THE MAINE GEOLOGIST

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

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THE PRESIDENT'S MESSAGE

We held another successful Spring Meeting of the Geological Society of Maine on April 11, 2008, hosted by Bowdoin College. I wish to thank those the Bowdoin Geology Department, with a special thanks to Marjorie Parker, for their efforts in hosting the meeting. The student presentations were excellent. Congratulations to the recipients of the Walter A. Anderson Awards for a job well done: Monica L. Hall of University of Maine at Farmington and to Rachel G. Daly of Colby College (see details within). It is encouraging to see that the student posters and presentations continue to improve with each year. And thanks to Marty Yates and Liz Champeon for judging.

Our evening speaker, Dr. Clara Chan from Bowdoin College, provided an excellent presentation on geomicrobiology of iron oxyhydroxide-depositing microbes. She showed a variety of conditions where the microbial mats are formed, ranging from abandoned mine working, to low-temperature volcanic vents. From my point of view, the study of iron oxy-hydroxide-depositing microbes has application to mining and mineral exploration, mineral site reclamation and environmental investigations. See more in the Secretary's Report. I hope that her research continues.

Martha Mixon has taken the lead on organizing the summer field trip. Information on the trip is included below. Many thanks to Martha, Joe Kelley and the other volunteers for leading the field trip.

I am pleased that the membership voted to approve the formation of a standing education committee. The formation of the committee is in progress with more information provided elsewhere in this newsletter.

The fall meeting of the Geological Society of Maine will be hosted by Poland Springs on Thursday October 2, 2008. The Thursday meeting represents a change in format from previous Friday meetings. As usual, the Fall meeting is a combination seminar and business meeting, and we are looking for geoscientists from academia, regulatory agencies or industry to provide technical presentations on their research or projects. More details regarding the Fall meeting will be included in the next newsletter and at the website.

Cliff Lippitt, President (2006-2008)
President Cliff Lippitt
clippitt@swcole.com

THE EDITOR'S MESSAGE:

Please send items of interest for the News from the Campuses and Member News columns, or other things you'd like to share.

Please check the date on your address label – members more than two years in arrears will be dropped from the mailing list. Send dues to Rob Peale (see address on the last page).

Dan Belknap, Newsletter Editor (1998 – present)
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GSM WEBSITE: www.gsmmaine.org

The GSM website contains copies of present and archived Newsletters, a calendar of events, and other items of interest to the Society, including the updated Bylaws. There are many important links to geology items in Maine and elsewhere. There is a page on Maine geology and the Photo of the Month. Let us know what you think.

Webmaster, Mike Lerley mike@rentageekme.com

GSM SUMMER FIELD TRIP

Acadia National Park – Bedrock, Glacial and Modern Environments

The GSM Field Trip will be July 25-27, 2008. Joe Kelley and others will be the field trip leaders. We will be staying at the Schoodic Education and Research Center (SERC) in their bunkhouse (4 to a room, linens not provided, bring sleeping bags). This is at the Schoodic Pennisula section of the Park, south of Winter Harbor, less than 1/4 mi on the right after taking the Peninsula spur road off the park loop road. The bunkhouse is not available until 5 pm Friday. Cost is ~$15/person/night. We have chartered a school bus seating 30 for the day on Saturday to take us around Mt. Desert Island. Saturday night will be the traditional cookout or banquet at SERC. Sunday there may be a few more field trip stops. We are still putting together details. Please email your RSVP to: **mmixon@acadiaenvironmental.com** and make sure GSM has your current email so we can keep you posted about the field trip as it approaches.

THE STATE GEOLOGIST'S MESSAGE

State Geologists Celebrate 100 Years of Association

Washington, DC, May 12, 1908: State Geologists from 23 states met at 2:30 PM in a conference room of the U.S. Geological Survey (probably the Patent Office Building, now housing the Smithsonian Institution's National Portrait Gallery) to consider "the advisability of effecting a permanent organization of State Geologists." With this modest beginning, the Association of American State Geologists was founded. In 2008, the AASG celebrates its centennial year and hundredth annual meeting with a return to its beginnings in Washington, DC[1], and a meeting co-sponsored by the USGS. USGS Director George Otis Smith (who first mapped at Vinalhaven, Maine) invited the State Geologists to Washington in 1908. Director Mark Myers (former Alaska State Geologist) will welcome the Association this year.

So in the 100 years of association, what has the AASG really accomplished? The very first issue undertaken in 1908 was the status of topographic mapping of the nation. At that time, the nation had very inconsistent coverage, with some areas completed at the then most detailed scale of 1:62,500, while other areas had essentially no coverage. The AASG worked with the federal agencies to implement a program of detailed mapping, cost-shared 1:1 by states and the USGS. This program produced Maine's 1:24,000-scale topographic maps that we rely on today.

Many of the policies and opportunities affecting state geological surveys are developed at the federal level, and the AASG established a liaison committee in the early 1960s to ensure that our voice would be part of the discussion of policies and programs. In the early years, this group consisted of half a dozen State Geologists that would visit Washington once a year. Imagine this group parking their car in front of departmental headquarters, walking in without an appointment, and having an audience with the Secretary! While this approach was very successful in those years, it would not get far today! Still, typically thirty State Geologists endure the security scrutiny twice annually to discuss issues of mutual interest with more than 30 federal agencies and other interest groups. This effort has paid many dividends in raising the awareness of the role of geological investigations to important national issues.

The AASG has promoted and supported important federal agencies. Considering the value of minerals to national defense, the AASG in its first decade pushed for legislation to create the U.S. Bureau of Mines. Having helped accomplish this, we subsequently lamented its demise in the 1990s. Similarly, when the USGS was threatened with abolishment in the 1990s, the AASG spoke on the values of USGS programs at congressional and committee offices on Capitol Hill. Fortunately, these views prevailed, and USGS maintains an important role in assessing the nation's natural resources and natural hazards.

State geological surveys have always focused on high-quality geological maps as primary products of their programs. In the 1980s the State Geologists noted, however, that more funding was being directed to derivative mapping (aquifer maps, landslide hazard maps, etc.) and more research-oriented work at the federal level and in some states, and away from the essential basic geologic map. At the time, only 20% of the nation had been mapped geologically in sufficient detail to address important issues. In response to this, the AASG began an effort to initiate a new mapping program focused on basic geologic information. The effort to push this program through Congress took nearly a decade, with many setbacks along the way, but in 1992 Congress passed the National Cooperative Geologic Mapping Act, which established the program as a cooperative between states and the USGS. Through this program Maine has received more than $1 million for important geologic mapping!

The AASG continues as a forum for discussion of the value of geological investigations to society and looks forward to the next 100 years!

[1]Not really Washington, but on the outskirts of the DC area in Shepherdstown, WV. Washington is just too expensive.

Robert G. Marvinney, Maine State Geologist: <Robert.G.Marvinney@state.me.us>

2007 Science Olympiad

In April 2007 Waterville Senior High School won the Maine State Science Olympiad Championship for the twelfth consecutive season. Fifteen teams from high schools in Maine competed in the state championship events. Rounding out the top four teams were Mt. Ararat, Waynflete and Cape Elizabeth. The Waterville team qualified to travel to the 2007 National Science Olympiad Championship at Wichita State University in Kansas. The Geological Society of Maine made a one-hundred dollar donation towards the expenses of that trip. At Nationals, the Maine team of sixteen students competed in twenty-three events including Rocks and Minerals, Entomology, Ocean-ography, Remote Sensing and Ecology. The Waterville team finished in thirty-seventh place out of sixty teams, with the Maine Ecology team taking a seventh place in that event, one out of the medal round. This year the National Championships will be held at George Washington University in Washington, D. C. the last weekend of May. The Waterville High team will compete in the State Championships in April at the University of Southern Maine hoping to again represent Maine in the national competition.. If anyone is interested in the National Science Olympiad events check out their web site at: http://scienceolympiad.gwu.edu/index.html

Thank you to the members of the Geological Society of Maine for supporting the Waterville team's efforts in the advancement of science education in Maine.

