



GSM Spring Meeting, 2026: Student Showcase

1:00-5:00 PM, April 3rd

Commons, 2nd Floor

Bates College

136 Central Avenue, Lewiston, ME

Schedule, Parking, and Program

12:30-1:00 PM: Arrival, greeted by Rebecca Minor and Tom Whittaker

Welcome Table, in hallway outside Commons 221/222

1:00-2:00 pm: Welcome and Oral Presentations, Dr Shreya Arora, Dr Beca Payne

Commons, 221/222

1:05 -1:10 pm: Welcome to Bates, Dr Bev Johnson, Chair of EACS, Bates College

1:10-1:15 pm: Welcome Address, Rich Campbell, GSM President

1:15-1:30 pm: Student Oral Presentation 1. **Tess Mooney (Bowdoin College)**

Presentation Title: Evaluating the roles of geochemistry, deformation, and coalescence to produce high aspect ratio garnet in Midcoast Maine

1:30-1:45 pm: Student Oral Presentation 2. **Ria Raval (University of Maine)**

Presentation Title: Evolving Ocean Conditions in the Gulf of Maine during the Holocene: New Insights from Marine Microfossils.

1:45-2:00 pm: Student Oral Presentation 3. **Alexander Roman (University of Maine)**

Presentation Title: Little Ice Age Glacial Advances Found in the Southern Alps of New Zealand at 43°S Suggest a Global Extent.

2:00-3:00 pm: Posters Presentations. Dr Daniel Chupik

In hallway outside Commons 221/222

2:30-3:00 pm: Coffee Break

In hallway outside Commons 221/222

3:00 pm-4:00 pm: Small Group Discussions, Dr Charlotte Connop

Rooms 200, 201, 211, 225

4:00-4:15 pm: Award ceremony, Announcements

Commons, 221/222

4:15-4:20 pm- Closing Remarks by Dr Nick Balascio

Commons, 221/222

4:20-5:00 pm: Reception/Social in Commons 221/222/Business Meeting

Commons, 221/222

A few notes about.....

Dinner. Guests are welcome to stay for dinner at Commons, if you would like. The price (for unlimited access!) per person is \$16; please pay at the entrance with a credit card (no cash).

Parking can be found on the streets surrounding Commons (136 Central Ave) or campus. (Pay attention to the restricting parking signs.) You can also park in the Visitor Parking on campus. The largest Visitor Parking Lot is behind Merrill Gym.

Abstracts:

◇ **Oral presentations** ◇

Tess Mooney (Bowdoin College): *“Evaluating the roles of geochemistry, deformation, and coalescence to produce high aspect ratio garnet in Midcoast Maine”*

Abstract: Metapelitic and metavolcanic outcrops of the Yarmouth Island formation in Midcoast Maine feature garnet porphyroblasts with high aspect ratios of up to 1:6, with long axes measuring up to 1.5 cm. Curiously, these high aspect ratio garnet porphyroblasts are located within a few cm of idioblastic garnet that measure up to 1 cm in diameter. The nearby Spring Point formation contains similar high aspect ratio garnet porphyroblasts that are interpreted to have been produced through a combination of brittle deformation, ductile deformation, and the coalescence of multiple nuclei. Here, we evaluate which processes contribute to the formation of high aspect ratio garnet in the Yarmouth Island formation and compare our findings with results from the Spring Point formation.

Ria Raval (University of Maine): *“Evolving Ocean Conditions in the Gulf of Maine during the Holocene: New Insights from Marine Microfossils”*

