OCGC SEMINAR

Past glacial fluctuations in the Rwenzori Mountains, Uganda, and implications for tropical temperatures during and since the Last Glacial Maximum

Dr. Meredith Kelly

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University of Ottawa
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Abstract: The tropics comprise nearly half the Earth's surface and are the primary source of latent heat and water vapor to the global atmosphere. Through phenomena such as the El Niño Southern Oscillation, the region is also the dominant control on modern inter-annual climate variability. The tropics today are undergoing rapid change with high-altitude regions warming at a rate nearly twice the global average. Determining how the tropics will respond to future warming is fundamental to projecting accurately the impacts of global climate change. One means for assessing the impact of the tropics in future climate scenarios is to establish their role in past climate transitions using proxy records of past temperature. Tropical glaciers are particularly sensitive to changes in temperature and thus make excellent paleo-thermometers. Determining the timing and magnitude of past changes in tropical glacier extents provides a window into past tropical temperatures. The equatorial Rwenzori Mountains, Uganda, are the most extensive alpine-glacial environment in Africa. My group is using geomorphic mapping and beryllium-10 surface-exposure dating to determine a chronology of glacial extents in the Rwenzori Mountains during and since the Last Glacial Maximum (~30 ka to present). We are also applying glacial modeling to determine the temperatures and amounts of precipitation that drove glaciers to the mapped and dated extents. A comparison of the Rwenzori glacier chronology with similar records from the South American tropics shows that glaciers across the tropics fluctuated at similar times over the last ~30 ka. This apparent synchrony of tropical temperature changes has implications for the role of high-latitude temperatures, greenhouse gases and ocean-atmosphere interactions in setting tropical, and global, temperatures on millennial timescales.

Dr. Meredith Kelly *is an Associate Professor in Earth Sciences at Dartmouth College. She runs a surface exposure-age dating laboratory and a sediment core laboratory and advises graduate and undergraduate students on projects. Meredith completed her dissertation at the University of Berne, Switzerland, in 2003. She then had the incredible opportunity to postdoc with Lonnie Thompson at The Ohio State University and travel with his group on an ice coring expedition to Peru (Quelccaya and Coropuna ice caps). Subsequently, Meredith was a postdoc at Lamont-Dougherty Earth Observatory. Her research focuses on using past glacial and ice-sheet fluctuations to understand the causes of climate change and to assess the stability of glaciers and ice sheets under a variety of climate conditions. She also obtains and analyzes sediments from lakes that provide information about past glacial extents as well as environmental conditions. Meredith has expertise in geomorphic mapping and analyses of glacial landforms using both remote data and detailed field investigations. She relies heavily on two chronologic methods. One is known as "surface exposure-age dating" and is based on the measurement of cosmogenic nuclides, such as* ^{10}*Be, produced in rocks at Earth's surface in direct relation to the time of exposure. She also uses radiocarbon dating of organic material obtained from glacial forefields and lake sediments. Meredith has worked on mountain glaciers in Switzerland, Peru and Uganda as well as on past ice sheet extents in Antarctica, Greenland and North America.*

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