The Maine Geologist

NEWSLETTER OF THE GEOLOGICAL SOCIETY OF MAINE

June 2019 Volume 45 Number 2

PRESIDENT'S MESSAGE

After a busy spring of many exciting geoscience-themed events in Maine, I'm looking forward to getting back in the field with friends and colleagues at the GSM summer field trip to southwestern Maine! Many Maine-based students had the opportunity to present their undergraduate and graduate research and engage with educators, exhibitors, and researchers from throughout the region at the Northeast Geological Society of America meeting held in Portland, Maine this past March. The GSM had a booth at the conference where we kicked-off the Walter Anderson Fund campaign and shared with the wider community some of the work we do throughout the year. In April, students from around the state presented their work GSM spring meeting held at University of Maine at Presque Isle. Dr. Aaron Putnam, University of Maine, Orono, gave a compelling talk describing "lessons from the past for a warming world". Read more about the spring meeting and find abstracts of the presentations within this newsletter. In celebration of the pending opening of the Maine Mineral and Gem Museum (MMGM) in Bethel, ME, this summer's GSM field trip will take place around the Bethel region with visits to multiple pegmatite quarries where we can expect to collect some exciting minerals as well as visits to a few sites featuring the surficial geology of the region. Field trip participants can explore the MMGM during the Saturday evening cook-out. Find out more about the field trip itinerary and registration information in this newsletter. Hope to see many of you in southwestern Maine this July!

Sarah Hall, GSM President
shall@coa.edu

KEVIN MCCARTNEY GEOSCIENCE EDUCATION FUND

In April, 2019, Kevin and Kate McCartney donated $10,000 to the Geological Society of Maine to establish the new **Kevin McCartney Fund**. This fund will complement the Walter Anderson Geoscience Education Fund to give GSM greater ability to grant educational funding requests. The society is extremely grateful for Kevin and Kate's generosity.

Kevin is currently in Szczecin, Poland, working on a compilation of his recent discoveries in the evolution of Cenozoic silicoflagellates made while he worked there as a Fulbright Scholar. When he returns in July we will meet with him to establish a mission statement for his fund to differentiate it from the Walter Anderson Geoscience Education Fund.

Bruce Hunter, GSM Treasurer
bruce.e.hunter@gmail.com

THE EDITOR'S MESSAGE

The newsletter is distributed through email in pdf format. Anyone with special needs please contact the Editor. Please send items of interest and photographs of GSM activities to:

Amber Whittaker, Newsletter Editor
amber.h.whittaker@maine.gov

GSM WEBSITE: www.gsmmaine.org
FACEBOOK: facebook.com/GSMMaine

2019 SUMMER FIELD TRIP REGISTRATION & FEES

Pegmatites and the Ellis River Valley:
A visit to Western Maine
July 27-28, 2019

The 2019 summer field trip is quickly approaching. If you plan to go, please be sure to register by July 12th, as space is limited. The registration fee is $15 for GSM members and $10 for k-12 educators. The registration form and trip information are attached to this newsletter and will be emailed to GSM members.

For any additional information please contact:

Myles Felch
mfelch@mainemineralmuseum.org

2019 NEIGC

The 111th meeting of the New England Intercollegiate Geological Conference (NEIGC) will be hosted by Norwich University, October 11-13, 2019. Trips will predominantly focus on areas in central and southern Vermont and immediately adjacent parts of New Hampshire and include investigations of the tectonics of the Champlain Valley Belt, trondhjemitic extensional magmatism, glacial history preserved in the upper Winooski and Lake Mansfield areas, mineralogical and geochemical variation in plutonic rocks of the New Hampshire plutonic suite, climate records preserved in upland lakes, stratigraphic and structural studies of faulting at the Ordovician arc margin, and others. A Friday reception will be held at the Vermont Granite Museum and a Saturday banquet will be held at the Old Labor Hall in Barre, Vermont. Look for field trip descriptions and schedules, registration details, and lodging/campground information at the NEIGC website in mid-June:

http://w3.salemstate.edu/~lhanson/NEIGC/index.html

Chris Koteas
gkoteas@norwich.edu

WEBSITE UPGRADE

Still working!

The Geological Society of Maine is continuing to work on its website upgrade! In case you missed the announcement in the last newsletter, here are a few improvements that will be coming soon to the GSM website:

Member center:
- Renew and pay for your membership online
- Create and edit your member profile

News, events, and announcements:
- A new online calendar for events of interest to the Geological Society of Maine community
- Clear guidelines on how to submit items for the calendar and newsletter

Resources:
- Education and outreach resources
- Geological Society of Maine publications
- Student funding and career opportunities
- Geology links

Giving:
- Information about how to give to the Geological Society of Maine's general fund and how to apply for grants
- An exciting new homepage for the Walter Anderson Fund

We also have a new email account for communicating with the Geological Society of Maine: mail@gsmmaine.org. We plan to launch the new website in the next two months, so please check back soon and let us know what you think.

NEWS FROM THE STATE GEOLOGIST

Leading the way on climate

By the time you read this, the 11th Beaches Conference will have already happened. Since 2000, this conference, organized by Maine Sea Grant with significant input from the Maine Geological Survey, Maine Coastal Program, and other agencies and organizations, has focused attention on the health of Maine (and since 2017 – New Hampshire) beaches. A major theme throughout the nearly two decades of the conference has been the impacts of sea-level rise (SLR) and coastal storms. For each conference, Marine Geologists Pete Slovinsky and Steve Dickson, along with marine interns, have created graphs showing the status of Maine's significant beaches in terms of erosion and accretion of sand. Much of the data comes from an army of volunteers who monthly measure profiles across these major beaches. On average over the last decade, Maine's beaches have been evenly split among those that are accreting, those that are remaining stable, and those that are eroding. Many of you will recall that the winter storms of 2018 were particularly rough on Maine's beaches. And fortunately, through the profile data we see that most beaches have recovered significantly by 2019. But what will the impact be of additional rise in sea level?

This and other questions will be addressed by the Maine Climate Council proposed by Governor Mills in a bill before the Legislature. The proposed 39-person Council would draw membership from the Legislature, senior leadership in almost every government department, and 20 members "representing state interests affected by climate change or with expertise in climate change issues." Many of the climate bills I discussed previously have been rolled into this one initiative.