Abstract: Reconstructing temperature trends and variability during the Holocene (11.6 ka - present) can help us understand long-term environmental processes, providing context for modern changes related to anthropogenic activity. Temperature reconstructions derived from a variety of locations and methods are vital to building a comprehensive understanding of global Holocene climate. The Gulf of Maine (GOM) is tightly linked to broader Northwest Atlantic circulation and is an ideal location to generate a high-resolution sea-surface temperature record due to high regional sediment accumulation rates. In this study, we reconstruct past sea-surface temperatures using both geochemical and faunal analysis. Single-specimen laser ablation mass spectrometry enables measurement of magnesium to calcium ratios (Mg/Ca) in planktic foraminiferal calcite, which increase with ocean temperature (von Langen et al., 2005). Abundances of planktic foraminifer species *Neogloboquadrina incompta* (which prefers warmer conditions) and *Neogloboquadrina pachyderma* (which prefers colder conditions) relative to other planktic species can also indicate changing environmental conditions (Kohfield et al., 1996). In our sediment core collected from Jordan Basin (EN669-JPC19), *N. incompta* percentages increase during the Holocene, while *N. pachyderma* percentages decrease, suggesting long-term surface ocean warming. Independent, complementary geochemical temperature estimates are also in progress using laser-ablation mass spectrometry of individual specimens. Preliminary results suggest that there was a shift in environmental conditions during the Holocene and that some reconstructions of past sea-surface temperature from planktic foraminiferal proxies may be seasonally biased.

Alexzander Roman (University of Maine): *“Little Ice Age Glacial Advances Found in the Southern Alps of New Zealand at 43°S Suggest a Global Extent”*

Abstract: The abundant historical records that document the Little Ice Age’s impact in Europe along with field evidence from outside that region seem to indicate that its occurrence may not have been confined to the Northern Hemisphere (Grove, 1990). Although paleoclimate records are currently insufficient to fully reconstruct the last 1000 years of climate history in the Southern Hemisphere (National Research Council (U.S.), 2002), the presence of the Little Ice Age has been identified in certain regions. Notably, evidence of its occurrence has been found in Argentina and the Tropical Andes of South America (Espizua & Pitte, 2009), highlighting the significance of the Little Ice Age outside of the Northern Hemisphere. While continuous records may be lacking, sporadic occurrences of the Little Ice Age in South America, albeit in shorter temporal stretches, provide compelling evidence for a global event. I have conducted fieldwork in the Southern Alps of New Zealand, located at ~43°S, targeting young moraines high in the mountains.

Using Birkeland et al. (1982)'s subdivision of Holocene glacial deposits, I targeted the youngest features for Be-10 exposure dating.

◇ **Poster presentations** ◇

Riley Baker (Bates College): *“Impacts of Agricultural Alterations on Sprague Marsh's West Branch through Carbon Isotope Signatures”*

Abstract: This project uses analysis of stable carbon and nitrogen isotopes to determine the impacts of anthropogenic alterations in the West Branch of Sprague Marsh. Data was analyzed from sixteen 1 meter-long sediment cores collected between July 2023 and June 2024 at the Bates Morse Mountain Conservation Area under the research of Beverly Johnson. Using C/N ratios, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, percent loss on ignition (LOI), and past elevation and sedimentation data, this research attempts to reconstruct the historical geochemical processes of the marsh, the impact of agricultural alterations, and the future of marsh restoration in the West Branch.

Hadley Blodgett (Bates College): *“Holocene reconstruction of a Greenland Ice Sheet outlet glacier in Inutoqqat Nunaat (Peary Land), northern Greenland”*

Abstract: High-latitude environments are sensitive to climate change, with recent decades of warming strongly affecting glaciers and ice caps. Warming has caused the retreat of the Greenland Ice Sheet (GrIS) and adjacent mountain glaciers, particularly in high-latitude areas, over the past two decades. However, short-term observations are insufficient to assess how these regions have responded to past natural climate variability. This study examines a proglacial lake sediment core from Lake Nukarleq, providing the first high-resolution Holocene record from this lake. The core is used to reconstruct outlet glacier changes along the northern margin of the GrIS and the Storm Ice Cap in Inutoqqat Nunaat (Peary Land), northern Greenland. We analyzed a 2.45 m sediment core using sedimentological and geochemical methods, including grain size, density, organic matter, and X-ray fluorescence. A radiocarbon-based age model indicates that the record spans the last c. 5,000 cal yr BP. The sediments are mostly finely laminated, except for two distinct turbidite deposits, and comprise three major sedimentological units. From c. 5,000 to 1,500 cal yr BP, sedimentation consisted of fine laminations of organic-rich, low-density sediment. At c. 1,500 cal yr BP, organic content decreased, sediment density increased, and Ca variability became more pronounced, reflecting a substantial increase in glacially derived sediment and cooler environmental conditions. These conditions persisted until the last c. 50 years, when an abrupt shift to thick laminations and dense, fine-grained sediment demonstrated a warmer environment and extended ice-free seasons. These sedimentological changes, recorded at Lake Nukarleq's climatically sensitive location, provide long-term context for Holocene glacier variability and reveal that recent ice retreat exceeds the range of variability observed through the Holocene. This record provides a basis for reconstructing ice extent and assessing the impacts of the Holocene climate including Neoglaciation and recent warming on this High Arctic environment.

