



A new record of post-glacial sedimentation in a glacial trough, offshore sub-Antarctic South Georgia

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Past studies of South Georgia's climatic history were constrained to land-based sedimentary records, such as peat bogs and coastal lakes, or to terrestrial geomorphology, such as terminal moraines. Hence, the current state of knowledge on past climatic changes in South Georgia is characterised by a complete absence of records from sedimentary marine archives in the fjords or coastal embayments of the region. This study comprises detailed examination of one of the first marine sediment cores recovered on its northeastern shelf in Royal Bay Glacial Trough. Alongside the analysis of new acoustic sub-bottom data, it is the first work to deliver extensive insight into South Georgia's post-glacial climatic history from a marine perspective. The glacial troughs on the South Georgia shelf radiate from the coast towards the shelf edge and represent major sediment traps as they form the only key large-scale depressions in the shelf bathymetry. Sedimentary records, covering a period since at least the Last Glacial Maximum, are thought likely to be recorded in most of them.

The sediment core of this study covers sedimentation dated from a maximum of $15,346 \pm 492$ cal. yr BP until the present day. Physical core parameters indicate a major change in climatic conditions around 14,000 cal. yr BP, the time of the Antarctic Cold Reversal. Holocene climate variabilities are also recorded in the trough infill. The acoustic data show a major change in sedimentation and a pronounced unconformity at the core site, which appears to have had a widespread effect over a large area of the shelf. The origin of the unconformity remains unclear, though several hypotheses, including bottom-current erosion, glacial overriding and earthquake activity, are proposed and discussed.

Another important finding at the core site is the presence of methane-derived authigenic carbonates. They form either as secondary precipitates in the subsurface or syndepositional at the seafloor as individual minerals or sediment cements. The authigenic carbonates are linked to the widespread occurrence of cold methane seeps on the shelf which are visible today as zones of acoustic blanking and wipe-out structures in the sub-bottom profiles. These seeps are evidence of major biogenic productivity and carbon drawdown on the South Georgia shelf and the subsequent decay of organic matter. This finding is an important consideration for future studies as authigenic carbonate production and methane release have an impact on the isotopic composition of carbonate shells of marine organisms. Thus, radiocarbon ages recovered from the South Georgia shelf need to be examined critically and might require additional corrections.