Supplementary information for Press release

Antarctic rocks help uncover clues about sea level changes

issued 11th November, 2011

NERC Research Grant: 2012-2015: ***A new approach to West Antarctic Ice Sheet evolution using blue-ice moraines on nunataks***

Did the West Antarctic Ice Sheet survive the last interglacial 120,000 years ago when the world was a little warmer than at present? Our inability to answer this question undermines attempts to predict the future of the WAIS and its effect on global sea-level change.

One hypothesis is that the WAIS disappeared under last-interglacial conditions and that global sea levels were about 6m higher than today. Another hypothesis suggests the WAIS may have varied in elevation but that it persisted as a coherent ice sheet during the last interglacial and had limited impact on global sea level. The co-existence of two opposing hypotheses shows that we do not fully understand the principal controls on ice-sheet stability.

We will test the two hypotheses using rock debris accumulating in blue-ice areas. Blue ice describes a rippled glacier surface where the underlying glacier ice and structures are exposed at the surface. Blue-ice areas are caused by strong down-slope winds which are often funnelled by mountains protruding through the ice. The strong winds blow away snow and lower the ice surface through a process of ablation. In response the ice flows towards such blue-ice areas, sometimes bringing rock debris to the surface which is then deposited at the ice margin. This debris accumulates on mountain slopes adjacent to the ice and some boulders have been there for 400,000 years.

This project brings together glaciologists, geomorphologists and geophysicists to work in the Heritage Range, mountains which protrude through the central dome of the West Antarctic Ice Sheet. We will test the two competing hypotheses firstly by examining the processes of blue-ice moraine formation today using field survey and radar, and secondly by establishing the characteristics of the moraines and their age. The latter will employ exposure-age dating, a technique that measure the time a rock has been at the surface and exposed to cosmic rays. The exciting thing is that if we use more than one isotope we can establish times when a rock surface may have been buried by ice and thus there is the potential to reconstruct a rich history of ice elevation changes.

The project, with a total value of £800k, involves Edinburgh working in collaboration with the Universities of Northumbria and Exeter, the Scottish Universities Environmental Research Centre (SUERC), the University of Cologne, and with logistics provided by the British Antarctic Survey. The project will run from 2012-2015

and involve two field seasons, each with four scientists based in tents and using snow scooters.

David Sugden said:

“We have been surprised to find boulders that have been on the ice surface for tens of thousands of years and on adjacent slopes for hundreds of thousands of years. Such ages point to a degree of ice-sheet stability that is a surprise.”

“This exposure-age approach in blue-ice areas is important to try. It is a fresh approach and will give a long term perspective to satellite and oceanographic observations of present-day changes of the ice sheet.”

“The West Antarctic Ice Sheet sits on a bed below sea level and is thus susceptible to melting by warm ocean water. There is strong evidence of past and present-day changes in the Pacific-facing sector of the ice sheet and this is a concern. It may be that the Atlantic-facing sector behaves in a different way.”

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