Bob Johnston, WSHS Science Olympiad parent and GSM member. Robert.A.Johnston@maine.gov

GSM MEMBER NEWS

Please send member news to:

Carolyn Lepage, Member News Correspondent (1996-present) <calepage@adelphia.net> or
PO Box 1195, Auburn, ME 04211-1195 or
Fax: (207)-777-1370; Phone: (207)-777-1049

GSM SECRETARY'S REPORT

Spring Meeting, April 11, 2007
Geology Department, Bowdoin College
Brunswick, Maine

The GSM spring meeting was graciously hosted by the Bowdoin College Geology Department this year. Special thanks to Marjorie Parker for her efforts, and to Bowdoin College Geology Department for hosting us. It was a great meeting and well facilitated. The food was excellent.

The meeting began at 2 pm with presentations of student research in poster sessions and talks. These were followed by a business meeting, social hour, dinner and an evening speaker. The meeting adjourned at 8:30 pm.

Student Presentations

Abstracts of the student poster presentations and talks are included below. There were 22 posters and 3 talks. The schools represented were University of Southern Maine, University of Maine at Presque Isle, University of Maine at Farmington, the University of Maine, and Colby, Bates and Bowdoin Colleges.

Winners of the Walter A. Anderson Award, recognizing outstanding student presentations were:

· Monica L. Hall, Poster, Evolution of the Composite Shirley-Blanchar Pluton: Field, Petrographic and Geochemical Evidence by Monica Hall and David Gibson, University of Maine, Farmington

· Rachel G. Daly, Talk, The Effect of Stomatal Proxies as a Function of Geographical Position Relative to Growing Season Sunlight, by Rachel G. Daly and Robert A. Gastaldo, Colby College.

Congratulations to both students on fine presentations.

Business Meeting

Old business: President Cliff Lippitt relayed that the ad hoc education committee, which was appointed last fall, met together with the executive committee on 3/18/2008. The purpose of this meeting was to discuss recommendations regarding the education program and funds. A decision was made at that meeting to use a single account to accommodate memorial and other donations that GSM receives, and to fund additional educational activities of GSM through a single fund. The Walter Anderson Fund, which has been used for student awards at the spring meetings, was renamed the Walter Anderson Education Fund, and will accommodate additional educational activities. The memoriam funds received in honor of Dee Caldwell and Jack Rand will be put into this fund. Education goals stated at the meeting included doubling the size of the Walter Anderson Education Fund (WAEF), and establishing a permanent Education Committee. The purpose of the Education Committee would be to develop programs to support K-16 geology education, while continuing the student poster and presentation awards at the spring meetings. See New Business.

Rob Peal, Treasurer, presented the Treasurer's Report, which can be viewed elsewhere in this newsletter.

New Business:

A motion was made to form an **Education Committee** whose purpose is to develop programs to support K-16 education, and to continue awards for poster and oral presentations at the spring meetings. After some discussion a motion was approved for an Education Committee to support K-16 geology education. The Education Committee will report to the Executive Committee. The Education Committee may award up to 10% of the funds in the Walter Anderson Education Fund independent of the Executive Committee or the Membership.

Volunteers for this committee were requested. Julia Daly, Bob Johnston and Lisa Churchill-Dickson volunteered. Patty Millette was nominated by Dan Belknap. Please contact Julia dalyj@maine.edu, Bob, or Lisa if you would like to volunteer for this committee or with your input and ideas.

A recommendation was made to double the size of the **Walter Anderson Education Fund** (to approximately $7000) by initiating a capital campaign, raising dues and designating a portion of dues to the education fund, and by transferring some money which has accumulated in the General Fund to the Walter Anderson Education Fund. After some discussion this resulted in a motion to **raise dues to $20 per year for regular members, with $8 of each dues payment going to the Walter Anderson Education Fund**. The motion passed.

A recommendation was made to move $4000 from the General Fund (which contained $9000) to the Walter Anderson Education Fund. After some discussion the motion was amended to **transfer** $2000 from the General Fund to the Walter Anderson Education Fund. The motion was seconded and passed by the members in attendance.

A $100 donation from GSM was approved for the Waterville High School **Science Olympiad Team** to go to George Washington University in Washington DC for participation in the National Science Olympiad. GSM member Bob Johnson, who made the request, coaches the team. Future requests will be directed to the Education Committee.

Announcements:

· The Fall meeting will be at Poland Spring. The proposed date is October 2, 2008.
· The Spring meeting will at Colby College. The proposed date is April 3, 2009.
· The GSM Field Trip will be July 25-27, 2008. We will be staying at the Schoodic Education and Research Center (SERC) in their bunkhouse (4 to a room, linens not provided, bring sleeping bags). The bunkhouse is being vacated by another group Friday and we have been asked not to arrive before 5 pm. Cost will be ~$15 per person per night for the bunkhouse. We have chartered a school bus for the day on Saturday to take us around Mt. Desert Island. The school bus seats 30. Saturday night will be the traditional cookout or banquet at SERC. Sunday there may be a few more field trip stops. We are still putting together details. Please email your RSVP to get your spot on the bus: mmixon@acadiaenvironmental.com. Please make sure GSM has your current email so we can keep you posted about the field trip as it approaches.
· GSM is looking for nominees for Vice President for next year. Contact Julia Daly dalyj@maine.edu
· Arthur Hussey, GSM Historian was contacted by the Federation of Mineral Clubs. They asked Art to nominate 2 students for scholarships of $2000 per year for 2 years for graduate work in the eastern US in any field of geology. Please contact Arthur Hussey [hussgeo@gwi.net] with your nominations.

Evening Speaker

The Keynote Address was delivered by Clara Chan, Visiting Assistant Professor in the Geology Department at Bowdoin College. She has also "done time" at Stanford University, the University of California Berkeley and Woods Hole Oceanographic Institute. The talk was titled "Microbes making minerals: tales of an abandoned mine and a submarine volcano". This was a captivating talk on iron bacteria. (Captivating, a talk on iron bacteria, I am saying to myself? Yes, absolutely.) We went from the Piquette Mines of Tennyson, Wisconsin to Pele's Pit on Loihi Seamount (the next Hawaiian island) and the Ula Nui vent field at its base. We learned what these places have in common with caves, groundwater seeps, wetlands, streams, the rhizosphere, and water wells. (The iron bacteria live where ferrous iron meets oxygenated water.) We saw iron bacteria from the perspectives of geologic time, the Jason II submersible and time series electron micrographs documenting the excretory activities of these critters.)

Some of the descriptive vocabulary we learned: rolling slime formations, pumpkin pulp, troll hair, orange snow. Ms. Chan's talk started with microbial mats in the flooded Tennyson Wisconsin lead-zinc mines, where divers encountered extensive microbial slime with high conductivity and low dissolved oxygen. The microscopic structure of the mats reveals filaments described as sheaths or straws and twisted stalks. Similar mats are present at the base of the Loihi Seamount, covering areas that are hundreds to thousands of square meters.