Among the duties of the Council is to appoint a Scientific and Technical Subcommittee charged with analyzing the best science on the direct and indirect effects of climate change and the factors contributing to those effects. Perhaps most important to southern Maine beach communities, this Subcommittee shall establish "science-based sea-level rise projections for the State's coastal areas," and "create maps that indicate the areas of the State that may be most affected by storm surge, ocean and river flooding, and extreme weather events…." MGS Marine Geologists Pete and Steve will be heavily involved in this work. In fact, over the past several years they have developed datasets that show potential inundation under several SLR and storm surge scenarios. MGS's GIS Manager, Chris Halsted, created a web mapping portal for easy access to these data.

https://www.maine.gov/dacf/mgs/hazards/slr_ss/index.shtml

Parts of the Climate Action Plan that the Council is charged with updating will set aggressive goals for GHG reduction and goals for electricity production from renewable (low-carbon) sources. In updating the Plan, the Council will evaluate mitigation strategies that would be most effective in meeting those goals. The Plan will also focus considerable effort on adaptation and resiliency strategies and actions. Many coastal communities are already developing adaptation strategies but are having difficulty finding the funding to implement them. Perhaps a bond will address some of this need.

During the hearing on the Climate Council bill, one Legislator asked, "If we do all the things called for in this bill, at considerable expense, will there be any impact on the rate of sea-level rise in Maine?" The answer is "no." But coastal communities, in particular, are already facing the impacts of climate change. Someone needs to take the first step. Dirigo.

Robert G. Marvinney, State Geologist
robert.g.marvinney@maine.gov

NEWS FROM THE CAMPUSES

Unity College

The end of the semester came on quick with the usual flurry of senior thesis defenses, student conference presentations, and internship preparations. The most recent round of graduates has been sent off into the real world and working, scattered as far west as South Dakota and some right here in Maine. With the passing of that milestone, summer is getting off to a (cold and damp) start with

research and curriculum development. As noted in my previous summary, we received some funding from NASA to conduct a pilot project utilizing drones to develop a better method of studying algal blooms. We've been busy developing, testing, and refining our methods and flying 2-3x per week. Our research students are busy not only assisting with drone flights but also working with my co-PI's conducting water quality testing and image processing. Other summer plans include making some changes to existing courses and scouting out some possible field trip sites for fall classes and possibly the for next summer's GSM trip. If anyone has any thoughts for the Jackman region, please let me know. Have a great summer!

Kevin Spigel
kspigel@unity.edu

College of the Atlantic

Three COA students and one recent alum presented their independent study projects at the NEGSA meeting in Portland as well as at the GSM Spring Meeting at UMPI. During spring term, the Seminar on Climate Change speaker series held at COA featured 12 visiting speakers from Maine and beyond, all working on aspects of projects related to climate change (link to series: https://www.coa.edu/shall/Geoscience/SCCSS_2019.html). This summer, COA and Middlebury students will work with Friends of Acadia, the Lawn and Garden Preserve, and Acadia National Park on local watershed projects on Mt. Desert Island.

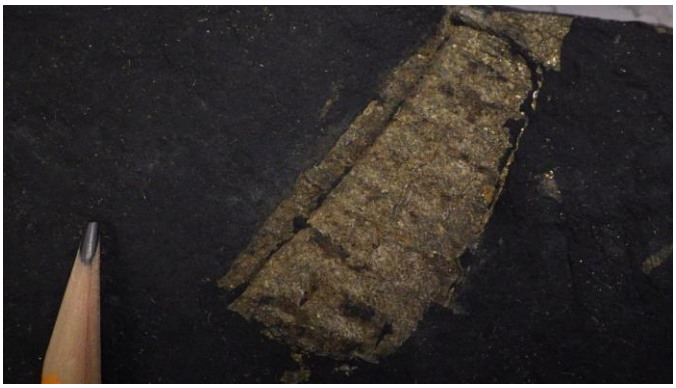
Sarah Hall
shall@coa.edu

Colby College

Dr. Alejandra (Aleja) C. Ortiz will join the Colby College faculty next fall as a tenure-track assistant professor. Dr. Ortiz earned her B.A. at Wellesly College and her Ph.D. from the MIT-WHOI Joint Program. She also holds an M.S. in Civil and Environmental Engineering from MIT, and she was a National Center for Earth Surface Dynamics 2 Synthesis Postdoctoral Fellow embedded in the Department of Geological Sciences at Indiana University. Dr. Ortiz's research interests include coastal geomorphology, coastal response to climate change, fluvial ecogeomorphology, and coastal engineering. She approaches questions in these areas using a combination of numerical modeling, remote sensing, and field measurements.

Bill Sullivan
wasulliv@colby.edu

University of Maine at Presque Isle



An orthoceratoid cephalopod fossil which entirely is pyritized was recently discovered in Upper Ordovician slate within the Munsungun inlier of northern Maine by Chunzeng Wang of UMPI. This may be the first report of such a genus ever discovered in the area.

Chunzeng Wang
chunzeng.wang@maine.edu

SECRETARY'S REPORT

The Executive Council (EC) met on March 4, 2019, by conference call. The agenda included planning for GSM's presence at the Northeast Section meeting of the Geological Society of America (NEGSA), held in Portland on March 17-19, 2019. Other agenda items were updates from the Walter Anderson Fund Committee, a request for field trip funding through the Walter Anderson Fund, and an update on the GSM website upgrade.

A GSM business meeting was held at the beginning of the GSM Spring Meeting on Friday, April 1, 2019, at University of Maine, Presque Isle. The Secretary was unable to attend, and sincerely thanks Vice President Kevin Spigel for recording the minutes of the business meeting.

1:20pm
Chunzeng Wang opened the spring GSM meeting with welcome remarks and logistics overview.

1:25
GSM President Sarah Hall opened the business meeting.

