Universität Basel

Research Project

Climate Drivers and Ancient History in Greenland Ice

Project funded by own resources

Project title Climate Drivers and Ancient History in Greenland Ice
Principal Investigator(s) McConnell, Joe ;
Project Members Chellman, Nathan ; Bruegger, Sandra ; McDonald, Brandon ; Wensman, Sophie ;
Organisation / Research unit
Faculty of Humanities and Social Sciences
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Ice cores collected from the polar ice sheets contain detailed records of past environmental conditions, climate, and climate drivers. For example, the timing, size, and sometimes even the locations of large volcanic eruptions can be detected in the ice. Such eruptions often were linked in the past to periods of strong cooling and changes in precipitation patterns that disrupted food production, leading to famines, human migrations, political unrest, and conflict. Similarly, ice cores contain detailed records of past industrial emissions of metals, acids, and other pollutants. For example, lead pollution is an especially sensitive indicator of past mining and smelting of lead/silver ores, and because many ancient coinage was made of silver, Arctic lead pollution can be used as a proxy or indicator past silver production and so overall economic activity. Indeed, Greenland ice cores analyzed at high depth resolution with the latest analytical instruments have yielded precisely dated (within one to two years) proxies of ancient, medieval, and modern economies. When compared to known historical events such as plagues and wars, historians, economists, and archaeologists can assess the resilience of past societies through their response to external shocks such as the arrival of plagues or a climate disruptions resulting from volcanic eruptions.

The goal of this research is to develop accurately dated, high-resolution, ice-core records of a broad range of elements and chemical species to expand and extend recently identified, causal linkages between (1) ancient societies; (2) volcanism and hydroclimate; and (3) wars, plagues, social unrest, and economic activity. Underpinning these efforts will be the collection and analysis of a 440 m ice core from the Tunu region on the northeastern flank of the Greenland ice sheet. An ice-penetrating radar survey extending 40-km upstream along the ice-flow line upstream of the ice-core site will support interpretation of the aerosol and water isotope records, as well as understanding of any possible impacts from changes in deposition processes upstream. The ice core will be analyzed using the continuous flow analysis system at the Desert Research Institute to develop accurately-dated records of over 30 chemical species linked to volcanism, biomass burning, sea salts, continental dust, and industrial pollution during the past 4,000 years.ăThe ice core will be dated using volcanically-constrained annual layer counting supplemented by measurements of cosmogenic nuclides from known solar proton events. Interpretation of the ice-core records will be conducted by an interdisciplinary team including environmental and climate scientists, volcanologists, historians, and social scientists. A laboratory-based course will also be developed to train historians, economists, archaeologists, and researchers from other related fields in ice-core analysis and how ice-core records can be used to address historical research questions.

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