Samuel Hallett (Bates College): *“Earth's Atmospheric Climate Sensitivity to Rapid High-Emission Greenhouse Gas Scenarios”*

Abstract: It is a major feat that life has been able to thrive even with Earth's relatively stable atmosphere. A key mechanism that drives atmospheric stability is the carbonate-silicate weathering cycle. However, there are questions about the future of Earth's atmosphere due to anthropogenic emissions if life on Earth will continue to thrive. The focus of this study is to interpret the overall net impacts on future changes in this weathering cycle on the global climate. Using geochemical proxies to establish initial parameters, this study

developed three climate scenarios that test Earth's atmospheric response to rapid, massive greenhouse gas emission events.

Sienna Lightman (Colby College): “*What are sand grains doing in Denali ice cores?*”

Abstract: In 2013, two Denali ice cores were taken from the Denali Research Summit. Unexpectedly, numerous sand grains were found within the ice cores. This study investigates how the sand grains were incorporated into the ice cores. Identifying their source, whether it was through rockfall above or from subglacial bedrock, is critical, as subglacial origins would suggest stratigraphic overturning. Previous research has used microtextures, specifically in quartz grains, to analyze the transport of grains and pebbles through subglacial and fluvial processes. In this project, 16 SEM images of sand grains containing quartz, feldspar, and biotite located throughout the Denali 2013 A and B ice cores were analyzed for various microtextures and morphological features (angularity and relief). Overall, the results indicate highly abrasive processes, with grains exhibiting sub-angular, medium, or low-relief morphological features. The most common microtextures analyzed included straight steps, sharp edges, conchoidal fractures, broken plates, impact pits, and sublinear fractures. Although analyzing these grains is a first step toward discovering their origin, additional research is needed due to a lack of literature on rock-fall embedded into ice cores and their mechanical and morphological surface features. Future research in comparing these grains to grains from the above rockfall on the summit saddle would allow for a more comprehensive analysis of these grains' origins.

Patti Millette (Mt. Blue High School): “*Determining the Origin of Sediments Adjacent to the Sandy River, New Sharon, ME*”

Abstract: Carved by ice, shaped by water, and revealed by time, the Sandy River in New Sharon, Maine tells a geologic story hidden in its sediments. The purpose of this investigation is to determine the identity and origin of sediment deposits at the research site. Researchers surveyed profiles with transit and stadia rods, then collected sediment samples using an Eijkelkamp Dutch corer and a post-hole digger. A standard grain size analysis was performed to determine the distribution of sediment sizes. Finally, the rocks and minerals collected in the samples were identified.

Izzi Sander (Bates College): “*Application of Charcoal and Polycyclic Aromatic Hydrocarbons to Reconstruct the Fire History of North-Central Maine*”

Abstract: Forest fires are a key driver of ecosystem disturbance and impact environments through biomass removal, negative water and air quality, release of sequestered carbon, and loss of biodiversity. The analysis of past fire dynamics provides long-term perspectives on their role in ecosystems and the association between fire activity and climate. The paleofire history of the eastern United States (US) is relatively under-studied in comparison to the western US. However, climate models predict eastern North America will undergo drying which will likely lead to longer fire seasons and increasing fire intensity. Therefore, understanding eastern US fire regimes is crucial for preparing future responses to wildfires. This study investigates the long-term fire history of central Maine using a sediment core from Lower South Branch Pond in Baxter State Park that spans the last c. 7,200 yr BP. We analyzed charcoal accumulation rates (>125 μm and 63-125 μm) and trends in 15 polycyclic aromatic hydrocarbons (PAHs) as fire proxies. The 63-125 μm charcoal accumulation rate ranged from 0.02-2.76 $\#/\text{cm}^3/\text{yr}$ while the >125 μm rates were between 0.01-0.88 $\#/\text{cm}^3/\text{yr}$. There were two distinct peaks in both sizes at c. 5900 cal yr BP and 50 cal yr BP, as well as a period of elevated charcoal from c. 3500-6000 cal yr BP. Eight PAHs were present with concentrations from 68.2 to 20722.6 ng/g of dry sediment, with three peaks at 5650 cal yr BP, 4800 cal yr BP, and 50 cal yr BP. These data show evidence for higher fire activity in the mid- to early Holocene, as well as evidence of historic fire. Differences in trends between charcoal and PAHs suggests the PAHs reflect a regional signal outside of the watershed, while charcoal is more sensitive to local fires. PAH distributions may also be attributed to regional differences in biomass burnings. The paleofire study of

