Timing of a newly identified Pleistocene glacial re-advance of the Northern Patagonia Icefield (NPI), Chile

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Project aims, methodology and key findings

This project aimed to constrain glacier and ice-dammed palaeolake dynamics using a landsystems approach and cosmogenic nuclide dating from the Baker Valley region of central Patagonia. We use 14 new ^{10}Be ages (partially funded by the BSG) to quantify the asynchronous advance of two outlet glaciers of the Northern Patagonian Icefield during the Antarctic Cold Reversal.

This project used geomorphological mapping (from field surveys and remote sensing), sedimentology and cosmogenic nuclide dating of glacially transported erratic boulders on the tops of moraines and below the level of ice-dammed palaeolakes.

Our project focused on two key outlet glaciers: Soler Glacier, from the Northern Patagonian Icefield, and Calluqueo Glacier, from Monte San Lorenzo. Soler Glacier produced lateral moraines above Lago Bertrand from 15.1 to 14.0 ka, when it dammed the drainage of Lago Buenos Aires through Río Baker. At this time, Soler Glacier terminated in the 400 m level "Lago Deseado". Later, Calluqueo Glacier (from Monte San Lorenzo) deposited subaerial moraines in the Salto valley near Cochrane at 13.0 ka. These moraines were deposited just above the level of the larger ice-dammed palaeolake that was unified through the Baker Valley (Lago Chalenko, 350 m asl).

Figure 1. *Sampling for cosmogenic nuclide ages at the Salto Moraine above the Baker Valley.*

The Salto Valley glaciolacustrine landsystem included subaqueous morainal banks, ice-scoured bedrock, glacial diamicton, perched delta terraces, palaeoshorelines and subaerial moraines.

Boulders located on top of morainal banks, below the level of Lago Chalenko, had exposure ages of 12.0 ka, providing the timing of recession of Nef Glacier blocking the drainage of Lago Chalenko and the lowering of the lake level.

These ice-dammed lakes exerted a considerable control on ice dynamics, with calving, ice margin position and final recession being controlled by lake level and topography. This accounts for an asynchronous response to the cooling experienced by the region during the Antarctic Cold Reversal.

Value of the BSG grant

The British Society for Geomorphology provided £789 towards the cost of cosmogenic nuclide ages. Together with additional funds from Royal Holloway University of London, the Quaternary Research Association and the Geologists' Association, these provided funds to cover the consumables costs of 14 ^{10}Be exposure ages, produced in the Cosmogenic Isotope Analysis laboratory at the Scottish Universities Environmental Research Centre.

These funds supported funded research to undertake fieldwork in Patagonia. These publications developed the evidence for Antarctic Cold Reversal ice dynamics in Patagonia[1], and allowed the development of an entirely new model of palaeo glacial lake evolution[2]. These datasets together allowed for a new reconstruction of palaeo ice dynamics in Patagonia and the highest resolution, to date, reconstruction of ice and palaeolake dynamics[3].

These papers are forming the basis of a number of new PhD research projects with our research group (e.g.[4]). This building of momentum of the Patagonian research group within the Centre for Quaternary Research at RHUL will foster new training opportunities for PhD students as well as new, larger-scale research bids to constrain Patagonian ice dynamics and links to palaeoclimate.

References

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