THE MAINE GEOLOGIST

THE GEOLOGICAL SOCIETY OF MAINE 1974

THE NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

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President's Message

Since our last newsletter, we have had two excellent and generally well attended meetings at the University of Maine at Orono/Bangor and at Bates College. My thanks to Joe Kelley and Joe Kowalik (MMRA) for organizing the winter joint meeting and to Don Newberg and Roy Farnsworth for running the spring meeting. With help like this, being President is much easier.

The presentations at the current marine research symposium were indeed current: they included slides even the speakers hadn't seen before. Joe Kelley, Craig Shipp, Dan Belknap and Sarah Miller all deserve thanks for hard work and good presentations. Ed Everson gave a provocative and well-illustrated presentation on glacial prospecting in Alaska: a good minerals/geologic crossover. I was very pleased with the attendance by both GSM and MMRA members at this meeting: we had perhaps 80 in the afternoon and 60 in the evening.

The spring meeting also featured excellent presentations. The student papers were the best in my memory. The division into presentations and poster sessions was a good idea and well-executed. Thanks to Stephen Whitaker, Mark Thorburn, Laura Simmons, Collin Lord, Michael Gagnon, John MacPhee, Amy Frankenburg, and Nagisa Yamamoto of Bates; John Biederman of UMO; and Michael Boland, Paul Torcoletti, and Mae Gillum from UMF for really good work. The audience for the Bates meeting worked on the "fan club" principle, with some schools attending parts of the presentations. It is unfortunate that more students could not stay for Bates' hospitality and Senator Trafton's intriguing presentation on land use and water rights law in Maine. Perhaps we could lock the doors?

The Nominating Committee submits the following slate of Officers for a vote at the Annual Meeting, July 28, 1984

Andrews L. Tolman, President
Dorothy Tepper, Vice President
Carol White, Secretary
Robert Gerber, Treasurer
New Director: Brad Hall
Newsletter Editor: Chris Olsen

Geological Society of Maine
Summer Field Trips and
Annual Meeting
Coastal Processes and Rocky Promontories
July 28-29, 1984

July 28

8:00 - Meet at MacDonalds in Scarborough Rte. 1 and Black Point Road (Rte. 207)

Dr. Joseph Kelley: Coastal Processes
Dr. Woodrow Thompson: Fossils and Landslides in the Presumpscot
Maine Geological Survey

Dr. Irwin Novak: Recent Landslides
University of Southern Maine

5:30 - Supper at New Harbor Fisherman's Coop (buy your own - BYOB)

7:00 - Annual Meeting, Darling Center, Walpole (camping available for a nominal fee at Darling Center)

July 29

8:30 - Meet at Darling Center

Dr. Arthur Hussey: Geology of the Boothbay Harbor Quadrangle
Bowdoin College

ABSTRACTS

SAND TRANSPORT MECHANISMS OF FLOOD-TIDAL DELTAS, MORSE AND SPRAGUE RIVERS, PHIPPSBURG, MAINE

FRANKENBURG, Amy C., Department of Geology, Bates College, Lewiston, Maine 04240

Flood-tidal deltas are stable depositional features in the tidal inlets of the Morse and Sprague Rivers. Asymmetric tidal velocities and durations result in a net upstream movement of sediment. Modification in the form of accretion and erosion of the deltas occurs on a regular basis due to the effects of a changing tidal prism. The degree of modification by the tidal currents is dependent upon the location of the individual delta within the inlet. For example, greatest modification occurs in free standing unshielded deltas closest to the river mouth. Coastal storms transport sediment into the inlets. Sedimentation processes are also affected by wind direction and strength.

Sediment size on the deltas decreases up inlet with distance from source. Where a significant ebb shield is present, delta sediment coarsens as elevation increases.

The ripple index of the flood-formed bedforms is directly proportional to the grain size of the deltaic sediment. If modification by eolian processes has occurred, the wavelength of the bedforms increases with increased wind velocity creating higher ripple indices.

