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## A detailed Pleistocene cosmogenic nuclide chronology of Patagonian Ice-Sheet expansions in north-eastern Patagonia (43°S)

Tancrede Leger<sup>1</sup>, Andrew Hein<sup>1</sup>, Robert Bingham<sup>1</sup>, Ángel Rodes<sup>2</sup>, and Derek Fabel<sup>2</sup>

<sup>1</sup>The University of Edinburgh, School of GeoSciences, Edinburgh, United Kingdom of Great Britain – England, Scotland, Wales (tankleger@gmail.com)

<sup>2</sup>Scottish Universities Environmental Research Centre (SUERC), Glasgow, United Kingdom of Great Britain and Northern Ireland

The former Patagonian Ice Sheet was the most extensive Quaternary ice sheet of the southern hemisphere outside of Antarctica. Against a background of Northern Hemisphere-dominated ice volumes, it is essential to document how the Patagonian Ice Sheet and its outlet glaciers fluctuated throughout the Quaternary. This information can help us investigate the climate forcing mechanisms responsible for ice sheet fluctuations and provide insight on the causes of Quaternary glacial cycles at the southern mid-latitudes. Patagonia is part of the only continental landmass that fully intersects the precipitation-bearing Southern Westerly Winds and is thus uniquely positioned to study past climatic fluctuations in the southern mid-latitudes. While Patagonian palaeoglaciological investigations have increased, there remains few published studies investigating glacial deposits from the north-eastern sector of the former ice sheet, between latitudes 41°S and 46°S. Palaeoglaciological reconstructions from this region are required to understand the timing of Pleistocene glacial expansion and retreat, and to understand the causes behind potential latitudinal asynchronies in glacial advances throughout Patagonia. Here, we reconstruct the glacial history and chronology of a previously unstudied region of north-eastern Patagonia that formerly hosted the Río Corcovado (43°S, 71°W) palaeo ice-lobe. Here we present a new set of cosmogenic <sup>10</sup>Be exposure ages from presumed pre-LGM moraine boulder and glaciofluvial outwash surface cobble samples, establishing for the first time a comprehensive chronology for pre-LGM glacial margins of the Río Corcovado palaeo-glacier. This new dataset completes our effort to date the entire preserved moraine record of the Río Corcovado valley: which captures at least seven distinct Pleistocene glacial events. Our results allow answering questions on the timing of the maximum local ice extent of the last glacial cycle as well as older, pre-last glacial cycle glaciations, for which few robust glacier chronologies exist in the Southern Hemisphere. The most informative cosmogenic nuclide-derived glacial chronologies with the capacity to resolve questions on interhemispheric phasing of climate change require unambiguous dating of glacial margins spanning the entirety of the last glacial cycle and ideally earlier glacial cycles. Therefore, our findings have significant implications for understanding past climate fluctuations at the southern mid-latitudes, former Southern Westerly Winds behaviour and interhemispheric climate linkages throughout the Pleistocene. They also provide further evidence supporting the proposed latitudinal asynchrony in the timing of Patagonian Ice Sheet expansion

during the last glacial cycle and enable novel glacio-geomorphological interpretations for the studied region.