Ms. Chans's research included culturing the mat bacteria in the lab and watching the formation of the stalks and sheaths in time series micrographs. The composition of the filaments is a ferric iron mineral (lepidocrosite). In answering the question 'Why would these bacteria fabricate these structures which are energetically expensive to produce?' Ms. Chan suggests the stalks are formed as repositories of ferric iron waste. The stalk formation is a way for the bacteria to excrete its waste products in structures that will not encapsulate the bacteria and prevent its growth. The most extensive iron bacterial mats in the world are at known from Loihi, which is a moderate to low hydrothermal environment. Perhaps these mats are recognizable in the fossil record and explain the genesis of banded iron formations.

Many many thanks to Clara for sharing this fascinating research with us.

The meeting adjourned at 8:30 PM.

Secretary, Martha N. Mixon, 2006 - present
mmixon@acadiaenvironmental.com

GSM TREASURER'S REPORT

The Society currently has 344 members; unfortunately only 50.6% are up to date with their dues. In keeping with previously decided policy, we will drop any members more than two years in arrears at the end of this calendar year. The present membership is distributed as follows:

Students:	50	Associates:	30
Regular:	257	Institutional:	7
TOTAL:	344	Total Paid Up:	174

Balance on Hand December 31, 2007

Anderson Fund Savings	$ 1,435.65
Anderson Fund CD	$ 5,629.25
General Fund Money Market	$ 4,398.28
General Fund Savings	$ 40.16
General Fund CD	$ 5,388.91
General Fund Checking	0.00
Total	$ 16,892.25

Income

Dues	$ 940.00
Interest	$ 180.82
Anderson Fund Donations	$ 279.00
Other Donations	$ -
Publication Sales	$ 0.00
Subtotal	$ 1,399.82

Expenses

Newsletters	$ 457.92
Honoraria	$ 150.00
Anderson Awards	$ 200.00

Other Awards	$	100.00
Meeting Expenses		-
Donations		-
Postage	$	159.90
Web Site		-
Refunds		-
Miscellaneous		-
Subtotal	$	1,067.82

Balance On Hand April 30, 2008

Anderson Fund Savings	$	1,568.85
Anderson Fund CD	$	5,710.20
General Fund Money Market	$	4,440.49
General Fund Savings	$	40.28
General Fund CD	$	5,464.70
General Fund Checking	$	0.00
Total	$	17,224.25
Net gain [or loss]	$	332.00

Respectfully submitted,
Rob N. Peale, Treasurer (2004 -present)
<Rob.N.Peale@maine.gov>

GSM Spring Meeting, Student Presentations: ABSTRACTS

ORGANIC EVIDENCE FOR PLEISTOCENE-HOLOCENE RELATIVE SEA-LEVEL CHANGE IN MAINE

BEEBE, Calvin, BUTCHER Kaitlyn and TAYLOR, Warren, Dept. Earth Sciences, 5790 Bryand Global Sciences, University of Maine, Orono, ME 04469, calvin.beebe@umit.maine.edu.

The deglaciation of North America at the end of the last ice age caused rapid relative sea-level changes in Maine. Important proxies that show evidence of changes in relative sea-level in Maine include radiocarbon dating of peat cores from salt marshes and of well-preserved littoral marine mollusk shells found in marine sediments (Belknap et al., 1988). Radiocarbon dating of peat cores from various salt marsh sites along the coast provide an accurate proxy for relative sea-level change. Ecological zonation of high-marsh species in cores coincides with mean high water, and shows a steady rise in relative mean high water of ~5 m in Maine from ~6,000 B.P. to present (Belknap et al., 1989). Prior to ~6,000 B.P., and terminating at ~16,000 B.P. radiocarbon dating of marine mollusk shells found in marine sediments is the best proxy of constraining relative sea level. Data show a period of very rapid and large changes in relative sea level during the late Pleistocene and early Holocene (Kelley et al., 1992; Borns et al., 2004). Dating of shells is less accurate for constraining relative sea level for number of reasons, however, a sea-level curve can still be developed. Beyond ~6,000 B.P. primary reliance on mollusk shells to constrain sea level allows for a less accurate curve than peat records. Shell data show that relative sea level in Maine reached a high stand ~60 m above present at ~14,000 B.P. because the crust was depressed due to the load of the Laurentide Ice Sheet. As the ice retreated relative sea level then fell rapidly due to isostatic rebound of the depressed lithosphere. A sea-level low-stand was reached at ~11,000 B.P. ~55 m below present sea-level, at which point the trend reversed into an equally rapid rise. This was due to rising sea levels caused by the melting of the Laurentide ice sheet and other ice sheets worldwide, and a coinciding subsidence of Maine caused by a migrating glacial forebulge trough. Data show a relatively steady increase in relative sea level of ~2 mm/yr until ~7,500 B.P., at which time the rate of relative sea-level rise increased to ~20-25 mm/yr over a period of <1000 years. Kelly et al. (1992) discuss this being the result of a resonance effect from a migrating glacial forebulge.

BEDROCK GEOLOGY OF THE CHINA LAKE, ME 7.5' QUADRANGLE

BOWDOIN, Wyeth and POLLOCK, Stephen G., Dept. Geosciences, University of Southern Maine, Gorham, ME 04038, wyeth.bowdoin@gmail.com .

The Waterville and Vassalboro Formations dominate the China Lake, ME 7.5'quadrangle. The Waterville Formation is the lowermost unit in the quadrangle and is a thinly bedded a slate - rich unit in the north and a variety of fine-grained biotite, garnet, staurolite + andalusite, to sillimanite bearing schists in the south. The Vassalboro Formation which overlies the Waterville, is a thin to thick (6 cm - 2 m) bedded quartzo-feldspathic metawacke and granofels. A variety of turbidite – related sedimentary structures are common in lower metamorphic zones in the northern 1/3 of the quadrangle. Interbedded with the granofels are subsidiary thin (1-9 cm) metapelites which range from slate to fine-grained biotite (+/- garnet) - bearing quartzo – feldspathic schist. Thin (3 - 8 cm) calcsilicate beds are locally present in southern portions of the quadrangle. A thin rusty weathering unit separates the Waterville from Vassalboro formations. A separate identical rusty weathering unit occurs at a stratigraphically higher position within the Vassalboro. Additionally, thin rusty weathering beds are local within both the upper Waterville and lower Vassalboro. This rusty unit is commonly a very fine- to fine - grained quartz, plagioclase, muscovite, biotite, (+/- sillimanite), pyrite, pyrrhottite, graphite bearing metasiltstone and schist. Fine-grained, rusty weathering quartz – rich metasandstone beds are locally present in this unit. Isoclinal folds are the dominant structures. These are a series of northeast – trending folds. The Dearborn Brook Fault crops out in the southeastern portion. Exposures of the fault include indicators of dextral strike slip. The Three Mile Pond pluton crops out in the southwestern corner of the quadrangle.