EROSIONAL AFFECTS OF THE MORSE RIVER TIDAL INLET ON THE POPHAM BEACH SYSTEM. AN AERIAL PHOTOGRAPHIC STUDY, POPHAM BEACH STATE PARK, PHIPPSBURG, MAINE

BOLAND, Michael P., TORCOLETTI, Paul J., University of Maine at Farmington, Farmington, Maine 04938

The Morse River Tidal Inlet, located in Popham Beach State Park, has been the topic of much research and study. Using a series of aerial photographs, dating from 1940 to 1975, we have studied the changes in this dynamic system. Our goal was to determine the mechanisms that control the geometry of the tidal inlet, and how the meandering nature of this inlet affects the shoreline at Popham Beach State Park and Hunnewell Beach, which is adjacent to the Park. Through study and subsequent research, we conclude that this inlet, as all tidal reentrants, is controlled by the dynamic processes of the ocean. Waves, tidal currents, storms, and sediment availability all have a significant affect on the inlet, be it long or short term change. There appears to be a correlation between the orientation of the Morse River Inlet, and significant erosion of shoreline in the State Park itself, as well as Hunnewell Beach.

SEASONAL AND TIDAL SALINITY CHANGES OF THE SPRAGUE RIVER TIDAL INLET, PHIPPSBURG, MAINE

SIMMONS, Laura A., Department of Geology, Bates College, Lewiston, Maine 04240

Salinity and temperature control the biological, physical and chemical processes of seawater (Emery and Uchupi, 1972). A study of the tidal and seasonal changes in salinity of the Sprague River tidal inlet was conducted in order to characterize the inlet. In the summer the Sprague River is nearly dry. Thus precipitation and meltwater can dramatically increase the flow of the river. In the absence of significant freshwater flow, the height of the tide controls the salinity values observed. During low tide, less freshwater is needed to produce salinity changes than during high tide; therefore, smaller changes in tide height can affect salinity. Observations of high salinities, low temperatures and the absence of a salinity variation upstream during high tide indicate that the Sprague River inlet is tide-dominated. Low tide observations generally show a salinity decrease upstream. High tide salinity only decreased upstream after exceptionally heavy precipitation increased the freshwater component of the Sprague River.

MOOSE HABITAT REGIONS IN YELLOWSTONE NATIONAL PARK PREDICTED FROM AERIAL PHOTOGRAPHS

GILLUM, Mae, Department of Geology, University of Maine, Farmington, Maine 04938

Using aerial photographs, the moose summer habitat range in a section of Yellowstone National Park was examined. With information acquired from previous moose studies by others, habitat characteristics were determined involving factors of drainage, landform and vegetation. Following this, the area's different physical factors relating to moose habitats were each examined separately. Subsequently, these physical factors were examined in relationship to one another in order to establish likely moose feeding and habitat ranges. The paper attempts to emphasize a method of justification for statements made with as few assumptions as possible. In addition, hopefully demonstrating that by using a sound base of information and a proper method of verifiable identification or written reference related to the subject, an air photo interpreter can examine, analyze and draw a defendable conclusion on a subject he may actually know little about.

A PETROLOGICAL STUDY OF THE LAMPROPHYRE DIKES OF WAYNE, MAINE, WAYNE AND FAYETTE 7.5' QUADRANGLES

LORD, Collin H., Department of Geology, Bates College, Lewiston, Maine 04240

North of the Androscoggin Lake Igneous Complex (ALIC), five lithologic units are recognized. Calc-silicate gneiss, garnet-sillimanite gneiss, and biotite schist are assigned to the Sangerville Formation. Granite and camptonite dikes intrude these metasedimentary rocks.

Average orientation of the camptonite dikes is N25°E, 58°W-74°E, with an average 95 cm wide. Phenocrysts are olivine, titaniferous-augite, and clinopyroxene glomerocrysts. Clinopyroxene occur as rims on olivine. The groundmass is composed of plagioclase, kaersutite, green hornblende and magnetite or ilmenite. Petrographic comparison suggests that these lamprophyre dikes occurring external to the ALIC are genetically related to the lamprophyre dikes within the complex. It is further suggested that lamprophyre dikes, the mafic/ultramafic plutonic rocks, and the diabase dikes are genetically related on the basis of petrological similarities and their relation in space and time. The external lamprophyre dikes are restricted in occurrence to the study area. Lamprophyre dikes related but external to the ALIC have not been described. The dikes are dated at 290 Ma (Northeast Utilities Co., 1975).

Permo-Carboniferous igneous activity in New England is largely granitic. This study suggests that mantle derived mafic magmas were also present in the Permo-Carboniferous time.

A TEXTURAL AND CLAY MINERALS STUDY OF TWO TILLS AT THE HATCH HILL SITE, AUGUSTA, MAINE

GAGNON, Michael A., and MacPHEE, John R., Department of Geology, Bates College, Lewiston, Maine 04240

Across New England, two distinct tills have been observed (Schafer and Hartshorn, 1965), one superimposed on the other. The problem of differing interpretations for the genetic origin of the two tills is the essence of both the "two till problem in New England" and this study.