- Sarah thanked those who helped at the NEGSA booths
- Amber Whittaker provided a website update including the new option of paying dues online and creating a member profile
- Sarah provided a brief overview of the upcoming summer GSM trip in/around Bethel including stops at Havey Mine and Newry Mine, Ellis River Surficial Geology led by Lindsay Spigel, Groundwater Hydrology led by Ryan Gordon and Keith Taylor. There will be a group campsite reserved and a BBQ.
- Sarah concluded with announcements. A reminder about a recently posted hydrogeologist job with the MDEP was noted.

1:30
Meeting adjourned
Submitted by:
K. Spigel
5/1/19

The EC met again by teleconference on Friday, May 3, 2019. Discussion items included the successful and well-attended spring meeting, Walter Anderson Fund awards for student presentations, summer field trip planning and communications, website updates, Walter Anderson Fund updates, and preliminary planning for the summer 2020 field trip. The agenda also included discussion of a very generous fund donated by Kevin McCartney, which will serve as the basis for an endowment fund to provide scholarships for educational opportunities. More information to follow as the vision for this fund takes shape.

Respectfully submitted,

Lisa Jacob, GSM Secretary
ljj@smemaine.com

GSM SPRING MEETING
APRIL 5, 2019

University of Maine at Presque Isle
Presque Isle, Maine

Keynote Speaker

Aaron Putnam
University of Maine at Orono

THE LAST GREAT GLOBAL WARMING: LESSONS FROM THE PAST FOR A WARMING WORLD

The last glacial termination featured the largest natural warming in recent history, and represents a great global experiment that can be studied to clarify the underlying operation of Earth's climate system. Here I will report the results of a decade-long effort to chart the demise of mountain glaciers since the last ice age in both hemispheres. I suggest that a spectacular warming prompted extensive and rapid mountain glacier recession in both hemispheres beginning about 18,000 years ago. This glacier reduction represented a dominant proportion of the full glacial-to-interglacial atmospheric temperature rise, marking a distinctly non-linear transition from a glacial to and interglacial world. This interhemispheric signature of ice recession coincided with the imposition of stratified conditions and winter-centric cooling in the North Atlantic at the onset of the interval known as "Heinrich Stadial 1". Building on these observations, I argue (together with colleagues) that this massive increase in interhemispheric summertime warming would have expanded ablation zones on circum-North Atlantic Ice Sheets, in turn producing the highly seasonal conditions of Heinrich Stadial 1. Aided by the results

of a state-of-the-art Earth System model, I will speculate on a possible southern-centric explanation for what drove the termination on a global scale. Finally, I will propose that the same non-linear climate dynamics that terminated the last ice age are being reawakened by the input of fossil-fuel carbon dioxide into the atmosphere, and that the climate system may have recently entered a new mode of operation.

POSTER PRESENTATIONS

P1

HYDROLOGIC MODELING OF THE UNITY COLLEGE SURFACE WATER DRAINAGE DITCH

Sierra Hopkins, Matt Porter, Meghan Burnell, Joshua Drost, Arthur Jacques, Jordan Leavitt, Emily McCarthy, Ethan Oliver, Sage Rabito, Patrick Saulys, Dillan Schmidt, Benjaman Swett, Den Suehiro, Kevin Spigel
Leading author contact: shopkins16@unity.edu
Unity College

Collecting and directing surface water runoff via culverts, grates and drainage ditches, is essential to ensure localized flooding doesn't occur around infrastructure and residences during rainfall events of various magnitudes. For this hydrology class project, students investigated the drainage ditch on campus that runs along Quaker Hill Rd. to estimate flow conditions and culvert effectiveness. This was done by surveying the drainage ditch, modeling using field surveyed data points, applying open channel flow calculations, collecting flow depth at three culverts in the study area and measuring the water stage in the channel during rainfall runoff events. A hydrologic model of the surface-water behavior in the drainage ditch for the duration of the semester was generated as a result of this project. During each rainfall event, students collected flow depths from 3 culverts with depth tabs and used a staff gage within the ditch. These measurements were used to calculate the stage and discharge of the site. Knowing the stage and discharge, the students could model a relationship between stage and discharge to better understand the quantity of water that was flowing through the area during various rainfall events. Ditch surveying was completed using a Total Station and Auto Level to establish elevations and the dimensions of the channel. With this information, the hydrology students were able to create a model in the computer program HEC-RAS to represent the characteristics and simulate flow conditions of the study site to understand how the runoff would flow through the drainage ditch and evaluate potential for flooding.

P2

GULF OF MAINE SEA-SURFACE TEMPERATURE DURING THE PAST 6,000 YEARS: IS MODERN WARMING ANOMALOUS?

Jonathan Maurer, Cassandre Stirpe, Katherine Allen
Leading author contact: jonathan.maurer@maine.edu
University of Maine

From 2004 to 2013, the Gulf of Maine warmed faster than 99% of the world's oceans, but the processes driving recent temperature change are not fully understood. The Gulf's increasing temperature poses a threat to ecosystems and fisheries that serve as key economic resources for coastal communities. A deeper understanding of oceanographic trends on time scales beyond instrumental records (~100 years) is needed to provide context for modern changes. Longer-term records also enable testing of past relationships between paleo fishing practices, recorded in archaeological sites, and past ocean temperature. In this study, we reconstructed sea-surface temperature (SST) of the past 6,000 years by measuring the ratio of magnesium to calcium in shells of the planktonic foraminifer Neogloboquadrina incompta, extracted from a sediment core collected in Jordan Basin. In the modern ocean, Mg/Ca of N. incompta shells increases with SST at a known rate, providing a calibration that allows Mg/Ca of fossil shells to be converted into a record of past temperature. We found that during the past 6,000 years SSTs were variable (~ 5˚C range, similar to the range observed in the past 40 years) with no pronounced thousand-year-scale trend of warming or cooling. When paired with an existing δ18O record from Jordan Basin, the SST variability suggests shifts in the proportions or nature of water masses entering the Gulf of Maine through time. More data are needed to increase temporal resolution and to test and strengthen observations from this pilot study. This research was funded by the Center for Undergraduate Research 2018 Summer Fellowship and the School of Earth and Climate Sciences Golden Fund for Undergraduate Research.

