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The Glacial Geomorphology of central-Patagonia (44 – 46°S): glacier dynamics within and beyond the austral Andes

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The former Patagonian Ice Sheet (PIS, 38 – 56°S) was one of the largest ice masses to develop in the Southern Hemisphere. Its formation was uniquely influenced by the Southern Westerly Winds (SWWs) colliding with the Andean Cordillera, generating a marked West-East precipitation gradient. Variability in the strength and position of the SWWs is thought to have played a significant role in ice sheet dynamics. In particular, understanding of the timing of palaeo-glacier fluctuations is required to elucidate the role of these regional climate drivers on ice retreat. However, in order to fully understand the structure and pace of deglacial ice fluctuations, detailed glacial geomorphological reconstructions must be completed.

During deglaciation, as the PIS retreated from local Last Glacial Maxima positions, large proglacial lakes formed east of the austral Andes, ice-dammed by the Andean Cordillera. In central-Patagonia (44 – 46°S) during the final stages of deglaciation, these ice-dammed lakes drained to the west, through the Andean Cordillera, opening new drainage corridors towards the Pacific Ocean. As a result, the floors of these valleys are now exposed subaerially, preserving a complex suite of glacial and glaciolacustrine landform assemblages. Moreover, as most of the region is now ice-free, excluding smaller mountain ice caps such as Queulat (44.4°S, ~2000 m a.s.l) more recent Holocene geomorphology has also been exposed. These landforms possess the potential to yield new insights into the style and manner of regional ice retreat, during the transition from large terrestrial ice-lobes, to smaller mountain glaciers and ice caps.

We mapped seven terrestrial palaeo-ice lobes of the PIS: the Río Pico (~44.2°S), Río Cisnes (~44.6°S), Lago Plata-Fontana (~44.8°S), Río El Toqui (~45°S), Lago Coyt/Río Ñirehuao (~45.3°S), Simpson/Paso Coyhaique (~45.5°S) and Balmaceda (~46°S) lobes. Mapping was then extended west, into the Andean Cordillera. Landforms were mapped using ESRI™ DigitalGlobe World (1-2 m) and Sentinel-2 (10 m) imagery, verified with field surveys. These new data build on previous work in the area. To date, over 60,000 ice-marginal, ice-contact, subglacial, glaciolacustrine and glaciofluvial landforms have been mapped across a ~70,000km^2 area of the Andean Cordillera and adjacent valleys. When combined with robust geochronological reconstructions, these data possess the potential to inform on the role of the SWWs, versus local topography, and ice-marginal processes in regulating the structure and rate of regional deglaciation.