APPLYING GPS AND GIS TECHNOLOGIES IN MAPPING PRESQUE ISLE MUNICIPAL INFRASTRUCTURES

BUTLER, Ryan (Environmental Studies) and JUNKINS, Chad (Business Management), UMaine at Presque Isle, Presque Isle, ME 04769, ryan.butler@maine.edu

In the summer of 2007, under supervision of Dr. Chunzeng Wang, we worked as paid interns on a GPS/GIS project for Presque Isle Public Works Department. We applied GPS and GIS technologies we learned from a GIS class in spring 2006 to collect data and build ground up geodatabases of storm water catch basins, sidewalks, and curbs. We firstly investigated the infrastructures and identified their attributes before designing the project and its database structures. We then used Trimble GeoXH to collect spatial and non-spatial data of 700 sidewalks, 1,050 curbs, and 636 catch basins throughout the city. GPS Pathfinder Office was used to make differential correction of the coordinates collected with the Trimble GPS. ArcGIS was then used to integrate the data and to build geodatabases of a storm water management system and a sidewalk/curb management system. The geodatabases are the first GIS data ever collected for the city. With the geodatabases the PIPW staff has better sense of their environment than ever before. The geodatabases allow them to better maintain their infrastructure and pinpoint problems.

HISTORICAL RECORDS OF STOMATAL INDICES FOR ***QUERCUS*** FROM THE SOUTH-EASTERN U.S.

CANTOR, Bradford M. and GASTALDO, Robert A. Dept. Geology, Colby College, 5800 Mayflower Hill, Waterville, ME 04901, bmcantor@colby.edu

Modeling atmospheric carbon dioxide concentration (pCO_2) is critical to understanding the Carbon Cycle over geologic time. Recently, biological proxies have become commonly used including stomatal frequencies on leaves. An inverse relationship exists between epidermal stomata and the pCO_2 under which the leaf grew and expanded; this provides a record of atmospheric gases as accurate as ice core data, another proxy, but at a higher temporal resolution. The two most commonly used leaf parameters are Stomatal Density (SD - # of stomata/unit area) and Stomatal Index (SI - the ratio between # stomata and total epidermal cells/unit area). However, stomatal frequencies have some limitations. A CO_2 "ceiling" exists where plants stop responding to gas concentration in a linear fashion above a certain threshold. Additionally, transfer functions calibrated from extant plants do not always correspond to fossil equivalents. Another recent consideration is that taxonomically related plants may not exhibit similar growth responses under the same pCO_2 conditions. To test this, 12 species of Oak (***Quercus***) were evaluated with respect to SD and SI over a 104-year interval based on trees grown under a humid subtropical climate in Lee County, AL. Herbarium specimens dating from 1894 to the 1980s were used to supplement the historical record; a collection made during June 2007 extended the record to the present. Herbarium samples were taken from collections made in the same year, if available. Materials were cleared in chromic acid, mounted on slides, where after stomata and epidermal cells were counted using a Zeiss Axioskop and AxioVision software. Initial results appear to demonstrate that Oak species respond independently to pCO_2. Both sections of ***Quercus***, white and red, have statistically different responses to pCO2 when results were compared. Some species such as ***Q. laurifolia*** and ***Q. nigra*** have statistically similar responses over time, but there are many anomalous data. Therefore, the present study suggests that approaches correlating data from extant taxa with data from extinct taxa are debatable and should be considered for their qualitative observations rather than quantitative measures.

THE IMPACT OF SULFIDE WEATHERING ON SURFACE WATER, FARMINGTON, MAINE

CASTLE, Holly, REUSCH, Douglas, EASTLER, Thomas, and MOROCCO, Terry, Dept. Natural Science, University of Maine at Farmington, Farmington, ME 04938. holly.castle@maine.edu

When exposed to the elements, the weathering of sulfide minerals produces sulfuric acid, which can mobilize toxic ions. In the Farmington region, the more than 400-million-year-old Temple Stream Fm., formed in a Black Sea setting, contains sulfides and arsenic up to 392 ppm. A powdered sample of black sulfidic shale quickly lowered the pH of de-ionized water to 3. Water samples from three local streams have high sulfate relative to chloride and bicarbonate. Overall, the stream water compositions are consistent with dis-solution of feldspar, calcite, biotite, and pyrite (iron sulfide) and minor input from precipitation. Local homeowners who use well water may want to consider testing for arsenic and related metals.

GROUND-TRUTHING BACKSCATTER SONAR DATA BY ANALYZING SEDIMENT SAMPLES, HARPSWELL SOUND

CHASE, Ali and LAINE, Edward , Bowdoin College, Brunswick ME 04011, achase@bowdoin.edu.

Harmful Algal Blooms (HABs), more commonly known as red tide, occur when conditions in the ocean are right for cysts of algae on the seafloor to increase in quantity at a rapid rate, or "bloom". Certain types of algae create a build-up of toxins in shellfish that filter feed on them and in turn the shellfish are toxic to humans who ingest them. Harpswell Sound is thought to be an area with an unusually high number of cysts of the phytoplankton ***Alexandrium,*** which causes the human illness associated with the toxic shellfish, known as Paralytic Shellfish Poisoning (PSP). By analyzing seafloor sediments and ground-truthing backscatter sonar data of Harpswell Sound, the percentage of the seafloor in Harpswell Sound that is muddy sediment can be determined. Since the cysts are deposited prefer-entially in muddy areas, the total quantity of cysts in the sound can then be estimated. Sediment samples were collected from the seafloor of Harpswell Sound by using a grab device. Samples were processed by being run through a stack of five different sized sieves. The samples were sorted, dried and weighed, and then the percentages of different amounts of gravel, sand, and mud in each sample were calculated. The samples could then be classified as gravel, sand, mud, or some combina-tion of the three. Results showed that mud and sandy mud samples correspond with darker areas of the sonar map, and gravelly samples correspond with lighter areas of the sonar map. This information allows us to infer that backscatter sonar data is accurate in predicting the texture of sediments on the ocean floor of Harpswell Sound.

THE EFFECT ON STOMATAL PROXIES AS A FUNCTION OF GEOGRAPHICAL POSITION RELATIVE TO GROWING SEASON SUNLIGHT

DALY, Rachael G., and GASTALDO, Robert A., Dept. Geology, Colby College, 5800 Mayflower Hill Drive, Waterville, ME 04901, rgdaly@colby.edu

Stomatal frequencies of fossil-plant species are used to estimate past pCO_2 levels based on the physiological functions of living taxa. Numerous studies have shown that there is an inverse relationship between pCO_2 and stomatal frequency paramters. As levels of pCO_2 increase, the Stomatal Density (SD) and Stomatal Index (SI) decrease. However, pCO_2 is not the only factor affecting Stomatal Density and Stomatal Index, which are a product of leaf growth and expansion. Stomatal characteristics differ between genera, and studies also have shown that SD and light intensity have a positive correlation. This study hypo-thesizes that SD and SI are not influenced by a leaf's physical orientation relative to the sun during the growing season. Leaves of Northern Red Oak, ***Quercus rubra***, were collected from trees on lake margins around six lakes in the Belgrade Lakes Region in Central Maine. Lakes oriented in NE/SW, NW/SE, and E/W directions allowed for sampling of trees exposed to varying light intensities throughout the day. Sun leaves were cleared in chromic acid, mounted on slides, where after stomata and epidermal cells were counted using a Zeiss Axioskop and AxioVision software. The SD and SI of each tree were calculated and comparisons made between populations exposed to morning, mid-day, or afternoon light intensities. Data from Salmon Pond, oriented in a NW/SE direction, show a statistically significant difference between the SD of trees on either side of the lake. However, the SI shows no statistically significant difference between trees located on either shore and exposed to different light regimes throughout the day. These preliminary data suggest that exposure to various sunlight regimes on opposite sides of lakes may not play a role in the stomatal response as reflected in SI of plants during a growth season.