P3

TRACKING RAIN WATER INFILTRATION ON THE UNITY COLLEGE CAMPUS INTO THE SEWER SYSTEM

Benjaman Swett, Emily McCarthy, Gunther Schletter, Kevin Spigel
Leading author contact: Bswett17@unity.edu
Unity College

This study originated in the surface and ground water hydrology course GL3044 of 2016, when the Unity Utilities District noticed more water present in the sewer system during rainfall events. The surface water runoff was tracked using Rhodamine; a nontoxic fluorescent dye that is light sensitive and detectable in small concentrations. Rhodamine Dye pucks were placed at various locations around the Unity College campus. These locations were chosen because they are points of high concentrated water flow, such as culverts or grates. The detection of dye would indicate whether infiltration or inflow was occurring in the sewer system. Rhodamine dye concentration in the wastewater was measured using cyclops which tests concentration in particles per billion (ppb). Regular flow depth measurements in the sewer were taken at 2 pm (high campus activity) and at 2 am (low campus activity) to establish high and low flow levels for Unity College. High flow and low

flow measurements were compared to runoff measurements to determine if there was an increase in flow levels. Wastewater was collected from a gravity-fed sewer line along Quaker Hill Road and put in a labeled sample bottles. Depths of wastewater were collected by attaching a depth tab to the end of a pole to measure the depth of flow which was then converted into discharge using the Manning's equation. Based on this study surface water runoff was found to be entering the Unity College sewer system through dye presence and increased flow levels.

P4

PRESERVATION OF OLD EXPLORATION CORES FROM MOUNT CHASE AND ORE MOUNTAIN (KATAHDIN IRON WORKS) DEPOSITS

Dylan Dambois[1], Adam Weyeneth[1], Sarah Swain[1], Caleb Ward[1], Chunzeng Wang[1], Robert Marvinney[2]
Leading author contact: dylan.dambois@maine.edu
1 University of Maine at Presque Isle
2 Maine Geological Survey

This presentation is about how we conduct relocation, evaluation, organization, and inventory of the old exploration cores drilled at Mt. Chase and Katahdin Iron Works. Since summer of 2018, we work as a team on the old core preservation project. In summer 2018, we culled, sorted, transported, and re-stored a large amount of core drilled and obtained from Mt. Chase and Katahdin Iron Works (also called Ore Mountain) in Maine prior to 1983, from Huber Engineered Woods LLC of Eaton to Presque Isle Industrial Park. The cores involved were 114 boreholes from Mt. Chase, and 21 boreholes from Katahdin Iron Works. There are more than 10000 boxes of cores in total. These rock/ore cores serve as an important data repository for Maine's geological history. After the cores were moved into the new storage building in Presque Isle later in the summer, cataloging has been conducted throughout fall 2018 and winter 2019 to provide ease of access and organization to this repository. The aim of this work was to have the core data available for future study and reference by geology professionals, educators, and students. For example, Wolfden Resources Inc studied and sampled some of the preserved cores in fall 2018 for their exploration project and geologic research in Maine. While working on the project we also had great opportunity to learn the rocks, in particular the different types of the ores at both deposits. We saw the difference in ore minerals at both deposits. For example, the Mt. Chase ore is composed of massive sulfides of dominantly pyrite, sphalerite, galena, and chalcopyrite, a typical volcanogenic massive sulfide (VMS) type ore, whereas at Katahdin Iron Works, the major sulfide is pyrrhotite which occurs within diorite and gabbro, a magmatic-type iron and cobalt ore. This project has been supervised by State Geologist, Dr. Robert Marvinney and Professor Chunzeng Wang. The National Geological and Geophysical Data Preservation Program at the U. S. Geological Survey financially supported this project through Maine Geological Survey.

P5

EMPLACEMENT LEVELS OF DEVONIAN-TYPE GRANITOIDS OF THE PISCATAQUIS MAGMATIC BELT, CENTRAL AND WESTERN MAINE

Sean Brock and David Gibson,
Leading author contact: sean.brock@maine.edu
University of Maine at Farmington

The Piscataquis Magmatic Belt (PMB) is a group of over 40 compositionally diverse plutons, which traverse central Maine. Compositionally they vary from gabbros to two-mica peraluminous granites; temporally they range from Early-Devonian, such as the 405 Ma Onawa, to Late-Devonian, e.g. the 364 Ma Songo pluton. These intrusions were also emplaced at differing crustal levels, for example the Katahdin granite was emplaced epizonally as evidenced by its texture and associated volcanic rocks. The zoned Onawa pluton displays a classic contact aureole and must therefore have also been emplaced into cooler, higher crustal levels. In contrast, at the southwest end of the PMB the Songo granodiorite pluton lacks any contact metamorphic effects and evidence from the surrounding metamorphic envelope suggests it was emplaced ~ 18km. The question addressed in this presentation is whether plutons were emplaced at regular intervals in the crust or if magmas ponded at specific crustal level(s). This study aims to examine the emplacement level of plutons in the PMB utilizing the Al in hornblende geobarometer. This necessitates that the granites have a metaluminous I-type mineralogy that is coexisting hornblende + biotite + sphene. The plutons examined in this study are – the Songo granodiorite, the North Lexington granite, the Chain of Ponds pluton and the metaluminous phases of the Mooselookmeguntic and Rome – Norridgewock plutons. These plutons not only represent a range of plutons ages but are located along traverses, which are both orogen parallel (NE – SW) and perpendicular to this (NW – SE). Therefore focus of this study is to better understand the emplacement levels of the plutons of this suite and therefore elucidate the assembly of this block of continental crust.

