Geomorphological mapping of the eastern Cajón de Pincheira glacier-periglacial complex (34°S): insights into rock glacier origins and dynamics.

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Poster

Geocriología

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The Central Andes of Chile (30-35°S) host one of the highest concentrations of rock glaciers worldwide. These debris tongues, indicative of mountain permafrost, represent a crucial cryospheric reservoir in a context of increasing aridity. However, their origin and dynamics remain poorly constrained. To better understand the relationship between their formation and changing environmental conditions, this study provides a detailed assessment of the eastern glacier complex of the Cajón de Pincheira (34.74°S ; 70.26°W), which exhibits an exceptional diversity of glacial and periglacial landforms within an apparently homogeneous topo-climatic setting. The proposed geomorphological mapping is based on (i) multi-scale photo-interpretation (aerial photos 1955, 1997 ; very high-resolution imagery >2007) validated by field work ; (ii) SAR offset-tracking (Sentinel-1 GRDH, 2024–2025); and (iii) diachronic analysis (aerial photos 1955-2025). Our study reveals a marked heterogeneity of glacial and periglacial landforms arranged along a downstream-upstream sequence, including terminal moraines, a massive hummocky topography, several superimposed rock glaciers, debris-covered glaciers, and clean-ice glaciers. In particular, rock glaciers have distinct input materials and degrees of activity. Four rock glaciers (RLG1-4) are mainly fed by colluvial inputs, while two others (MRG1-2) are mobilizing Late-

Holocene moraines. Two lobes (RLG1-2) display steep frontal slopes (>35°) reflecting ongoing dynamic flow, whereas smoother fronts seem to indicate progressive fossilization. Most rock glaciers were already stabilized by 1955, as revealed by our diachronic analysis, which also indicates a phase of marked proglacial accretion in upstream areas until the 1990s, an acceleration phase between 2007-2013, a slowdown between 2013-2020, and renewed activity since 2020-2021. Our mapping confirms a composite glacial-periglacial trajectory, suggesting a possible future for current local debris-covered glaciers and clean-ice glaciers. This preliminary study highlights a poly-genetic spatially contrasted system and provides a solid basis for developing a local “landsystem” model illustrating the transition from an active clean-ice glacier to a rock glacier. The next step of this research is to constrain the chronology and paleoclimate implications of this glacial-periglacial complex.