GEOLOGIC CONTROLS ON THE ORIGIN AND EVOLUTION OF COASTAL FEATURES, SOUTHEASTERN GERRISH ISLAND, KITTERY, MAINE

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Previous studies of geomorphological changes along the coast of Maine deal predominantly with sedimentary systems. However, significant changes can also be documented in bedrock coastal systems. Historic photos and field observation reveal that lithology, structure, and glaciation have played roles in shaping the southeastern coastline of Gerrish Island, Kittery, Maine. Gerrish Island is underlain by the massive Rye Formation gneiss, with foliation striking N 61˚E. At least 10 Mesozoic diabase dikes cross-cut this unit with orientations ranging mostly from N 14˚E to N 49˚E; the thickest dike is approximately 25 m in total width, and is perpendicular to the orientation of the coast with strike N 42˚W. This dike is a resilient bedrock feature, but has been significantly eroded in historic time. Orientations of 300 joints showed dominant trends between N 25˚E and N 60˚E. Orientations of dikes and major joint sets contribute to the shaping of the coast by creating zones of weakness resulting in minor re-entrants. Although unambiguous glacial flow indicators are rare, two sites were located; both glacial striations and crescentic marks indicate that glacial flow over the island was most recently from N 32˚W to N 34˚W, or ~90˚ to the orientation of Rye Formation foliation. The dominant linear trend of the coastline between 43˚03'54"N and 43˚04'43"N is N 62˚E; this is essentially parallel to the foliation of the Rye Formation and perpendicular to glacial flow direction, suggesting glacial plucking was a major factor in gross coastal alignment at this site.

A LIMNOLOGICAL AND HYDROLOGICAL ASSESSMENT OF THREE WHITE MOUNTAIN, NEW HAMPSHIRE LAKES.

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Application of road salt throughout the winter on northern and high elevation roads is necessary to keep them ice free and safe for travel. However, the deposited salt eventually finds its way into lakes, rivers, and soils causing short and long term environmental effects to the road's watersheds. In order to understand road salt's impact, a year long comparative study was done on three, small, alpine, New Hampshire lakes, Lily Pond and Saco Lake, which contained paved highways in their watersheds and Ammonoosuc Lake which did not. The ionic concentrations in the water column were measured directly in water and snow samples taken from the lakes. In addition, conductivity was measured using a ***Hydrolab*** water quality probe as well as a ***Solinst*** conductivity logger in Lily Pond. It was found that unlike Ammonoosuc Lake, which remained exceptionally clean, Lily Pond had elevated conductivity levels, particularly at depth, year round. Conductivity in Saco Lake was at the "pristine" level of Ammonoosuc Lake from mid-July to mid-December but about twenty five times more conductive at depth than Ammonoosuc Lake in mid-March. The conductivity increase at depth in Lily Pond and Saco Lake in the spring caused precariously low levels of dissolved oxygen in the water columns. Levels measured on March 16, 2008 were classified as "Poor" by EPA Water Quality Parameters and were about two mg/l less than levels measured at depth in Ammonoosuc Lake. With future research, even lower, nearly anoxic levels could be measured in the lakes as more salt enters with further spring snowmelt. Anoxic conditions at depth could prove to be detrimental to respiration of bottom dwelling bacteria and pond life. Another concern of salt loading at depth is that it may interfere with the density gradient that causes lakes to turn over in the spring. If the bottom water contains high enough concentrations of salt ions it may prove to be denser than the surface water and will not overturn as it should in the spring. At present, it is uncertain whether the timing of spring turnover was altered by salt loading in the lakes, but with future results expected this spring, a comparison of temperature profiles in Lily Pond, Saco Lake and Ammonoosuc Lake relative to the timing of spring turnover may be made.

THREE HUNDRED YEARS OF LEAD DEPOSITION IN TAYLOR POND, AUBURN, MAINE

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Since the Clean Air Act leaded gasoline is no longer the major source of Pb emissions in the United States. Currently non-ferrous mines/smelters and fossil fuel power plants are the major sources of Pb emissions. However, while almost none of these current major sources of Pb emissions are located in New England, Pb aerosols can travel several thousand kilometers before being deposited. Therefore this region, sometimes referred to as, "the tailpipe of the nation," potentially remains at risk for elevated Pb deposition. In this study a detailed record of Pb deposition was constructed by measuring Pb concentrations in lacustine sediment cores collected from Taylor Pond (TP) in Auburn, Maine. Freeze-dried sediments were microwave digested using EPA Method 3051 prior to analysis for Pb and scandium (Sc) by inductivity coupled plasma-optical emission spectrophotometer. Additionally, $^{239\text{-}240}$Pu radionuclide dating was used to determine average sedimentation rates and timing of Pb deposition. Total organic carbon values were determined to normalize for changes in organic deposition through time while Sc concentrations were used to normalize for natural Pb inputs. Based on $^{239+240}$Pu activities, which began to rise between 7.5 and 6.5 cm and peak at 4.5 cm, an average sedimentation rate of ~0.12 cm/yr was calculated. Assuming constant sedimentation rates, the TP record represents ~300 years of deposition. The most rapid increase in Pb deposition occurred through the 20th century, and likely represents widespread use of leaded gasoline. A significant decrease in Pb deposition after passage of the 1973 CAA was expected and not measured at TP, possibly due to the masking effects of bioturbation.

EVOLUTION OF THE COMPOSITE SHIRLEY-BLANCHARD PLUTON: FIELD, PETROGRAPHIC AND GEOCHEMICAL EVIDENCE.

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The Shirley-Blanchard pluton, located south of Greenville in north-central Maine, lies within the Piscataquis Magmatic Belt, a suite of ~ 40 compositionally diverse plutons. The pluton was mapped as a composite intrusion by Espenshade and Boudette (1964), with the Shirley phase exposed in the northeast of the pluton and the Blanchard phase in the southwest. The relative ages of these phases are given by zircon age dates (Bradley et al., 2000) which suggest the Shirley phase (404 ± 4.4 Ma) is younger than the Blanchard phase (407 ± 1.5 Ma). This study details field relations and petrography of the Shirley-Blanchard pluton and examines its evolution. The Shirley phase ranges from a granodiorite at and near the contact to a biotite-granite in the northeast portion. The Blanchard phase ranges from a quartz-monzodiorite to a quartz-diorite, both of which are seen in close proximity. At the contact, half-meter-sized angular blocks of both Blanchard variants are observed within the Shirley phase and leucocratic veins of the Shirley phase intrude these "autoliths." Geochemical data show that the two

phases are compositionally distinct. The Shirley variants are more evolved (SiO_2 66 – 73%) than the Blanchard variants (SiO_2 52 – 57%), and have higher Al_2O_3, CaO, Fe_2O_3, MgO, and TiO_2. Harker diagrams display linear trends for both phases with a consistent compositional hiatus. Extrapolation of the trends displayed by the Blanchard phase to higher silica values coincides closely with the data for the Shirley phase. The trace element data define similar linear trends. The field, petrographic, and geochemical evidence support evolution by a fractionating comagmatic series. We propose that the Blanchard phase was emplaced and began fractionating into the two observed variants while the magma chamber began to fractionate at depth. A short time later, the Shirley phase was emplaced and began to fraction-ate, explaining all field observations and geochemical trends.