P6

PAST, PRESENT, AND FUTURE OF THE COLLEGE OF THE ATLANTIC STREAM: A SMALL COASTAL WATERSHED ASSESSMENT

Patricio Gallardo García Freire, Sarah Hall, Brian Henkel
Leading author contact: pgallardo17@coa.edu
College of the Atlantic

In this study, we established a baseline characterization of the COA Stream (COAS) and its respective COA Watershed (COAW). The project was guided by 4 spheres of study: The Spatial, Social, Ecological, and Economic Spheres. We identified changes in land use, land ownership, and water infrastructure through time that may have led to the current configuration of stormwater outlets, drinking water mains, and sewage piping within the COAW. Using GIS, we created a database with relevant geological, hydrological, and ecological data for the COAW, to be expanded through future research

questions. Given the substantial landscape changes associated with the recent reconstruction of Rt. 3 and the future construction of new student housing and the Center for Human Ecology, a new building proposed for the COA campus, we established monitoring stations at all the freshwater outlets of the COAW draining to Frenchman Bay. With this study, we developed a framework for continued monitoring of some useful ecological metrics: discharge, stage, channel geometry, pebble counts, and water quality, which enable us to identify hourly, seasonal, and annual trends in watershed conditions. These data and corresponding infrastructure can inform best management strategies, while providing an educational resource on the COA campus tied to course curricula, as well as opportunities for public involvement through Citizen Science. Beyond the larger stream networks within Acadia National Park (ANP), monitored by ANP and Wild Acadia initiatives, this current study serves as a model to expand monitoring, through a human ecological approach, to other coastal watersheds of Mount Desert Island beyond ANP that also drain into Frenchman Bay. Continuous monitoring of small coastal watersheds is important for identifying contributions of sediment, nutrient, and pollutant loads from similar watershed systems draining directly to the intertidal zone; these small drainage networks that line our extensive Maine coastline have direct impacts in the ecological, social, and economic integrity of coastal communities. Based on the concept of interdependent and decentralized watershed "microgrids", we also included variables such as stream loads, water and energy usage, discarded resources, and greenhouse gases (GHGs) emissions into this study, further delineating a holistic framework for future data collection and dissemination strategies of sustainability metrics at the microscale in the context of climate change.

[Winner Best Student Poster]

P7

GEOMORPHIC MAP OF KEBO BROOK WATERSHED: IDENTIFYING CHARACTERISTIC CHANNEL GEOMETRY AND CHANNEL HEAD LOCATIONS FOR A SMALL POST-GLACIAL COASTAL NEW ENGLAND WATERSHED

Sahra Gibson, Sara Lowgren, Sarah Hall, Seam Smith
Leading author contact: sgibson17@coa.edu
College of the Atlantic

Defining and mapping the upstream point at which a first order channel begins, the channel head, is important for the quantification of drainage networks. Their positions have implications to drainage density and total channel length, which are important for quantification of the transport of water, sediment, and other constituents through watershed drainage networks. Detailed mapping of first order channels and their upper termini, have not yet been accurately delineated in many locations of coastal Maine. In this study we conducted field and remote mapping of Kebo Brook Watershed, a ~1.5km2 post-glacial basin situated in a north-south trending valley on the eastern side of Acadia National Park. We mapped watershed settings defined by vegetation, permeability, soil composition, surficial deposits, slope, and landscape features such as glacial moraines. We also delineated headwater streams throughout the watershed. These data were used to identify associations between watershed settings and first order channel characteristics. Stream network analyses such as these will help improve future modeling and management activities in the post-glacial granitic landscapes of the northeastern coastal region.

P8

PETROGRAPHY AND GEOCHEMISTRY OF THE TWIN LAKES GRANODIORITE, CENTRAL SAWATCH RANGE, COLORADO

Forrest Meader and David Gibson
Leading author contact: forrest.meader@maine.edu
University of Maine at Farmington

The Twin Lakes granodiorite is located in the central portion of the Sawatch Range in Colorado, and outcrops over an area of approximately 130 km2. It is of Paleocene age and intrudes a package of Pre-Cambrian gneisses, schists and foliated granites. Gravity studies (Case 1964) suggest that the Twin Lakes rocks along with other granitoids of the area may be the exposed top of a larger mass of batholithic proportions. Wilshire (1969) recognized distinct mineral layering in the granodiorite, which resembles similar petrographic features evident in plutons, such as the Mt Waldo and Deer Isle of coastal Maine, where magma mixing and mingling has been a dominant process during their crystallization. This study aims to re-evaluate the field relationships and petrography of the Twin Lakes granodiorite and, along with geochemical data, examine possible modes of origin for the mineral layering. The rocks of the Twin Lakes pluton are predominantly coarse grained, light brown colored, porphyritic granodiorites with a CI of 9 to 12% and abundant k-feldspar phenocrysts. These range from 1 to 5 cm in size and generally lack a preferred orientation. The groundmass is predominated by plagioclase feldspar, quartz, biotite and minor hornblende and k-feldspar along with accessory amounts of sphene. Other minor petrographic variants are evident within the main body of porphyritic granodiorite and these are generally more leucocratic granites and lack the large phenocrysts of the main phase. The main areas of mineral layering or schlieren are exposed in the north-central and eastern parts of the intrusion adjacent to margin with the country rocks. They range in width from veins < 5cm to over 1m and have variable dispositions. Mineralogically they vary from being feldspar rich, containing both plagioclase and orthoclase, to more melanocratic with higher abundance of biotite and hornblende along with accessory phases of sphene and zircon. The development of mineral layering or schlieren is often attributed to the separation of crystals from liquid during convective flow in a dynamic magma chamber. However, the preponderance of the layering in the Twin lakes intrusion close to its contact suggests that upward flow and phase separation was restricted to the marginal zones of the pluton.

P9
IS THERE A CORRELATION BETWEEN THE LOCATION OF GEOLOGIC STRUCTURES AND PRIVATE WELL WATER CHEMISTRY? A VIEW FROM NORTHERN MT. DESERT ISLAND
Gabriela Moroz, María Fé Aragón Orrego, Sara Lowgren, Sarah Hall, Anna Farrell, Jane Disney, Bruce Stanton
Leading author contact: gmoroz21@coa.edu
College of the Atlantic

Studies have shown that consuming even very low levels of arsenic can have harmful, long-term health effects. The ongoing "All about Arsenic" collaborative project, initiated by the MDI Biological Laboratory (MDIBL) and Dartmouth College, aims to simultaneously collect water chemistry data from privately owned wells in Maine and New Hampshire while also enabling high school educators to supplement existing groundwater curricula with a focus on a locally relevant topic: arsenic abundance in drinking water. The project was initially funded through an EPA Environmental Education grant and is currently funded through a NIH Science Education Partnership Award (SEPA). As an extension of this large project, researchers from College of the Atlantic (COA) designed a sampling event to look at the spatial distribution of well water components with respect to the local geology. Over 75 participants from the northern portion of MDI volunteered to have their private well water tested during December 2016. A second sampling event will occur during the winter of 2019 to supplement the 2016 data. Preliminary results suggest that groundwater components do generally correlate with geologic features such as bedrock types and fault locations, however not currently in a predictive way.

