40 to 50m wavelength flood-orientated sandwaves to 2 to 8m wavelength flood-orientated megaripples. Though net flow of sediment is seaward, the estuary apparently releases material only in large pulses during Spring freshet.

DELINEATING SOURCES OF THE EMBDEN FORMATION IN THE LOWER CARRABASSETT RIVER VALLEY, MAINE.

JAGER, M. G., Department of Geological Sciences, University of Maine, Orono,ME 04469.

Detailed surficial geologic mapping of glacial deposits in the lower Carrabassett River valley establishes the source areas and spatial distribution of the Embden Formation. The Embden Formation, as defined by previous workers, is a time transgressive, fine-grained, glaciofluvial, pebbly sand deposit that conformably overlies the fossiliferous marine mud of the Presumpscot Formation. Within the study area, Embden Formation sediments are present in the ice distal facies of two outwash plain systems, the Lexington Outwash Plain and the Carrabassett Outwash Plain.

Samples of mud deposits, collected from surface exposures and by piston coring in Embden Pond, contained only enough fossil material to ascertain that the muds were marine in origin. Hence, attempts to establish an absolute chronology for the deglaciation of this area, during this study, failed.

SILICEOUS MICROFOSSILS FROM DEEP SEA SEDIMENTS OF THE GREENLAND MARGIN.

LURVEY, L. KIRK, Micropaleontology Undergraduate Research Laboratory, UM-Presque Isle, Presque Isle, Maine 04769.

The Ocean Drilling Program (ODP), an international oceanographic organization, recovered sediments from the continental rise of the Greenland Margin during a cruise in October of 1993. The study hole 918D, is located approximately 130 km from the Greenland coast near the center of a seaward-dipping reflector sequence. A core of Tertiary sediments was recovered with various siliceous microfossils from a water depth of 1868 m.

A quantitative study of the microfossils was conducted and found to include sponge spicules, silicoflagellates, and ebridians. A large fossil-barren interval occurred in early Miocene and again in late Miocene sediments of the core. Though generally rare, the sponge spicules were morphologically diverse, with monaxons being the most abundant. Some specimens of an undescribed spicule type were found. Representatives of several silicoflagellate genera were found in a narrow horizon. The differing ages of the silicoflagellates suggests that this layer has been reworked, possibly because of a turbidite sequence. This interval also included two large ebridians, *Triskelion gorgon* and *Adonnadonna primadonna*, that have not been previously observed from the North Atlantic. This suggests that these species are more widely distributed than the current literature would indicate. An unidentified ebridian, lacking a circular inner ring, was also noted.

CHEMISTRY OF TWO SALT-CONTAMINATED BEDROCK AQUIFERS FROM CENTRAL MAINE

Marci, J. P., Dept. of Geological Sciences, Univ. Maine, Orono, Maine 04469

The chemistry of groundwater highly contaminated by roadsalt at two sites in Maine (Glenburn and Winterport) has highly elevated concentrations of Ca and Mg derived from cation exchange, in addition to the Na and Cl from the roadsalt. Calcium and Mg are highly correlated for samplings at both sites and at different times. These correlations are attributed to base cation exchange between the salt-rich solutions and the soil.

A chemical model has been developed using a mass balance approach to distinguish among the different sources contributing cations to the groundwater. The salt from the salt-storage piles is factored out of the chemistry. Sodium lost through adsorption on the soils is compensated by gain, on an equivalent basis, of Ca, Mg, and K desorbed from the soil. Correlations between exchanged Na and the sum of desorbed Ca, Mg, and K are very strong ($R^2 \cong 1.0$) with slopes ranging from 1.03 to 1.13, nearly the predicted 1.0.

Two analytical advection-dispersion hydrologic model are used to predict the shape and chemistry of the plume at Winterport, through space and time. The final goal is to predict the time necessary for the system to have concentrations of contaminants to potable water standards.

THE GEOCHEMICAL INFLUENCES OF ROAD SALT ON SOILS AND SURFACE WATER IN EASTERN MAINE.

MASON, Charles F., Department of Geological Sciences Room 119, 5711 Boardman Hall, University of Maine, Orono, ME 04469-57111.

The sea salt effect, a process where Na from salt shifts cation exchange equilibria, helps describe the effect of marine aerosols on surface water chemistry. Sodium cations exchange for other cations sorbed to soil particles, increasing dissolved cation concentrations in soil solution and runoff. Road deicing salts are a more concentrated source of salt and produce significantly higher Na concentrations in soil solutions, thus increasing the amounts of H, Al, Ca, Mg, and K desorbed from soils.

By studying two small catchments in central Maine, a bett understanding of geochemical influences of road salt on surface water will be achieved. Sampling streams along elevational transects reveals their chemical evolution over time and space. Ion concentrations are a function of atmospheric salt deposition, road salt application, chemical weathering of bedrock and road bed material, and cation exchange. For one stream, the net release of Ca, Mg, and K into solution due to cation exchange is on the order of 95, 26, and 6 ueq/l (average), respectively. Conversely, Na is accumulating within the soils (38 ueq/l average loss from solution).