COMPOSITION AND AGE OF MONAZITE IN PARAGNEISSES FROM THE LARSEMANN HILLS, PRYDZ BAY, EAST ANTARCTICA

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The rare-earth phosphate monazite, (REE, Th, Ca)(P, Si, S)O_4, can be used to estimate the temperature of metamorphism, oxygen fugacity and age of crystallization. It is a widespread accessory in granulite-facies paragneisses of the Larsemann Hills, Prydz Bay, East Antarctica. The current study is based on monazite from a cordierite-hercynite-biotite-monazite±xenotime segregation in biotite gneiss and from quartzite containing biotite, magnetite, apatite (several modal percent), and, in places, plagioclase, cordierite and xenotime. Monazite grains are commonly zoned in Y, Th and U. Solvus thermometry on monazite (average of 6 grains) associated with coarse-grained xenotime in the segregation gave 689±50 °C (Pyle et al., 2001, J. Petrol., 42, 2083) and 757±45 °C (Heinrich et al., 1997, J. metamorph. Geol., 15, 3); maximum temperatures for monazite associated with fine-grained xenotime in a quartzite are 607 °C and 682 °C, respectively. Gadolinium distribution temperatures (Gratz & Heinrich, 1998, Eur. J. Mineral., 10, 579) are 728±28 °C (segregation) and 636 °C (quartzite). The temperatures are somewhat lower than standard estimates of 800-860 °C determined by other methods and reported in the literature. Compositional data on the sulfur fit very closely to the coupled substitution Ca + S = REE + P, with up to about 5.5 mole % $CaSO_4$ component. SO_3 content reaches 1.89 wt%, almost as much as reported from the highly oxidized emery of the Cordlandt complex, New York (Tracy, 2004, annual GSA mtg. abstract). This relationship shows that oxygen had a high chemical potential in the metamorphic system. Only the segregation monazite contains sufficient Th for dating with the electron microprobe. Age maps show older cores, but zoning is complex. Very preliminary quantitative analyses gave a bimodal distribution with one cluster of ages lying mostly between 850 and 970 Ma; the second, between 520 and 600 Ma. Overall, results support previous findings indicating two distinct metamorphic events in the Larsemann Hills area.

HRXCT AND EBSD ANALYSIS OF ELONGATED GARNETS OF SPRING POINT FORMATION, CASCO BAY, ME.

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Near Harpswell, ME, the Ordovician Spring Point Formation is part of the 170 km long Casco Bay Group that includes the southern and south-central regions of Maine. Between proto-Atlantic sedimentary stratigraphy, the Spring Point Formation is composed of 470 Ma. basalt intrusions that have subsequently been metamorphosed into amphibolite gneiss during the Acadian Orogeny. Previous research determined low to intermediate peak metamorphic conditions of 550-600 °C and 3-4 kbar associated with compression and underlying granitic plutons. Elongated garnet porphyroblasts have lengths of 0.5-1.5 cm and aspect ratios ranging from 1:1 to 1:5. Three-dimensional imaging obtained with high-resolution X-ray computed tomography (HRXCT) at University of Austin Texas (UTCT) demonstrates that garnets are irregularly ellipsoidal with two long axes parallel to foliation. Garnets occur near foliation bands of higher felsic composition and are surrounded by an amphibole-, plagioclase, and quartz-rich matrix. Consistent throughout bands, porphyroblast size and distribution vary across the outcrop. Garnet grains have abundant inclusions of quartz, ilmentite, and sericite-altered plagioclase, as well as pressure shadows of biotite and occasional calcite. Electron Dispersive Spectrometry (EDS) yields compositions of approximately $Py_5Alm_{68}Sps_8Grs_{19}$. Electron backscatter diffraction (EBSD) analysis of 18 garnets reveals 3-25° shifts in crystallographic orientation across garnet grains. Consistent 1-3° gradual shifts in orientation across subgrains and subgrain boundaries of <10° in larger porphyroblasts have been observed. Garnet microstructures suggest either ductile metamorphic deformation or atypical dynamic crystallization. According to previous research, low to intermediate metamorphic grades of <700 °C cannot account for ductile deformation of garnet. Processes responsible for uncommon low-temperature garnet elongation could include fluid-facilitated porphyroblast growth or retrograde plagioclase replacement.

GEOLOGY OF THE ARISTARCHUS PLATEAU: FACTORS AFFECTING FUTURE LUNAR MISSIONS

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With President G.W. Bush's official proposal in January 2004 to have humans back on the Moon by 2020, lunar research is again at the forefront of space discovery. This research is based on the 2006 NASA Strategic Plan as well as the 2005 Exploration Systems Architecture Study in their desire to insure mission safety in future lunar explorations. The research presented is designed to investigate the Western Volcanic Province (WVP) and more specifically the Aristarchus Plateau Region (APR) as one of many possible landing sites for upcoming scientific—manned and/or unmanned— lunar landing missions. This report summarizes the geology of the APR as it may affect mission planning, particularly mission safety and in situ resource utilization.

A LATE PLEISTOCENE COLEOPTERAN FAUNA FROM PRE-PRESUMPSCOT FORMATION SEDIMENTS IN PORTLAND, MAINE

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The Presumpscot Formation of coastal Maine and New Hampshire consists of early postglacial glaciomarine silts deposited on an isostatically depressed coastline. Excavations in summer, 2007, revealed terrestrial organics, including logs, embedded at the base of these deposits, ^{14}C dated at 11,750 ± 55 yrs. and 11,900 ± 55 yrs. before present. The organics yielded a diverse terrestrial arthropod assemblage, dominated by Coleoptera (beetles). The fauna indicates climatic conditions comparable to modern Maine, and a forested coastal environment with local open sand and marsh; all species thus far identified occur in the modern Maine fauna. Ground beetles (family Carabidae) in the fauna indicate organic-rich, shaded wet substrates. This same habitat would have suited other beetles in this assemblage, including ***Stenus*** sp. and ***Acidota subcarinata*** (Staphylinidae), and ***Cercyon*** sp. (Hydrophilidae). ***Plateumaris*** (Chrysomelidae), represented by numerous small fragments, feeds on emergent aquatics, particularly sedges. ***Hydroporus*** sp. (Dytiscidae) indicates at least seasonal standing water. A carpenter ant (***Camponotus*** sp.) and three species of bark beetles (Scolytidae) are consistent with logs found in the deposit. A forest duff component is suggested by the presence of the detritovore ***Aegialia*** (***Psammaporus***) ***terminalis*** (Scarabaeidae: Aphodiinae) and the round fungus beetle ***Agathidium*** sp. (Leiodidae). ***Orsodacne atra*** is a leaf beetle that feeds on wildflower pollen as an adult and suggests at least some open space. At least localized open, sandy substrates are also indicated by ***Bembidion nitidum*** (Carabidae) and ***Aegialia*** (***Aegialia***) sp.; members of this latter subgenus are generally restricted to coastal sand dunes and comparable environments.

ASSESSMENT OF EUTROPHICATION POTENTIAL ON PATTEE'S POND, WINSLOW, MAINE

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The average annual Secchi disk transparency in Pattee's Pond, Winslow, ME has decreased about 0.5 m over the past 4 years after many years of improving average Secchi transparency. Residents think that algal blooms have been increasing and are concerned about the possible increase in eutrophication. The 2007 variability of Secchi transparency measured by the Volunteer Lake Monitor ranged from about 3 m to 5 m with decreased transparency apparently correlating with rain during the prior week. On July 5, 2007 after a few days of stormy wet weather, the total dissolved phosphorus concentrations (P_{tot}) of an unfiltered water sample taken from 1 m depth at the center of the pond was 170 g L^{-1}. The Secchi transparency was 2.3 m. On July 17, 2007 the P_{tot} and Secchi transparencies were 40 g L^{-1} and 4.3 m respectively. In early August, 2007 water from Bellows Stream overflowed Pickerel Point Rd after a sudden heavy downpour. The following Sunday the Secchi transparency was very low. In November, 2007 we measured P_{tot} (with concentrations up to 1800 g L^{-1}) at several points along Bellows Stream. We verified previously unpublished ME DEP data showing elevated P concentrations during storm events in the watershed. Storm water erosion adds a great deal of suspended P to Pattee Pond, which probably increases the potential for eutrophication of that water body.