This study compared grain-size and x-ray diffraction data from the Hatch Hill land fill, a multiple till locality in Augusta, Maine, to other multiple till sites in New England. The Hatch Hill tills tend to be finer grained than tills from southcentral New England. Only the tills from the Boundary Mountains in western Maine show similar scatter plots on ternary diagrams of Hatch Hill.

The sand:silt:clay ratio from western Maine and Hatch Hill are unique to central Maine and may suggest a regional trend in grain-size due to similarities in bedrock type, terminal grade modes and depositional mode.

This investigation further attempts to clarify the two till problem by clay minerals analysis using x-ray diffraction techniques. Due to their large surface area and layered structure, clay minerals are easily weathered. X-ray diffraction of samples taken at Hatch Hill show mixed-layer phases of chlorite and illite to exist in both tills. These mixed-layer phases typify a weathered zone (Newton, 1978) in upper portions of both tills.

Two models have been presented for the two superimposed tills found throughout New England. One model suggests that the tills were deposited by one glacier resulting in a lower lodgement and an upper ablation till. The other model considers the two tills to be the result of two separate glaciations.

X-ray diffraction, showing a weathered zone to exist on both tills at the Hatch Hill site, precludes the one glaciation hypothesis as a break in deposition must have occurred to produce a weathered zone in both tills.

GEOLOGY OF THE RATTLESNAKE MOUNTAIN IGNEOUS COMPLEX, RAYMOND AND CASCO, MAINE

WHITAKER, Stephen B., Department of Geology, Bates College, Lewiston, Maine 04240

Mesozoic rocks of the Rattlesnake Mountain igneous complex intrude the Carboniferous Sebago Batholith and Silurian biotite gneiss of the Merrimack Sequence in the northwest corner of the Raymond, Maine 7.5 minute quadrangle. Dikes of fourchite, trachyte, and nepheline trachyte predate the emplacement of syenite, nepheline-bearing syenite, and nepheline syenite. All are assigned to the White Mountain magma series on the basis of texture, mineralogy, petrology, and structure.

The exposed rocks of the Rattlesnake Mountain igneous complex are genetically related through fractional crystallization of ferrohastingsite, plagioclase, clinopyroxene, apatite, and opaque minerals. The following differentiation sequence is recognized: alkali olivine basalt→ fourchitic dike rock/trachytic dike rock→ syenite→ nepheline-bearing syenite→ nepheline syenite. Perfect Rayleigh fractionation of the above minerals in observed modal proportions suggests that nepheline syenite may be derived by eighty percent crystallization of trachytic magma. A nepheline-normative alkali olivine basalt derived from a metasomatized spinel lherzolite mantle is proposed as parental to the trachyte (Eby, 1984).

The dikes are injected along regional joint patterns produced by a decrease in the principal northwest-southeast stress following the Acadian Orogeny (Griffith, 1983).

The Rattlesnake Mountain pluton is part of a linear belt of feldspathoidal intrusions in northern New England. The proposed tectonic control is a deep-seated crustal fracture normal to the tensional stress-field associated with the White Mountain magma series. A mantle source for the Rattlesnake Mountain complex contrasts with the majority of saturated and oversaturated rocks of the White Mountain series.

PETROLOGY OF THE CHAIN LAKES MASSIF ALONG ROUTE 27 IN CENTRAL-WESTERN MAINE: A PRECAMBRIAN HIGH GRADE TERRANE

BIEDERMAN, John L., Department of Geology, University of Maine, Orono, Maine 04469

The Chain Lakes Massif (CLM) is a crystalline terrane now in the chlorite grade of regional metamorphism. Relict minerals and pseudomorphs document a pre-Taconic metamorphic event in sillimanite to sillimanite + K-feldspar grades. A fossil isograd between these two grades can be mapped in the field area. No evidence of a pre-high grade event is preserved in the field area. The retrograde greenschist event affecting the CLM and surrounding region is believed to be Acadian in age, although a Taconic greenschist event can not be ruled out.

Biotite-in and andalusite/sillimanite transition isograds can be drawn for the contact aureole of the Seven Ponds Pluton which intrudes the CLM. The assemblage of and-sill-staurolite-muscovite constrains the depth of emplacement of the pluton to between 12.5 and 7.5 km.