Lower South Branch Pond will be used in combination with other fire records to reconstruct wildfire history on a regional scale.

Matthew Stein (Bowdoin College): *“Titanite Misorientation Records Deformation in Tuolumne Intrusive Suite, Sierra Nevada Batholith, CA”*

Abstract: Shear zones may make room for pluton emplacement by weakening the crust and facilitating the movement of magma. How the crust accommodates pluton emplacement, especially in the absence of active shearing, is not fully understood. Electron backscatter diffraction (EBSD) analysis of titanite can be used to recognize and characterize deformation in sheared plutons. Titanite readily (re)crystallizes in response to changes in temperature, pressure, and differential stress and records deformation as crystal lattice distortion.

Katie Westbrook (University of Maine): *“A ^{10}Be Chronology of Moraine Construction in Lysefjorden, Southwest Norway, During the Late-Glacial Cold Reversal”*

Abstract: Moraines preserved mid-way between those formed during the last glacial maximum and those formed during the Holocene document glacier resurgence that interrupted overall recession during the last glacial termination. Such late-glacial moraines have been documented in both hemispheres. However, it is unclear whether glacier resurgence and late-glacial moraine construction occurred simultaneously or asynchronously between the hemispheres. A resolution to this question will help discern among proposed drivers of millennial-scale climate variability during the last termination. Here we present a ^{10}Be surface-exposure chronology of an exceptionally well-preserved moraine belt located at the mouth of Lysefjorden in southwestern Norway. Our results indicate that the resurgence of the Lysefjord outlet glacier of the Scandinavian Ice Sheet had culminated by 12,800 yrs BP, followed by recession. On the opposite side of the world in the Southern Alps of New Zealand, surface-exposure chronologies indicate that moraine construction there was concurrent with Lysefjorden. According to our comparison of moraine chronologies between the hemispheres, the late-glacial climate reversal appears to have been global in extent, and therefore requires a mechanism capable of producing climate change on a global scale.

Lucy Whitelam (Bates College): *“A c. 13,000-year Record of Wildfire Activity from Ossipee Lake, New Hampshire”*

Abstract: Examining fire activity in response to natural climate changes of the past is key to better understanding future fire dynamics. Sedimentary charcoal records can be used to pinpoint past fire events within a watershed and document long term regional trends in fire activity. In this study, we present a c. 13,000-year paleofire record from Ossipee Lake in central New Hampshire. Charcoal particles ($>125\ \mu\text{m}$) were counted and charcoal morphologies were quantified by using image analysis software integrated with a transmitted light microscope. Trends in the morphometry of the particles including: aspect ratio, area:perimeter ratio, roundness, and circumference were analyzed to infer changes in the source of charcoal. Additionally, select charcoal samples were imaged using a scanning electron microscope to determine the vegetation types of the burned material over the Holocene. Charcoal accumulation rates show elevated fire activity from c. 5,600-10,100 cal yr BP and two large peaks, c. 10,100 cal yr BP and c. 8,200 cal kyr BP. Generally lower charcoal accumulation rates define the last c. 5,600 cal yr BP, although elevated values are observed from c. 1000-700 cal yr BP. Greater fire activity in the early Holocene does seem to be supported by other records, but few exist in close proximity to our site. This study contributes to our understanding of the northeastern United States fire history. Ongoing work will examine the connections between fire activity, changing climate, human activity, and vegetation throughout the region to better understand the drivers of these trends.