

Tracking latitudinal shifts in the Southern Westerlies using unstudied ice limits in Patagonia

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Project summary

The goal of this research is to assess whether precipitation related to the Southern Westerlies shifted towards the equator during the last glacial period, causing asynchronous ice advances across Patagonia. We will reconstruct former ice extents in the unstudied northern region of Patagonia (42 to 44 °S) using geomorphological, sedimentological and geochronological techniques. The field research performed here and subsequent laboratory analyses will provide proof of concept to pump-prime a NERC Standard grant application that I am preparing for submission in 2018.

RATIONALE: The Southern Westerlies bring storms and precipitation to the mid-latitudes of the Southern Hemisphere, and are predicted to shift $\sim 1 - 2$ °S in the coming century (IPCC AR5). However, there is low confidence in this prediction as we lack the robust, long-term datasets required to evaluate model simulations. The north-south transect of Patagonia is influenced to varying extents by the Southern Westerlies and therefore provides a natural laboratory to study any latitudinal shifts in related precipitation. Our research is filling an important spatial gap in ice sheet reconstruction $\sim 42 - 44$ °S as it holds the key to identifying any equatorial shifts of the Southern Westerlies.

AIM: To determine whether the Southern Westerlies shifted towards the equator during the last glaciation by reconstructing past climate 42 – 44 °S in Patagonia. Work Packages: (1) Field campaign to study the former landscape (*Completed*); (2) Constrain the timing past ice limits using luminescence and cosmogenic nuclide dating; (3) Reconstruct palaeoenvironmental change from lake cores.

Field research

Eleven sediment samples from outwash and lake sediments were collected for luminescence dating to constrain the inner and outer moraine limits in three valleys (Epuyen, Esquel and Rio Pico) and three cobbles samples to test new OSL dating technique. Seventeen cosmogenic nuclide samples were taken to constrain deposition of the moraines and 4 were additional paired samples for OSL surface exposure dating. Three sediment cores preserving palaeoenvironmental records were also obtained: (1) Rio Pico - 2.5 m core of peat and minerogenic layers overlying bedrock; (2) Esquel - 7 m core of peat with some likely erosional sand layers; (3) Epuyen - 4.0 m core of organic and minerogenic units. Further sites with greater potential to preserve a record of environmental change throughout the last glaciation but would require open water coring were identified for future research.



Fig. 1. Outwash sediment in Epuyen sampled for luminescence dating.



Fig. 2. Example section of core from 2.15 – 2.65 m extracted from Epuyen.

Future plans and intended outputs

Samples collected for luminescence and cosmogenic nuclide dating are being analysed at the University of Liverpool and Pontificia Universidad Católica (Chile), respectively. The sedimentology, geochemical and palaeoecological properties of the sediment cores are being analysed at the University of Liverpool. Two themes for publications are planned for the region from 42 to 44 °S: (1) the reconstruction of ice limits; (2) the reconstruction of palaeoclimate from lake sediments. This research will provide the basis for the submission of a NERC Standard grant application in 2018.