The peculiar textures seen in the CLM are interpreted as follows: "clasts" and "quartz blebs" are detrital from a pre-existing metamorphic terrane, "flecks" are products of porphyroblastic growth of poikiloblastic biotite and cordierite crystals during the high grade event. Anatectic textures were not observed in the field area.

The CLM has been interpreted as a possible Precambrian suspect terrane (Boudette, 1982; Zen, 1983). The results of this study, combined with those of the Deep Crustal Seismic Relection Survey in Maine, and with new isotopic age determinations in the CLM, may support this interpretation.

THE STRATIGRAPHY AND GEOCHEMISTRY OF SEDIMENT CORES, DAMARISCOTTA LAKE BASIN, SOUTHCENTRAL MAINE

THORBURN, J. Mark, Department of Geology, Bates College, Lewiston, Maine 04240

During the deglaciation of coastal southcentral Maine, the lowland areas in front of the ice sheet were occupied by an ice-marginal sea. Glaciomarine sediments were deposited in the lowland areas until isostatic rebound of the land occurred. Lowland basins, now present-day lake basins, preserve a record of the transition from glaciomarine to lacustrine sedimentation.

Damariscotta Lake is located in this lowland area. Twenty meters of sediment core was recovered from 2 sites in Muscongus Bay on Damariscotta Lake, 30 km. southeast of Augusta, Maine. Cores recovered from site 1 (water depth = 4m.) have a 3.5 meter thick glaciomarine unit which is overlain by 30 cm of lacustrine sediment. Cores recovered from site 2 (water depth = 7.2m.) have 1.75 meters of glaciomarine sediment which is overlain by 4.2 meters of lacustrine sediment. The difference in the thickness of lacustrine sediment is attributed to the mid-1700 damming of Damariscotta Lake.

The sediment facies are characterized by physical stratigraphy, percent weight loss on ignition, grain size and porewater cation concentrations. The paleoenvironments are determined by the relative differences between cation concentrations in the glaciomarine and lacustrine units. The cation concentrations from site 1 show the effects of freshwater influx and leaching of cations due to the subaerial exposure of the glaciomarine unit prior to the damming of Damariscotta Lake.

THE EFFECT OF PHYSICAL PROPERTIES UPON THE COMPRESSIVE STRENGTH OF REMOLDED CLAYS

YAMAMOTO, Nagisa, Bates College, Lewiston, Maine 04240

Compressive strength of clays is dependent on various factors such as the internal structure or fabric, particle size distribution, and moisture content. In undisturbed samples, the internal structure plays a major role in determining the compressive strength of the clays. But what happens when this internal structure is destroyed by natural or man-caused phenomena such as earthquakes/tremors, rapid rise of the water table, or vibrations caused by drilling? What characteristics then determine the compressive strength of the clay samples? To answer this question, a number of laboratory tests designed to measure specific physical properties were performed on remolded clay samples.

Remolded samples are samples lacking their original stable structure. They are prepared by molding and reshaping the clay samples by hand until the original internal structures are destroyed.

Remolded clay samples with various moisture contents were tested for their unconfined compressive strength. Unlike undisturbed samples, strength of remolded clays, as reflected by the slope of the stress/strain curve, plotted as a function of varying moisture content, revealed a linear relationship. This relationship is here referred to as "moisture sensitivity."

The moisture sensitivity of the remolded samples, confirmed that there are physical properties, other than moisture content, that are important determinants of compressive strength. Further investigation of physical properties done by mechanical analysis and determining Atterberg limits showed that the percent of clay sized particles and the plasticity index seemed to be related to the moisture sensitivity, while the liquid limit and the sorting coefficient seemed to be related to the strength of the clays at higher moisture contents.

MEMBERSHIP DUES STATEMENT

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

The Society holds three meetings each year, in the late fall, early spring and (with the Annual Meeting and sometimes field trips) in mid-summer. 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 annual memberships:

$5 REGULAR MEMBER - Graduate geologists, or equivalent, with 1 year of practice in geology, or with an advanced academic degree in geology

$4 ASSOCIATE MEMBER- Any person or organization desirous of association with the Society

$2 STUDENT MEMBER - Persons currently enrolled as students in college who are interested in geology

$2 APPLICATION FEE - A one-time fee to all new members, payable when applying for membership

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Correspondence about membership in the Society should be mailed to Robert G. Gerber, Ash Point Rd., South Harpswell, 04079. Items for inclusion in the newsletter may be directed to Roy L. Farnsworth, Dept. of Geology, Bates College, Lewiston 04240.

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