Quaternary glaciations on sub-Antarctic Marion Island: breaking new ground with cosmogenic nuclide dating

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Sub-Antarctic Marion Island (46°54'S 37°45'E) is a shield volcano in the southern Indian Ocean. Created by multiple volcanic eruptions, it is characterised by a simple geological sequence of Late Pleistocene grey basalts that pre-dates Holocene black basalts and scoria cones. The older grey basaltic outflows date from before the Last Glacial Maximum (LGM) and for this reason can hold valuable information about Quaternary glacial sequences. Geomorphic evidence and proxy dating of the grey lavas suggest several events of glacial advance and retreat, but these dating techniques have, thus far, proven limited in determining the timing and extent of glacial sequences. Consequently, the exact distribution and duration of glaciers on Marion Island is not yet known. The knowledge of glacial advance and retreat can provide answers for landscape development and holds valuable implications for ecological colonisation and succession. This is due to the fact that exposed rock surfaces provide refugia for the establishment of biological species during glacial periods. Hence, it is essential to determine more concise temporal and spatial constraints of glacial activity on Marion Island. Cosmogenic nuclide dating of glacially striated surfaces and glacial deposits provide such an opportunity.

Cosmogenic nuclides are created when radiation from outside our atmosphere (mostly solar) react with elements within rock surfaces. Terrestrial *in situ* cosmogenic nuclides are more specifically produced within a rock surface once it is exposed to radiation. Resultantly, the quantity of nuclides in a rock sample can be measured and effectively translated to the exposure period of a surface due to glacial retreat. Recent advancements of this dating technique has ensured a wider application of the method (latitude, longitude and lithology) to accommodate the different production rates of nuclides specific to rock mineralogy.

The current study aims to target sites within the grey basalts for the application of cosmogenic nuclide dating, to measure quantities of ^{36}Cl, ^{3}He and ^{21}Ne nuclides and determine exposure dates. The extent and period of glaciation at these locations will shed light of the island's glacial sequencing and may facilitate a better understanding of the geomorphic and ecological patterns observed today.