ARSENIC VARIABILITY IN DRINKING WATER FROM A DOMESTIC WELL, UNITY, MAINE

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Wells in Unity, Maine are known to have elevated arsenic, hardness, and iron concentrations (Caswell et al., 1995). We investigated the variability of arsenic concentrations in 23 well water samples from a domestic well taken over twenty-four hours. Water samples were taken from the faucet closest to the well prior to any in-line water treatment. The water was allowed to run for ten minutes before sampling. Iron(II), total iron, hardness (Ca and Mg), Arsenic(III) and (V), specific conductance, dissolved oxygen, pH, temperature and oxidation-reduction potential were all measured. All parameters except total iron were measured on site. The specific conductance (314 µS/cm), temperature (10.5˚C), and pH (6.8) stayed fairly constant with relative deviations of less than 10%. The hardness titration endpoints were difficult to spot but the mean hardness is about 218 mg/L as $CaCO_3$. The dissolved oxygen concentrations were low (2-4 mg/L) with corresponding oxidation-reduction potentials of -10 – 25 mV. The total iron concentrations ranged from 1.8 to 4.0 mg/L with Fe(II) varying from 0.6 to 1.8 mg/L. The total arsenic levels in the well water ranged from 7 to 225 µg/L. The cause of the arsenic variability has not yet been determined. The iron removal system installed by the owners was tested twice and works well decreasing the total iron concentrations to less than 0.25 mg/L. Although this system also decreases the arsenic concentration by half, the water at the kitchen sink does not consistently meet the 10 µg/L EPA limit.

DAGGETT'S ROCK: MAINE'S LARGEST GLACIALLY DEPOSITED ERRATIC

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Daggett's rock is located in Phillips, Maine and is Maine's largest erratic, at 7.6m tall, 24 m long, 9m wide, and weighing ~7,200metric tons. It is composed of a two-mica granite, light brown color with equigranular texture and rests upon Devonian metasedimentary bedrock, locally overlain by glacial till. Based on regional ice flow data indicating ice flow from the WNW in Phillips, two granitic plutons are considered potential sources of the erratic-the Redington Pluton (RP) located ~20km to the NW, and the Lexington pluton (LP), located ~60km to the north. We present the results of a petrographic and geochemical study, the first of its kind for sourcing erratics in Maine. Samples were collected across the RP from Orbeton stream in the SE, Spaulding Mtn. in the NW, and a displaced boulder located between Mt. Abraham and Farmer Hill in the eastern arm of the pluton. The RP samples range from equigranular granite (Orbeton stream) to porphyritic granite containing feldspars up to 2cm (the Mt. Abraham boulder) and severely weathered granite/schist (Spaulding Mtn.). However, the Saddleback Mtn. sample, a two-mica equigranular granite, is the closest petrographically to the Daggetts's rock erratic. Samples of Daggett's rock and the RP were analyzed for major and trace elements using XRF spectrometry. These data when combined with published data for the RP (Tomascak et al.,2004) and data for the LP (Gibson, unpublished data) provide a significant data set to attempt a geochemical correlation of the Daggett's rock erratic. Preliminary data for the levels of MgO, TiO_2 and CaO, reveal that the closest correlation exists between the erratic and samples from Saddleback Mtn. The combination of petrographic and geochemical similarities are consistent with the striation data indicating that Daggett's rock originated 20km to the WNW in the Saddleback Mtn. range.

HIGH-RESOLUTION STRATIGRAPHY OF THE PERMIAN-TRIASSIC BOUNDARY AT BETHULIE, KAROO BASIN SOUTH AFRICA

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The Permian-Triassic extinction in the continental record has focused on the stratigraphy of the Karoo Basin, South Africa. The extinction event has been linked to a short sequence in the upper Balfour Formation of the Karoo Supergroup that includes a concretionary paleosol, referred to as the End Permian Paleosol (EPP), which marks the last occurrence of Dicynodon. The nodule layer is overlain by several meters of interbedded siltstone and mudstone that has been referred to in past works as the "Event Bed" or "Dead Zone." This interval is considered to be stratigraphically unique. The EPP and "Event Bed" have been defined by the stratigraphy at Bethulie, located in the Free State province and correlated across the entire Karoo Basin. Lateral variation of the marker horizon on the Bethel and Heldenmoed farms in the Bethulie district was tested for continuity using high resolution stratigraphy assisted by data collected via thin section, XRD, and SEM analyses. The lowermost 4 m of the EPP interval are composed of greenish grey and maroon siltstones and document a minimum of three aggradational cycles. The base of each cycle is marked by green-gray siltstone plugs that crosscut the maroon strata, some of which are interpreted as infilled vertebrate burrows. Katbergia burrows also were found in several intervals in addition to two distinct carbonate-cemented nodule layers that occuring in the predominantly maroon siltstone. A sequence of interbedded very fine sandstone, sandy coarse siltstone, and mudstone in fining upwards couplets immediately overlies the paleosol. Tracing the maroon paleosol and overlying laminated siltstone interval across the two farms resulted in the recognition of significant lateral variability particularly in the "Event Bed." Within several hundred meters, the well defined interbedded siltstone grades to massive siltstone with angular, millimeter-sized mudclasts, overlain by interbedded fine sandstone and siltstone. Two hundred meters northwest, this interval is replaced by massive green-gray siltstone containing pebble-sized mudclasts. Basin-scale correlation of the "Event Bed" seems unlikely due to the lithological variances occurring over the <1 km examined in the present study.

COMPARISON OF LABORATORY AND WHOLE-ECOSYSTEM CHEMICAL WEATHERING IN EARLY POST-GLACIAL ENVIRONMENTS

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The post-glacial northern environment is characterized by rapid physical and chemical change. As ice retreats, it deposits and exposes mechanically-ground, relatively fresh (i.e., chemically unreacted) rock material (till, outwash) on the landscape. This highly reactive regolith quickly (~10-200 yr) undergoes soil development under the warmer, wetter interglacial surface conditions. Early geochemical weathering of the predominantly silicate rock material is dominated by the dissolution of trace minerals (e.g., apatite, calcite, and fluorite) disseminated throughout the granitic material. Upon depletion of these rapidly weathered trace minerals, slower primary silicate mineral weathering (i.e., feldspar, biotite, amphibole, and muscovite) becomes the controlling factor in solute flux out of the system. While the overall abundance of trace minerals is low in continental silicate rocks, their dissolution rates are rapid enough to dominate the chemical weathering flux of freshly exposed glacial landscapes for the first ~200 years of exposure. Understanding the magnitudes and trajectories of the dissolution of these trace minerals in whole-rock regolith systems is crucial in evaluating an early post-glacial landscape's carbon flux and nutrient budget.