Analyses of soil samples will help determine the extent to which roadside soils can buffer doses of Na before the soils become depleted of Ca, Mg, and K to an extent harmful to vegetation.

The Bedrock Geology and Tectonic History of Davis and Thompson Island, Muscongus Bay, Maine

MULLENS, B. R., Dept. of Geology, Bates College, Lewiston, Maine, 04240

This project focused on the bedrock geology and tectonic history of Davis and Thompson Islands which are part of the Georges Islands of Muscongus Bay, Maine. These islands lie within the peri-Gondwanan St. Croix Terrane. They are located directly east of the Sennebec Pond fault and just west of the Turtle Head Fault, both major terrane boundaries.

Four major metasedimentary units were mapped with in the Allen Island Formation which has been correlated to the Cambro-Ordovician Penobscot Formation. Five unique phases of igneous intrusion were mapped in the study area. These igneous units range in age from Silurian to Mesozoic.

Three major phases of ductile folding (D1, D3, and D4) and one phase of brittle thrust faulting (D2) were recognized in the field area. Three phases of metamorphism were observed in the field and confirmed though thin section analysis. M1 and M2 were sillimanite zone events while M3 was a retrograde chlorite event.

It is clear from the high grade metamorphic and structural events mentioned above that this study area experienced significant tectonism. Most of the major tectonism occurred in the Silurian Salinic orogeny. This is different than the previously accepted dominance of the Devonian Acadian Orogeny.

MODERN SEDIMENT DISTRIBUTION AND POST-GLACIAL CHANGES IN THE LAKE AUBURN BASIN, AUBURN, MAINE

NORTHROP, Marjorie C., Geology Dept., Box 527 Bates College, Lewiston, ME 04240

A study of the Lake Auburn basin was conducted to assess the significance of the modern sediment distribution and evaluate the mid-Holocene sediment record.

The Lake Auburn basin contains a sedimentary record that illustrates past environmental conditions from the retreat of the last ice sheet, approximately 13,000 years B.P., up to the modern temperate, diamictic, lacustrine conditions of today. Evidence for both the natural fluctuations in the sediment record and artificial changes induced by human encroachment on the watershed are preserved.

Post-glacial fluctuations in climate influenced lake levels lake levels making them significantly lower, than present or historical levels, during the Holocene, following a regional pattern of climatic warming. The lake level lowered from the stable basin threshold in the early Holocene at 79m asl to a low stand in the mid-Holocene at 74 m asl. Macrophytic plant fragments in the sediment record have dates of 6720±225 and 8,840 ±130 years BP which indicates the extent of the mid-Holocene low lake level, in accordance with regional trends in the Northeastern United States. In addition, there are disconformities in the acoustic record which may reflect basinward shifts in nearshore and shoreline deposits and erosional benches 6 to 7 meters below the surface.

The sediment record preserves effects of modern impacts, including the 18th century dam, with a coarse unit below modern lacustrine sediments.

STRUCTURAL HISTORY OF THE MOXIE PLUTON, NORTH-CENTRAL MAINE.

REDMOND, ANNA d., Dept. of Geology, Colby College, Waterville, Maine 04901.

As a part of the northern Appalachian Mountains, the Moxie Pluton has been subjected to multiple phases of deformation: the emplacement of the pluton, regional compression of the Paleozoic (D_1), regional extension of the Mesozoic (D_2), and postglacial jointing. The structural features embedded in the pluton can be systematically related to extension and failure of the continental lithosphere. Previous study of the central portion of the pluton by Hon and Schulman indicates that it intruded in Early Devonian time (approximately 393 m.y.). Mineralogical analysis by Draper and Meckel suggests that the southern ultramafic portion of the pluton consists predominantly of olivine, pyroxene, feldspar, and occasional spinel. Deformation properties within the pluton are controlled by joint and foliation orientations, which are linked to the flow-induced alignment of crystals.

THE ELLSWORTH AND RELATED FORMATIONS: strongly sheared rift deposits (quasi-ophiolitic melange)?

REUSCH, D., Dept. of Geological Sciences, University of Maine, Orono, Maine 04401

A metasedimentary-igneous complex comprising the Ellsworth Formation, North Haven Formation, and part of the Islesboro Formation extends from North Haven Island NE to Ellsworth and beyond. It is composed primarily of greenschists, including metaarkose, riddled with greenstones (basalts) and locally metarhyolites. The metabasalts exhibit little strain compared with the metasediments, in which bedding is typically transposed. A locally developed lineation plunges gently to the SE. On Deer Isle, a block of gabbro structurally isolated within greenschist suggests that two nearby sheared serpentinite bodies have affinity with this assemblage. The EF may be thrust NW over the Ordovician? Penobscot Formation, has an ambiguous relationship with the Castine Formation, and is unconformably overlain by the Silurian Ames Knob Formation.

