



Constraints on the former extent and configuration of the South Orkney ice cap, northeast Antarctic Peninsula, from new bathymetric and geological data

William Dickens (1,3), Alastair Graham (2), James Smith (1), and Julian Dowdeswell (3)

(1) British Antarctic Survey, High Cross, Madingley Road, Cambridge, United Kingdom, (2) College of Life and Environmental Sciences, University of Exeter, Exeter, United Kingdom, (3) Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge, United Kingdom

Advances in the coverage and quality of marine geophysical and geological data over the past decade have led to significant improvements in our understanding of the glacial history of the Antarctic Peninsula and neighbouring sub-Antarctic islands. Despite these advances, very little is known about the history or past behaviour of ice caps that once dominated the South Orkney Islands (SOI), northeast of the Antarctic Peninsula. In this study, we present a new, high resolution (300 m) bathymetric grid of the SOI and surrounding continental shelf (49° - 39°W to 64° - 59°S). The new bathymetry provides the first detailed insights into past glacial regimes for the islands' offshore realm. The continental shelf is shown to be dominated by seven glacially eroded troughs, marking the pathways of glacial outlets that once drained former ice caps centered over the SOI. During previous glacial periods, trough morphologies demonstrate that grounded ice extended to the shelf break to the north of the islands at least once, and likely on numerous occasions. A large, ~ 250 km long sediment depocenter, visualised for the first time by our bathymetric data, and interpreted as a maximum former ice limit of one or more Cenozoic glaciations, suggests that ice was only ever grounded to the ~ 300 m contour in the south and did not extend beyond. Hypsometric analyses support this interpretation, indicating that a significant proportion of the shelf has been unaffected by glacial erosion. Using observations from the new bathymetric grid, we propose a preliminary ice cap reconstruction for a time-independent maximum glaciation of the South Orkney plateau. This reconstruction suggests an areal ice coverage of ~ 19000 km², providing a critical test for ice-cap models in this region. Although the spatial extent of the ice cap is resolved by new data, the timing of maximum ice extent, number of past advances and pattern of subsequent deglaciation(s) remain uncertain. To this end, we present preliminary results of further, targeted marine geological (sediment core lithological, physical and geochronological analyses) and geophysical investigations (multibeam swath bathymetry and seismic studies) which aim to address these questions directly, contributing to an overarching objective to provide significantly improved constraints on sub-polar ice cap history in the Antarctic.