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Collaborative Research: Late Quaternary History of Reedy Glacier

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Final Report for Period: 06/2006 - 05/2007

Submitted on: 05/30/2007

Principal Investigator: Hall, Brenda L.

Award ID: 0229034

Organization: University of Maine

Title:

Collaborative Research: Late Quaternary History of Reedy Glacier

Project Participants

Senior Personnel

Name: Hall, Brenda

Worked for more than 160 Hours: Yes

Contribution to Project:

Brenda Hall has led the mapping effort at Reedy Glacier. She is supervising a graduate student who is working on this project. In addition, she has undertaken all of the radiocarbon work.

Post-doc

Graduate Student

Name: Bromley, Gordon

Worked for more than 160 Hours: Yes

Contribution to Project:

Gordon Bromley is the principal graduate student on the University of Maine portion of this collaborative project. Gordon participated in the field work and has been constructing glacial geologic maps. He defended his thesis recently and is now working on papers for publication.

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

University of Washington

This is a collaborative project with the University of Washington. U. Washington personnel are not listed in the 'Participants' section, because it is assumed that the Washington PIs will enter that information for themselves. This project is fully integrated between the two institutions. We were in the field together and are cooperating closely. Gordon Bromley has travelled to Seattle twice to work in the exposure-age dating lab. Brenda Hall also travelled to the lab. Claire Todd (from Seattle) visited the University of Maine. The collaborative relationship between both the PIS (Stone, Hall, and Conway) and the graduate students (Bromley and Todd) that developed as a result of this Reedy Glacier project has led to new joint projects for both the PIS (Scott Glacier) and the graduate students (Peruvian Andes).

Other Collaborators or Contacts

Dr. Sarah Spaulding, USGS - Boulder

Dr. Spaulding examined some of our samples for freshwater diatoms in hopes of finding if they exist at this far-southern latitude.

Ms. Marcy Davis, University of Texas

Ms. Davis has been instrumental with helping us with bedrock information for the region and for providing us with preprints of a new bedrock map.

Activities and Findings

Research and Education Activities:

We spent ~ 1 month at the Quartz and Caloplaça Hills during the 2003/04 season. During this time, the University of Maine component of the field team mapped the surficial geologic features in these areas in order to produce detailed glacial geologic maps. We also collected samples for grain-size analysis to characterize the deposits. These were in addition to the samples collected by Stone and others from Washington for exposure-age dating.

During 2004/2005 we spent 6 very successful weeks in the field. We carried out work at the Quartz Hills, Polygon Spur, and several nearby nunataks. The Maine part of our team created detailed surficial geologic maps of these areas and collected samples similar to the previous year.

More recently, we have been working on surficial geomorphologic maps, organizing radiocarbon data as it comes in from the lab, and helping to interpret exposure ages. Gordon Bromley defended his M.S. thesis and is continuing to work on Reedy Glacier data as he begins his Ph.D. We are now working on papers.

Findings:

We are confident that we have located the last glacial maximum limit of Reedy Glacier in the Quartz and Caloplaça Hills, at Polygon Spur, and at several nunataks both north and south of these areas. In the Quartz Hills, it is 275 m above present ice level. In the Caloplaça Hills, it is at ~100 m above ice level. The LGM ice limit decreases to only about 50 m above the ice near the head of Reedy Glacier. These indicate 1) thickening of Reedy Glacier in response to grounding of the West Antarctic Ice Sheet (WAIS) in the Ross Sea, 2) greater thickening of Reedy Glacier at the mouth than at the head, consistent with the WAIS exerting a damming effect on the glacier, and 3) little change in the level of the East Antarctic Ice Sheet. In addition, we have noted recent moraines about 10 m above present ice surface, which suggest some recent changes in the level of Reedy Glacier (and hence the WAIS). Our mapping encompassed deposits that range from the Holocene and LGM back as far as the mid-Cenozoic, so we will be able to see the evolution of Reedy Glacier through time. Finally, we found small proglacial ponds with living algae and ancient algal deposits high above the lakes, indicating times of greater lake level and ice extent. These are the farthest south radiocarbon samples ever obtained. The dates indicate lake-level lowering, presumably as a result of ice-margin retreat and thinning, over the past 7000 years and are in general agreement with the exposure ages. Details of the exposure ages will be in John Stone's report.

