Geophysical Research Abstracts
Vol. 14, EGU2012-13055, 2012
EGU General Assembly 2012

Subglacial meltwater channels in Marguerite Bay: observations from ROV and ship-mounted instruments

K. A. Hogan (1), J. A. Dowdeswell (1), I. C. Bartholomew (2), R. Noormets (3), M. Garcia (1), J, Evans (4), and C. Ó Cofaigh (5)

(1) Scott Polar Research Institute, University of Cambridge, Cambridge CB2 1ER, UK (kah55@cam.ac.uk), (2) University of Edinburgh, School of Geosciences, Edinburgh, EH8 9XP, UK, (3) The University Centre in Svalbard (UNIS), P.O. Box 156, N-9171 Longyearbyen, Norway, (4) Department of Geography, University of Loughborough, Loughborough LE11 3TU, UK, (5) Department of Geography, Durham University, Durham DH1 3LE, UK

The mechanisms and flow-paths by which subglacial water is transported beneath the Antarctic Ice Sheet are not fully understood; however, this information is critical for understanding modern ice-flow regimes, the transfer of meltwater to ice-sheet margins and subglacial bedform development (Wingham et al., 2006). Given the inaccessibility of the beds of modern ice sheets, marine geophysical evidence from the well-preserved beds of former ice sheets is an important source of evidence on the distribution and dimensions of subglacial channels cut into bedrock. On the western Antarctic Peninsula grounded ice is known to have advanced through Margeurite Bay to a position at the shelf edge during the last glacial. Multibeam bathymetry from Marguerite Trough have revealed streamlined subglacial bedforms along the length of the trough and meltwater features (subglacial basins and channels) in the bay and on the inner to middle continental shelf. The channels are inferred to be subglacial in origin based on the fact that they have sections with negative slope gradients and areas of overdeepening along their thalwegs. We investigate the subglacial channel systems on the continental shelf, fully describing their morphometry using medium- and high-resolution multibeam bathymetry data. These data allow us to calculate potential subglacial meltwater fluxes through the channels and to explore the possible origins of the meltwater that is assumed to have incised them. A detailed analysis of channel morphometry was made possible by the acquisition of high-resolution multibeam data (gridded surfaces have cell sizes c. 0.4 m) and seafloor photographs taken by the Isis ROV. A comparison of these data with the medium-resolution multibeam data (grid cell sizes of c. 40 m) from ship-mounted systems reveals that the side slopes of the channels are much steeper than originally thought, with some even being undercut. The resulting increase in cross-sectional area of the channels has, in turn, increased estimates of potential meltwater fluxes through the channel systems. Here we present the results of these calculations and ground-truth the geophysical data using seafloor photographs and geological cores from the flat areas immediately in front of the channel systems. Given the magnitude of the channels (up to 200 m deep and 1500 m wide) and the subglacial meltwater fluxes that we calculate we find it highly unlikely that the channel systems operated with continuous “bank-full” or even “half-full” conditions during the last glacial. Rather, we suggest that high-magnitude, low-frequency events (outburst floods) helped to incise the channels to their great size.