ORAL PRESENTATIONS

O1
PRELIMINARY LITHOLOGICAL AND LITHO-GEOCHEMICAL ANALYSES OF THE PICKETT MOUNTAIN VMS DEPOSIT, MAINE
Michael McCormick[1], Chunzeng Wang[2], Martin Yates[1], Alicia Cruz-Uribe[1], Donald Hoy[3], Dave Lentz[4]
Leading author contact: michael.j.mccormick@maine.edu
1 University of Maine; 2 University of Maine at Presque Isle
3 Wolfden Resources LLC; 4 University of New Brunswick (Canada)

The Pickett Mountain base-metal deposit (PMD), formerly known as "Mt Chase deposit", is a volcanogenic massive sulfide (VMS) deposit, within the southeast limb of the Weeksborough-Lunksoos Lake Belt (WLLB), in northern Maine. The WLLB is a part of the Ordovician Northern Maine Volcanic Belt (NMVB) situated within the Gander terrane. The Gander terrane also includes the Bathurst Mining Camp (BMC), a world-class system of VMS deposits. As part of the Gander terrane, the NMVB has potential to host other VMS deposits. Paired with lithogeochemical analyses, via portable X-ray fluorescence (pXRF), this study utilizes geological mapping and petrographic analysis to differentiate lithological units, tie altered and/or strained units back to protolith equivalents, and observe important micro-structures. Field mapping and drill core logging confirm that the PMD is a bimodal VMS system dynamically metamorphosed to greenschist grade with footwall felsic crystal tuff (dominant), tuffaceous lapillistone, tuff, minor rhyolite, hanging-wall mafic and felsic tuff, basaltic flows and hyalotuffaceous units interlayered with graphitic slate. This Ordovician volcanic system is underlain by pelitic slates and siltstone of the Cambro-Ordovician Grand Pitch Formation. The system has gone through complex hydrothermal alteration, shown by the presence of alteration products (chlorite, sericite, and quartz veins), as well the differential development of foliation and shearing. Systematic analysis of cores from two boreholes was performed by pXRF. Results show depletion of Mg, Ca, and Ti at the boundary of the heavily altered mafic flow unit overlying hanging-wall, felsic pyroclastic tuff units. The pXRF analyzer detected compositional changes of Al, Si, P, Ca, K, Fe, Ti, Zr, etc. in the felsic pyroclastic units both in the hanging-wall and footwall. Spikes in base metals (Zn, Pb, and Cu) indicate proximity to sulfide horizon(s), while elevated levels of Si and K show silica and sericite alteration associated with the footwall stockwork zone. The lithological and lithogeochemical study of the PMD sequence helps understand geological associations and alteration related to this important VMS deposit and refine the overall geology of the WLLB.

[Winner Best Student Oral Presentation]
O2
MICROPLASTICS IMPACT ON PHYSICAL SOIL ANALYSIS
Emily MacDonald
Leading author contact: emacdoanld15@unity.edu
Unity College

Microplastics have become a part of our natural environment and studies are showing that they have an even bigger impact every year. They are most commonly thought of as a marine ecosystem pollutant but it is becoming more apparent that they are also in freshwater and terrestrial ecosystems. With the infiltration of microplastics into our terrestrial environment it brings to mind questions like how do microplastics impact the environment and how do they impact testing used to analyze the environment? This study specifically looks at if microplastics impact the results of loss on ignition testing and soil particle size analysis and at what concentrations. Microplastics were created from a mixture of plastics for this study and added to clean soil samples of three different textures. The concentrations were adjusted after each test to determine the next concentration of plastics. The study determined that at a concentration as low as 0.5% of the mass of the sample was significantly different from the blank tests run and showed that microplastics do impact these standard soil analysis techniques.

O3

PROXY DEVELOPMENT IN PALEOCEANOGRAPHY: EXPLORING MG/CA ANOMALIES IN CORE-TOP SEDIMENT

Cassandre Stirpe, Katherine Allen, Alicia Cruz-Uribe, Elisabeth Sikes, Brenda Hall
Leading author contact: cassandre.stirpe@maine.edu
University of Maine

As our planet warms, it becomes increasingly important to understand the climate system and how it operates. The ocean plays a crucial role in this system as a reservoir of carbon and heat. Marine microfossils such as foraminifera offer insight into ocean conditions under past climate regimes. The magnesium-to-calcium ratio (Mg/Ca) in foraminiferal calcite is widely used for paleotemperature reconstructions because the calcite's Mg/Ca ratio increases with increasing temperature. However, the Mg/Ca ratio is also affected by secondary controls (e.g. carbonate saturation), biological processes ("vital effects"), and diagenetic effects (e.g. dissolution). In order to accurately reconstruct paleotemperatures, a thorough understanding of the Mg/Ca-temperature proxy is required. This study examines the benthic foraminifer Uvigerina peregrina, taken from core-top samples from New Zealand's Bay of Plenty. A core-top study enables the pairing of recent sedimentary material with modern measurements of water properties to establish relationships between variables, such as Mg/Ca and temperature. In this study, many of the sites show Mg/Ca values consistent with other studies at that temperature, but some sites show high-Mg anomalies that require explanation. While low-Mg anomalies can be attributed to dissolution, high-Mg anomalies are less well documented. Samples from the affected sites may be contaminated, or they may have elevated Mg/Ca ratios within the calcite due to a poorly-understood secondary effect. To determine which hypothesis best explains the high-Mg anomalies, this study utilized scanning electron microscope (SEM) imaging and laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS). Use of the SEM revealed evidence of aluminosilicate and carbonate contaminants within foraminifer chambers, often along the interior wall. The use of LA-ICP-MS enabled the analysis of foraminiferal calcite from the center of the chamber walls, away from surfaces most likely to be contaminated. Six specimens from three sites were analyzed. The LA-ICP-MS results are consistent with previous, solution-based, ICP-MS results from the same sites. The similarity of Mg/Ca ratios between the two methods suggests that the high-Mg anomalies exist within the calcite rather than in surficial contaminant phases. This observation suggests that a secondary, non-temperature effect is increasing Mg incorporation during shell formation at the affected sites. Until the nature of such high-Mg anomalies is understood, caution should be used when reconstructing paleotemperature using foraminiferal Mg/Ca.