Training and Development:

This project has provided field experience for a graduate student. By being an integral member of the research team, he learned to develop and carry out a scientific project (something that is serving him well as a Ph.D. student). He also gained experience in presenting the results of his research by giving scientific talks and attending meetings. He currently is writing a paper.

Outreach Activities:

Experiences related to this work have been incorporated into presentations given in elementary school classrooms and at K-12 Earth Science Teachers workshops. We also were involved with 5th and 6th grade classes in Massachusetts. They had lectures on Antarctica given by our former TEA. They also wrote to us in the field (more than 120 students!) with their questions and followed our journals on our website. In addition, we recently had a proposal funded by the Education Division of NSF to develop a web-based system whereby people can learn about the scientific process and specific research projects. The Reedy Glacier project was chosen as the first module for this web-based system.

Journal Publications

Bromley, G., and Hall, B., "Reconstructing late Quaternary ice-surface profiles of Reedy Glacier - Part 1.", 11th Annual WAIS meeting, p. x, vol. , (2004). Published

Hall, B., "LGM ice-surface elevations along the Transantarctic Mountains front", 11th Annual WAIS meeting, p. x, vol. , (2004). Published

Todd, C., Stone, J., Conway, H., Hall, B., and Bromley, G., "Reconstructing late-Quaternary ice-surface profiles of Reedy Glacier - Part 2", 11th Annual WAIS meeting, p. x, vol. , (2004). Published

Bromley, G., Hall, B., Stone, J., Todd, C., Conway, T., and Conway, M., "Post-LGM evolution of Reedy Glacier, Antarctica, as an indicator of current ice-sheet stability", 12th Annual WAIS Meeting, p. x, vol. , (2005). Published

Hall, B.L., Bromley, G., Conway, H., Stone, J., and Todd, C., "Relict algal mats at Reedy Glacier: Radiocarbon dating at 86S", 12th annual WAIS Meeting, p. x, vol. , (2005). Published

Bromley, G., "Quaternary history of Reedy Glacier", M.S. Thesis, University of Maine, p. 1, vol. , (2005). Published

Bromley, G., Hall, B., Stone, J., Conway, H., and Todd, C., "Holocene thinning of Reedy Glacier, Transantarctic Mountains, in response to grounding-line retreat of the West Antarctic Ice Sheet", GSA Abstracts with Programs, Annual Meeting, p. 51, vol. 38, (2006). Published

Books or Other One-time Publications

Web/Internet Site

URL(s):

<http://www.climatechange.umaine.edu/Research/Expeditions/reedy04.html>

Description:

This is a public information/expedition site that explains our project and gives updates and journal entries. We also have a project page at <http://www.climatechange.umaine.edu/Research/projects/reedy.html>

Other Specific Products

Product Type:

Antarctic database metadata

Product Description:

Metadata for this project can be found at http://gcmd.nasa.gov/getdif.htm?Hall_Reedy

Sharing Information:

This is freely available to the public at the URL listed.

Contributions

Contributions within Discipline:

Our findings define the level of the West Antarctic Ice Sheet in the southernmost Ross Embayment during the last glacial maximum. In addition, we are now able to track thinning of the ice sheet through the Holocene by documenting changes in Reedy Glacier. This project will aid in understanding the recent, present, and potential future behavior of the West Antarctic Ice Sheet.

Contributions to Other Disciplines:

This project will contribute to studies of eustatic sea-level rise during deglaciation. In particular, we will be able to address whether or not large meltwater pulses recorded elsewhere could have been produced in the Antarctic. This work also will bear on potential sea-level rise by assessing the future stability of the West Antarctic Ice Sheet.

Contributions to Human Resource Development:

This project supports the educational and professional development of a graduate student. In addition, results from this research are routinely incorporated into presentations and courses given to students at all levels (K-12 and college-level).

Contributions to Resources for Research and Education:

We were funded by the Education Division to create a public, interactive, web-based, educational system. This system will have different modules (projects), which the public can explore and learn about scientific inquiry and methodology, as well as current research. The Reedy Glacier project has been chosen as the first module.

Contributions Beyond Science and Engineering:

The results have the potential to influence policy by addressing the critical question of the behavior of the West Antarctic Ice Sheet and its future stability.

Categories for which nothing is reported:

Any Book