A model for the EF has it accumulating within a sediment flooded extensional setting (Gulf of California-type) based on extensive mafic and lesser felsic igneous rocks, Ni-rich ultramafic bodies, presence of arkose, and Cu-Zn mineralization. It was heterogeneously but strongly deformed at a convergent (or transpressional) boundary and transported NW over the PF (basal Avalonian/Gondwanan rift deposits over younger A/G slope-rise). Later deformation was minor compared with the pre-Silurian event.

THE RELATIONSHIP BETWEEN FRACTURED BEDROCK AND ARSENIC-BEARING WELLS IN THE BUXTON, MAINE AREA

STARER, Amy L., Dept. of Geology, Bates College, Lewiston Maine 04240

A brittle structure analysis of bedrock outcrops in the vicinity of the Saco River was completed to evaluate the relationship between elevated levels of arsenic in private wells and the regional bedrock geology. By evaluating the distribution, orientation, and continuity of bedrock fractures, it is possible to determine the relationship between the As-bearing wells and the fractured bedrock.

The dominant orientations of these fractures are determined from field measurements and from topographic maps and aerial photographs. The field data was digitally plotted on histograms, Rose diagrams, and contoured equal area projections. The straight stream reach and photo-lineaments were traced off topographic maps and digitized using the Geographic Information System at the Maine Geological Survey.

Brittle structures included bedding planes, cleavage, dikes, joints, and veins. The dominant orientations are NE to SW and ESE to WNW. The straight stream reaches resemble the synoptic brittle structure data with major orientations of NE to SW and SE to NW. The photo-lineaments are oriented primarily in a N to S direction.

There is no relationship between the arsenic contamination and surficial geology. The contaminated wells occur in the metamorphic rocks and are absent in the granitic plutons. The dikes and joints share the NE to SW orientation and are interpreted to be genetically related. The co-existence of the basalt dikes and the metamorphic rocks appears linked to sites where the groundwater is contaminated.

PALEOMAGNETISM OF UPPER-PLEISTOCENE SEDIMENTS ALONG NUSHAGAK BAY, SOUTHWESTERN ALASKA.

WOBUS, Cameron W., Geology Department, Bowdoin College, Brunswick, ME 04011

Many lowland basins in Alaska contain thick fills of Pleistocene sediment that accumulated in diverse depositional environments. Correlation within and between basins generally requires application of a broad spectrum of geochronological techniques. This study assesses the utility of natural remanent magnetism (NRM) as a stratigraphic tool for the correlation of upper-Pleistocene nonglacial deposits in Alaska, focusing upon the Nushagak-Bristol Bay lowland of southwestern Alaska.

Bluffs along the western shore of Nushagak Bay expose a consistent stratigraphic sequence constrained by radiocarbon dating and tephra layers. Basal glacigenic units, including the Nushagak Formation (>40 ka), represent extensive ice advance into a macrotidal estuary similar to the modern bay. Overlying nonglacial units that pre-date 25 ka include the Etolin complex, a massive organic silt affected by colluvial and pedogenic processes under cooler-than-modern climates.

This study seeks to determine the reliability of paleomagnetic secular variation as a means of correlating Upper-Pleistocene sediments. Secular variation curves were constructed for the Etolin complex in three different locations along the shores of Nushagak Bay, and declination swings have been correlated using tephra layers and lithostratigraphic boundaries as markers. In addition, the study finds that tidal muds of the Nushagak Formation have steep, positive inclinations consistent with the orientation of the modern-day geomagnetic field. This result conflicts with earlier observations that the unit records shallow, reversed inclinations attributable to a geomagnetic excursion.

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 modern 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.
$4.00	STUDENT MEMBER	Persons currently enrolled as college students.

A $2.00 APPLICATION FEE is a one-time fee for all new members, payable when applying for membership.

THE GEOLOGICAL SOCIETY OF MAINE ANNUAL RENEWAL / APPLICATION FOR MEMBERSHIP

Application Fee	$2.00	$_____	Name_____	**Checks payable to:**
Regular Member	$7.00	$_____		Geological Society of Maine
Associate Member	$6.00	$_____	Address_____	Martin Yates, Treasurer
Student Member	$4.00	$_____		c/o Dept. Geological Sciences
Contributions to GSM		$_____ (gift or fund on check)	_____	5711 Boardman Hall
TOTAL ENCLOSED		$_____		University of Maine
			_____	Orono, Maine 04469

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

1995/96 SOCIETY YEAR BEGINS AUGUST 1 - PLEASE SEND DUES TO TREASURER

THE GEOLOGICAL SOCIETY OF MAINE
c/o Arthur M. Hussey, II, Postal Chairman
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Brunswick, ME 04011

THE MAINE GEOLOGIST is published three times a year, in early fall, mid-winter, and summer, for members of the Geological Society of Maine.

Correspondence about membership in the Society should be mailed to Martin Yates, Department of Geological Sciences, 5711 Boardman Hall, University of Maine, Orono, Maine 04469.

Items for inclusion in the newsletter may be directed to Susan Weddle, 11 Beech Drive, Brunswick, ME 04011.

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