UPCOMING EVENTS

Date	Event	Location	Organizer
July 27-28	**2019 GSM Summer Field Trip**	**Western Maine**	**Myles Felch**
August 18-23	Goldschmidt Conference 2019	Barcelona, Spain	European Association of Geochemistry and the Geochemical Society
September 14-17	AIPG Annual Conference	Burlington, VT	American Institute of Professional Geologists www.aipg.org/annualmeetings
September 22-25	2019 Geological Society of America Annual Meeting	Phoenix, Arizona	www.geosociety.org
October 1	**Anderson Fund grant proposal deadline**		**GSM**
October 11-13	111th New England Intercollegiate Geological Conference	Norwich University, Vermont	Chris Koteas
October 13-19	Earth Science Week	Check the website for events	American Geosciences Institute www.earthsciweek.org
October 27-29	Exploration Mining and Petroleum Conference	Fredericton, New Brunswick, Canada	New Brunswick Department of Energy and Resource Development
November 8	**2019 GSM Fall Meeting**	**Augusta Civic Center**	
December 9-13	2019 American Geophysical Union Fall Meeting	San Francisco, California	www.agu.org
2020			
March 1	**Anderson Fund grant proposal deadline**		**GSM**
March 1-4	Prospectors & Developers Association of Canada (PDAC) Annual Convention	Toronto, Ontario, Canada	Prospectors & Developers Association of Canada www.pdac.ca

Please submit events to include on the calendar to the Newsletter Editor: amber.h.whittaker@maine.gov

PHOTOS

State Geologist Bob Marvinney presenting awards to Emily MacDonald (Unity College; left) for her oral presentation, and Sahra Gibson (College of the Atlantic, right) for her poster presentation.

Audience members enjoying the talks at the GSM Spring Meeting.

Somehow we did not get a picture of keynote speaker Aaron Putnam (sorry, Aaron!), but we did get a picture of his enthusiastic compère, David Putnam (left), and the youngest member of our audience (with mum Kat Allen; right), excited to hear the keynote address!

GSM Spring Meeting organizer Chunzeng Wang (left) and GSM President Sarah Hall (right) ready for a phenomenal event. Thanks to you both for another successful Spring Meeting!

MEMBERSHIP DUES STATEMENT

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 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 a field trip). A newsletter, ***The Maine Geologist***, is published for all members three times a year. The Society year runs from Aug. 1 to Jul. 31. Annual dues and gift or fund contributions to the Society are tax deductible. There are four classes of membership:

2019 FEE SCHEDULE

$ 30.00	REGULAR MEMBER	Graduate geologists, or equivalent, with one year of practice in geology, or with an advanced degree.
$ 30.00	INSTITUTIONAL MEMBER	Libraries, societies, agencies, businesses with interests in or practicing geology and related disciplines.
$ 15.00	ASSOCIATE MEMBER	Any person or organization desirous of association with the Society.
$ 5.00	STUDENT MEMBER	Persons currently enrolled as college or university students.

THE GEOLOGICAL SOCIETY OF MAINE ANNUAL RENEWAL / APPLICATION FOR MEMBERSHIP

Regular Member	$ 30.00	$_____
Institutional Members	$ 30.00	$_____
Associate Member	$ 15.00	$_____
Student Member	$ 5.00	$_____
Contributions to GSM		$_____
(please write gift or fund on check)		
TOTAL ENCLOSED		$_____

Name _____

Address _____

_____

_____

Make checks payable to:
Geological Society of Maine
Bruce Hunter, GSM Treasurer
44 Old Fairgrounds Rd
Readfield, ME 04355

Email Address _____

(GSM funds include the Walter Anderson Fund _____ , and discretionary gifts as noted by contributor)

THE MAINE GEOLOGIST is the Newsletter of the Geological Society of Maine, published three times a year, in mid-winter, summer, and early fall, for members and associates.
Items for inclusion in the **Newsletter** may be directed to:

Amber Whittaker, Newsletter Editor
amber.h.whittaker@maine.gov
207-287-2803

2018/2019 SOCIETY YEAR BEGAN August 1
PLEASE SEND DUES TO TREASURER.

THE GEOLOGICAL SOCIETY OF MAINE
c/o Bruce Hunter, GSM Treasurer
44 Old Fairgrounds Rd
Readfield, ME 04355

PLEASE PAY YOUR DUES!

THE GEOLOGICAL SOCIETY OF MAINE EXECUTIVE COUNCIL

President	Sarah Hall	(2020)	College of the Atlantic, shall@coa.edu
Vice President	Kevin Spigel	(2020)	Unity College, kspigel@unity.edu
Secretary	Lisa Jacob	(2020)	Sevee & Maher Engineers Inc., ljj@smemaine.com
Treasurer	Bruce Hunter	(2020)	Maine DEP, bruce.e.hunter@gmail.com
Newsletter Editor	Amber Whittaker	(2020)	Maine Geological Survey, amber.h.whittaker@maine.gov
Directors	Martin Yates	(2019)	University of Maine, yates@maine.edu
	Mike Deyling	(2020)	CES, Inc., mdeyling@ces-maine.com
	Henry Berry	(2021)	Maine Geological Survey, henry.n.berry@maine.gov
Historian	Daniel Belknap	(2020)	University of Maine (retired), belknap@maine.edu

REGISTRATION FORM

2019 SUMMER FIELD TRIP, July 27-28

Pegmatites and the Ellis River Valley: A visit to Western Maine

REGISTRATION DEADLINE: Friday, July 12th

You **MUST** register for this field trip. Space is limited.

