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SGER: Is Bolling Warming Recorded by the Southeastern Margin of the Laurentide Ice Sheet?

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Organization: University of Maine

Title:

SGER: Is Bolling Warming Recorded by the Southeastern Margin of the Laurentide Ice Sheet?

Project Participants

Senior Personnel

- Name:** Borns, Harold
- Worked for more than 160 Hours:** Yes
- Contribution to Project:**
Principal Investigator
- Name:** Hall, Brenda
- Worked for more than 160 Hours:** Yes
- Contribution to Project:**
CoPrincipal Investigator
- Name:** Dieffenbacher-Krall, Ann
- Worked for more than 160 Hours:** Yes
- Contribution to Project:**
Associate Research scientist
- Name:** Nurse, Andrea
- Worked for more than 160 Hours:** Yes
- Contribution to Project:**
Technician/volunteer
- Name:** Putnam, Aaron
- Worked for more than 160 Hours:** Yes
- Contribution to Project:**
MS candidate

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Maine Geological Survey

Other Collaborators or Contacts

nothing to report yet

Activities and Findings

Research and Education Activities:

The objective of this research was to test the hypothesis that the Pineo Ridge End Moraine Complex (PRC) marks the termination of a short glacier readvance which was reversed by the onset of the Bolling warm interval at about 13,000 14C B.P.

Methods employed: During these glacier events the ice terminated in the transgressing sea and the radiocarbon ages of marine shells in the glacial marine mud distal to the PRC and just behind it would bracket the age of the PRC. In addition the surface exposure ages of very large granite boulders on the moraine, which have always been above sea level, will also provide ages for the emplacement of the moraine.

Findings:

Results to date: Ten AMS radiocarbon dates from moraine shells collected from as close to the base of the glacial-marine mud as possible in four locations provide a minimal date, uncorrected for the reservoir effect, for the recession of the glacier margin prior to the readvance of 13,350 ± 50 14C yr B.P. shells dated from the base of a sediment core from Lily lake, 1 km north of the PRC and which provided lacustrine sediment underlain marine mud, indicated that the ice margin had retreated from the PRC by about 13,000 14C yr B.P. (corrected for the marine reservoir factor)-400 years.

Samples of rock have been collected from the tops of six large, stable granite boulders each in the order of 2 m in diameter, for the determination of their surface exposure ages. These samples are currently undergoing final laboratory processing and interpretation.

The analysis of chironomids in the lacustrine sediments from Lily Lake have yielded preliminary data indicating that summer lake surface temperatures rose rapidly 6° to 8°C following the emplacement of PRC and draining of the sea from the basin at about at least by 13,000 14C B.P. (uncorrected). Preliminary evaluation of dates on marine shells and terrestrial plant remains found together in the transition from marine to lacustrine conclusion in the Lily Lake core suggest a marine reservoir factor of about -300 years for that time and location. Previous research by M. Kashgarian (1992) suggested of marine reservoir factor of -600 years following the start of upwelling of old carbon in the Gulf at about 12,000 14C B.P., suggesting a small correction factor prior to the start of upwelling. To the south of the PRC the geology is marked by hundreds of cross-cutting grounding line end moraines, while to the north the deposits are characterized by non-linear glacial marine outwash features, such as eskers, esker deltas and fans. This differences in styles of deposits indicates a significant and rapid increase in meltwater following the emplacement of the PRC.

Together, these data suggest that ice retreat from the PRC marks the onset of atmospheric warming that correlates with with an abrupt onset of the Bolling warm interval also found in diverse global records including Dye 3 Ice Core in Greenland, Lake Gerzensee in Switzerland, formaminifer record from the North Atlantic and the beetle record of the British Isles and recently in Chile and New Zealand.

In addition, using existing glacial geology, the difference in styles of deposits, and a few good radiocarbon dates the PRC has been tentatively traced westward across central Maine to the New Hampshire border.

Training and Development:

This research as allowed our Paleoecology laboratory staff, including undergraduates, to refine their ability to analyze chironomid records used to determine former summer lake surface/atmosphere temperatures. In addition it has allowed modification of our lake sediment coring methods and equipment, and refinement of our surface Exposure Dating Lab sample preparation methods.

Outreach Activities:

nothing yet to report

Journal Publications

Borns, H.W., Hall, B., Nurse, A., and Thompson, W., 2007, "Is Bolling warming recorded by the southeastern margin of the Laurentide Ice Sheet?: Abst., Program of the Northeastern Sect.", Geol. Soc. Am, p. , (). Submitted,

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Contributions

Contributions within Discipline:

Principal discipline: glacial and Quaternary geology. The major contribution has been to determine the chronology and geography of a readvance of the Laurentide Ice Sheet in Maine during late Pleistocene time that is reasonably correlated with the Older Dryas cold event and subsequent Bolling warm event in diverse global data sets.

Contributions to Other Disciplines:

Other discipline (s):Northeastern paleoecology. Appropriate sampling and analysis of lake sediments a few kilometers both beyond and behind the readvance end moraine have demonstrated, for the first time, an abrupt rise of summer air temperatures of 6?-8?C following the termination of the readvance.

Contributions to Human Resource Development:

Development of human resources: Technical personnel in the University of Maine Paleoecology Lab have refined the technical aspects chironomid analysis that allows determination of paleo-lake surface summer water temperatures which, in turn, affect summer atmospheric temperatures.

Contributions to Resources for Research and Education:

Institutional resources: The Paleoecology Lab analytical and lake coring equipment have been improved, and the chironomid data base for the region has been added to and refined.

Contributions Beyond Science and Engineering:

Other aspects: The research has provided an improved understanding of the natural history of the southeastern coastal zone of Maine in an area where the economy is nearly entirely based on utilization of the natural resources. The improved knowledge can be a help to decision makers to decide on the best uses for the natural resource base, and to schools for the enhancement of the understanding of their natural science curriculum.

Categories for which nothing is reported:

Any Book

Any Web/Internet Site

Any Product