

Prior Funding

In Spring 2004 I received \$525 of AGS funding for my M.S. thesis field work in the Andean highlands, completed from May 8 to July 22, 2004. The AGS funds were applied towards round-trip transport from Bangor, Maine to Lima, Peru on American Airlines at a cost of \$625. All other expenses I incurred in the completion of my M.S. thesis field work were covered by a \$4,000 Maine Economic Improvement Fund (MEIF) award, also received Spring 2004.

In Fall 2004 I received \$350 of AGS funding for my M.S. thesis lab work. The AGS funds were used to purchase necessary equipment for preparation and analysis of Alca obsidian rock samples using Inductively Coupled Plasma-Mass Spectrometry (ICPMS) at UMaine's Sawyer Environmental Science Lab.

In Spring 2005 I received \$525 of AGS funding for continued M.S./preliminary PhD field work in the Andean highlands from June 15 to July 14, 2005. The AGS funds were used for per diem meals in various locations in Peru during completion of field work. Other project expenses were covered by a \$3,388 Churchill Expedition Fund grant and a \$400 Department of Anthropology grant, also received Spring 2005.

Abstract

The interdisciplinary project *Glacial Geologic and Geoarchaeological Investigations of the Nevado Firura, Peru* seeks to understand links between the glacial geologic history of the central Andes, climate change, and the initial human settlement of South America.

In 2004 as part of my M.S. thesis research, I led a UMaine team to the central Andean highlands where we found a previously undiscovered deposit of obsidian (volcanic glass) some 10 km to the north of the Nevado Firura glacier – this is the location of the Alca source, the largest known deposit of obsidian in Peru, and the first known to be used by Paleoindians for stone toolmaking when they colonized the central Andes at the end of the last ice age some 13,000 years ago. Near the Alca deposit we found numerous archaeological sites on and among glacial landforms. Does this discovery mean that Paleoindians in Peru were using ice-edge environments? If so, then glaciers were not an impediment but a natural resource which aided human settlement of the South American continent. To answer this question, we would have to determine the former extent of local glaciation during the period when people were first entering the Andean highlands. In the central Andes, however, critical issues regarding the timing and spatial extent of ice during late glacial climatic episodes remain unresolved, especially in the previously unstudied arid Western Cordillera.

This past summer Climate Change Institute glacial geologist Gordon Bromley and I conducted field work in the remote highlands surrounding Nevado Firura, a glaciated volcano of 5,498 m (18,038 ft) elevation located on the plateau of southern Peru. We had two objectives: 1) to find and date former limits of the Nevado Firura glacier, and 2) to locate and sample early archaeological sites between the glacier and the Alca obsidian source. Gordon and I mapped and

sampled glacial landforms relating to four significant glacial episodes, collected over 20 rock samples for exposure-age dating, and retrieved sediment samples from an archaeological site for radiocarbon dating. In addition, we documented a number of archaeological sites containing obsidian spear points suggesting that this area may have been colonized by people as early as 13,000 years ago. If these sites are as old as they appear, this early occupation may be the world's highest elevation late ice age, Paleoindian settlement.

The next step in the project is to secure funding to date the rock and sediment samples, which both Gordon and I are pursuing separately from the AGS, Sigma Psi, Lambda Alpha, and the Geological Society of America for the glacial and archaeological aspects of the project. Gordon will be using an exposure-age technique applicable to rock samples collected from glacial landforms. I will date the archaeological site using an Accelerator Mass Spectrometer (AMS), which can measure the radiocarbon age of small amounts of organic material found in bulk sediment samples. Ultimately, with these results we will be able to answer key questions regarding the climatological response of the tropics to the last ice age and recent evolution of atmospheric circulation over tropical South America, as well as the relation between people, climate change, and geography in this extreme environment. Both Gordon and I plan to continue this exciting interdisciplinary research in our separate PhD dissertation projects here at UMaine's Climate Change Institute.

Item #	Description of Item	Source (Company)	Quantity	Individual Cost	Total Cost (Quantity x Ind. Cost)	Amount Requested
1	AMS date	University of Arizona AMS lab, Tucson	3	\$475	\$1,425	\$770.00
		National Ocean Sciences AMS lab, Woods Hole	3	\$794	\$2,382	
		Geochron AMS lab, Cambridge	3	\$575	\$1,725	
Total					\$ 5532.00	\$770.00

Itemized Budget

Budget Justification

Price quotes for three Accelerator Mass Spectrometer (AMS) dates were obtained at <http://www.physics.arizona.edu/ams/service/fee.htm> for the University of Arizona's AMS lab, http://nosams.whoi.edu/clients/turnaround_calculator.html for the National Ocean Sciences AMS lab at Woods Hole, Massachusetts, and <http://www.geochronlabs.com/14c.html> for Geochron Laboratories in Cambridge, Massachusetts.

Prior AGS funding has been critical to the success of my M.S. thesis field work and laboratory study. Additional Fall 2005 funding from AGS would greatly facilitate the continuation of the project by helping me to pay for three AMS dates, which will provide the absolute age of early archaeological materials found near the Nevado Firura glacier. Once I have this preliminary evidence, it will be easier to secure a larger grant through the National Science Foundation, Wenner Gren, or Fulbright to continue this project for my dissertation. I am also applying for funding through the Sigma Psi and Lambda Alpha organizations and the Geological Society of America. Thank you very much for considering my funding request.