WATER TEMPERATURE VARIATION IN THE WESTERN MOUNTAINS OF MAINE

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Documenting local temperature variability has become increasingly important for identifying long-term patterns of climatic change. Seasonal and annual temperature changes in lakes and ponds in the western mountains of Maine are of interest to evaluate local climate trends and to identify major influences on water temperature in high elevation ponds with small watersheds. Baseline temperature data for air and surface water temperatures were collected at three locations from July through September: Webb Lake (207 m) and Tumbledown pond (875 m) in Weld, ME, and Cranberry pond (866 m) in the Bigelow range north of Kingfield, ME. This pilot study seeks to address the following questions: What is the relationship between air and water temperatures? What is responsible for the onset of a significant rise or fall in water and air temperatures? What is the influence of elevation on water temperature variability? Water and air temperatures follow similar trends, however the average monthly air temperatures at both Tumbledown and Bigelow are cooler than the average monthly water temperatures. For example, the September average air temperature was ~12 degrees C and the average surface water temperature was ~15 degrees C. Surface water temperatures fol-lowed similar trends at all three locations, but temperatures were warmest at the lowest elevation (Webb Lake) and coolest at the highest elevation (Tumbledown). Water temperature at each loc-ation is a function of multiple factors, including insolation, precipitation, air temperature, surface area, and water volume. We initially predicted that summer rain events might be responsible for drops in water temperature, but the comparison of water temperatures to precipitation records indicates water temperatures were falling up to a day in advance of the rain event at both locations. While there is a close correlation between insolation and air temperature, we will demonstrate that cloud cover plays a prominent role in moderating surface water temperature.

FLUVIAL SYSTEMS AND CARBONATE NODULES REVEAL LATE PERMIAN CLIMATE CHANGE AT WAPADSBERG PASS, EASTERN CAPE PROVINCE, SOUTH AFRICA

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Changes in late Permian climate are crucial to understand the dynamics responsible for the end Paleozoic mass extinction. The Karoo Basin, South Africa, has been the focus for documenting terrestrial ecosystem response because of Permian and Triassic rocks that cross the purported boundary. The present study builds on previously reported stratigraphy at outcrops exposed in Wapadsberg Pass near Graaff Reinet, Eastern Cape province. The R61 roadcut consists of interfluvial and fluvial deposits of aggradational and degradational landscapes. Floodplain aggradation includes fining-upward sequences of fine sand and silt in m-scale beds. Weakly developed paleosols are identified by vertical to sub-

vertical rhizo-concretions and/or horizons of calcite-cemented nodules. Meander-ing rivers represent initiation of degradational processes and include basal channel deposits of fine-to-medium Qtz-wackes in lenticular geometries. Channel fills consist of either sandstone bar forms and/or silt-stone plugs of abandonment. Landscape equilibrium is dem-onstrated by rooted paleosols and an autochthonous forest litter. Stable-isotope values from carbonate-cemented concre-tions show a positive $\delta^{13}C$ PDB excursion to -5.7 in paleosols ~60 m below the P/T boundary without significant deviation in $\delta^{18}O$ SMOW values. Subsequently, $\delta^{13}C$ values become more negative upsection reaching -14.9 at the P/T boundary. These trends are interpreted to represent a change from increasingly seasonal to more wetland conditions in the latest Permian. There is no significant change in $\delta^{18}O$ SMOW values. Climate trends based on stable-isotope data are augmented by phy-sical stratigraphy. Meandering channel fills are characterized by multiple, stacked paleosols within abandoned channels, indicating the presence of ephemeral conduits and dramatic swings in seasonality. These data may support an overall drying trend in the latest Permian, although wetlands play more of a role in the landscape than previously recognized.

APATITE GEOCHEMISTRY OF WESTERN MAINE PLUTONS

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Apatite is a useful accessory mineral because it concentrates many trace elements that are incompatible in major minerals. It is therefore useful as a record for trace element levels, it geochemically distinguishes differing granite types, and zoning provides a record of magmatic processes. Apatite from 14 samples from granites western Maine and southern New Hampshire were analyzed for minor constituents (Mn, Fe, S, Sr, Y, Ce, La, Si) using the electron microprobe. Backscatter electron images (BSE) and compositional maps were also acquired to document zoning in individual grains. Metaluminous samples show a positive relationship between Si and REE. Apatite from peraluminous granites show higher levels of Mn and Y. Inclusions of quartz, potassium feldspar and plagioclase are found only in apatite from peraluminous granites. Metaluminous samples show lower amounts of Mn and higher levels of Si. Two samples from metaluminous granites display complex zoning. Bright zones in BSE images denote higher levels of REE and Si, suggesting the following substitution: $Si^{+4} + REE^{+3} = Ca^{+2} + P^{+5}$. The compositional differences between metaluminous and peraluminous granites are reflected in the chemical compositions of apatite. Complex zoning, including dissolution surfaces that truncate earlier zones, are preserved in apatite from metaluminous granites. To produce this zoning, the apatite grains were exposed to different chemical surroundings within the magma chamber, and therefore must have formed within an active, dynamic magma chamber. The age of the Songo pluton ~384 Ma and argon ages for hornblende are ~ 310 Ma. Despite remaining at elevated temperatures for >70Ma, complex zoning on the order of 2 microns is still preserved, therefore diffusion of Si in apatite must be very sluggish. The lack of zoning in peraluminous samples may point to crystallization in a less dynamic chamber.

A STUDY OF RECENT FOREDUNE EROSION AT POPHAM BEACH, ME

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In September of 2007, students in Global Change (GEO 109) conducted a study of erosion at Popham Beach in Phippsburg, ME. Handheld GPS receivers were used to take waypoints along the swash zone. A GIS was used to overlay the GPS data onto orthographic images from 2001 and to calculate changes in areal extent of beach features between 2001 and 2007. Sections of the beach have undergone 125 to 175 m of shoreline retreat over the last six years. Additionally, approximately 50,000 m^2 of the vegetated foredune has been eroded. This erosion is likely due to the continued migration of the Morse River across the ebb-tidal delta, coupled with storm activity over the last six years.

ORIGIN OF A LOW-LYING BOULDER FIELD, WESTERN MAINE

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An extensive boulder field of uncertain origin is located between two large lakes in western Maine. Trending east to west between Rangeley Lake and Mooselookmeguntic Lake, the boulder field is mapped as a meltwater channel (Caldwell, 1974), but the absence of a pronounced topographic channel warranted further research into the origin of this feature. An alternate origin for the boulder field is as a lag deposit in an outlet channel associated with Rangeley Lake. The boulder field is divided into two visible areas (7800 m^2 and 4000 m^2) separated by a road and forest. Boulders size range from 50 cm to 3 m long at the surface and decrease in diameter at depth. The two boulder lithologies present are schist and granite. These rocks derive from Bald Mountain, outcropping immediately to the northwest of the boulder field. Boulders are sub-angular to well rounded, and winnowed of fines. The thickness of the boulder field is greater than 2 meters. Forest vegetation obscures most of the lateral contact between the boulder field and adjacent till. The surface between the boulder field and the till zone show no change in elevation. The elevation of the boulder field surface decreases to the southwest and has less then a 1 percent gradient. The orientation of the long axis of the boulders tends to be predominantly to the west. The shape and orientation of the boulders support the idea of a lag deposit. However, if this is a lag deposit, a significant volume of interstitial finer material originally found between the boulders must have been removed. These fines may have been transported into Mooselookmeguntic Lake. Furthermore, the removal of so much material would be expected to result in the development of a topographic channel, but no distinct channel is observed in the boulder field.

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

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

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THE GEOLOGICAL SOCIETY OF MAINE
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