PARTICIPANT INFORMATION

Name(s): _____ _____

Mailing Address: _____

_____

Contact email: _____ Phone: _____

I/we plan to attend: Saturday Y / N Sunday Y / N

I/we plan to camp: Friday Y / N Saturday Y / N

Are you an educator (K-12)? Y / N

REGISTRATION FEE

Number of participants registering on this form _____

$15 per participant (GSM members only) $ _____

$15 per participant + membership (Nonmembers see dues below) $ _____

$10 K-12 educator (no membership required) $ _____

OPTIONAL ADDITIONAL ITEMS

GSM MEMBER DUES (if owed) Reg. $30 / Assoc. $15 / Stud. $5 $ _____

[Check here if a new member ☐]

DONATION TO WALTER ANDERSON FUND (tax deductible) $ _____

TOTAL ENCLOSED: $ _____

K-12 EDUCATOR INFORMATION

Contact hours will be given for participation. Please provide the name of your school below:

_____

REGISTRATION INSTRUCTIONS

1. To save your spot on the field trip registration list, complete this form and send it as an email attachment to BOTH Bruce Hunter and Myles Felch at:

bruce.e.hunter@gmail.com and mfelch@mainemineramuseum.org

2. Print out the completed registration form and mail it with a check for the total amount made payable to *Geological Society of Maine* at the address below by **Friday, July 12th**. [No day-of registration!]

Bruce Hunter, GSM Treasurer
44 Old Fairgrounds Rd
Readfield, ME 04355

Questions about the field trip? Email Myles Felch mfelch@mainemineramuseum.org

PARTICIPANT INFORMATION

2019 SUMMER FIELD TRIP, July 27-28

Pegmatites and the Ellis River Valley: A visit to Western Maine

PARTICIPATION

***Saturday*:**

Plan to meet by 8am on Saturday (7/27) at the MDOT Riverside Rest Area on Route 2 in Bethel, across the street from the Sunday River Brewing Company. There is a restroom at this location. We will try to consolidate vehicles at the rest area. The first part of the day will include several stops in the Ellis River Valley to discuss the surficial and hydrogeology of this area. The lunch stop will be in Andover center; there is a small general store located in the town square. The final stop on Saturday may require further consolidation of vehicles for the drive up to the Plumbago North pegmatite quarry. After the final stop, the group will drive back to the rest area to round up vehicles and participants are encouraged to set-up at the campground or check into their hotels. An evening event will be held at the Maine Mineral & Gem Museum, which includes a visit through the exhibits and tour of the laboratory. Dinner will be served at the museum (included with registration).

Accessing the last stop on Saturday will require vehicles with some clearance. If you have a 4WD or AWD vehicle and are considering bringing it, please contact Myles Felch.

***Sunday*:**

We will depart from Bethel Outdoor Adventure at 8:30am. Two separate pegmatite quarry trips are scheduled for Sunday, the Bumpus in the morning and Havey in the afternoon. Do not plan to meet the group at the quarries. We will have lunch at the Havey quarry. There will be no opportunity to stop for food between the two sites, please pack a lunch (see food section below for preparation). The Havey is located in Poland with less than a 10-minute drive to Interstate 95.

K-12 Educators:

Though it is certainly not required, we encourage you to participate both days. However, if you cannot we recommend that you plan to attend the Sunday trip to the two pegmatite quarries. At these locations leaders will cover mineral identification basics and help you build your own mineral collection. **Please indicate if you are planning to attend one or both days.**

LODGING

A group campsite will be provided Saturday night at Bethel Outdoor Adventure, 121 Mayville Rd, Bethel. We have reserved the space for Friday night as well for folks who are travelling long distances. **Please indicate if you are planning to stay both nights**. Campsite information will be announced in an emailed preceding the trip and all camping fees are included in the registration. Bathrooms (including a hot shower) and a fire pit are located on site. For a full list of amenities visit: http://www.betheloutdooradventure.com/campground.html

There are several motels located in a one-mile radius of the campground, not provided by GSM. If you need more information, please contact Myles Felch or give Google a try.

FOOD

Breakfast and lunches will not be provided. There is a Hannaford located on Main street in downtown Bethel and the Good Food Store Market on Route 2 (Mayville road) near the campground. Several restaurants are also in the area within walking or short driving distance from the campground.

Plans for Saturday evening include a cookout at the Maine Mineral & Gem Museum. You may join for the cookout whether or not you plan to stay the night at the campground. There is no additional charge for the cookout. Please indicate if you have any food allergies or special dietary requirements. Several breweries, pubs and restaurants are located in walking/short-driving distance of the museum.

OTHER INFORMATION

In addition to camping gear, bring adaptable clothing and footwear for whatever weather the day might bring. The pegmatite quarries contain freshly blasted material that is very sharp, please bring closed toed shoes for these visits. Insect repellent and sunscreen are recommended, and water is essential.

There will be some light walking through the woods on two of the Saturday stops.

Hard hats will be required for our trip to the Bumpus Quarry. Hardhats will be provided, but if you have a hardhat available that you prefer please bring it with you. Please bring your own protective eye-wear!

Note on the pegmatite quarries: This is in large part a collecting trip. Bringing a hammer, chisel, and eye protection is encouraged, you are guaranteed to see some amazing minerals! Please be advised that the quarry owners may have areas that they do not want you collecting from, when in doubt ask first! Remember to always be aware of your surroundings when you're using a hammer. Be aware of where parking is permitted, make sure your vehicle is not blocking the quarry access road.

ACKNOWLEDGMENTS

Thank you to the quarry and land owners for allowing us access to these sites, in no particular order Gary Freeman, Jeffery Morrison, Lawrence Stifler and Mary McFadden, Rumford Water District. Thank you to the Maine Mineral & Gem Museum and all their staff for hosting our group for an evening. Thank you to the individual(s) helping with the Saturday night cookout. Thank you to all the field trip leaders and those contributing to the field guide: Lindsay Spigel, Ryan Gordon, Alexander Falster, Jim Nizamoff, Chris Koteas, and Skip Simmons. Lastly, a big thank you to Sarah Hall, Bruce Hunter, and Henry Berry for all their helpful conversations.

Questions about the field trip? Email Myles Felch mfelch@mainemineramuseum.org