



Cryophenomena in the Cold Desert of Atacama

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The study area of the Valle de Barrancas Blancas in the High Atacama Andes of Chile ($68^{\circ}39'$ W, $27^{\circ}02'$ S), a kind of Patagonian “bajo sin salida”, shows well preserved landforms resulting from a combination of slope, eolian, lacustrine/litoral, fluvial, glacial and periglacial regimes. They permit the reconstruction of geomorphological processes within this isolated catchment of approximately 160 km^2 . The mean annual air temperature varies between -2 and -4 °C and the precipitation is approximately 150 mm/a . Snowfall is frequent but the snow is quickly sublimated, redeposited and/or covered by cryosediments, i.e. mainly pumice pebbles. Water bodies present icings, even in summer. Regarding its climatic conditions the study area represents an extremely cold desertic region. Extremophile microfauna was also found. The area displays both in situ mountain permafrost and creeping permafrost. The active layer is 30 to 45 cm thick. It is a periglacial macro-environment where interdependent processes, and not only cryogenic processes but also erosion and eolian deposition and the action of fluvial washout mainly caused by precipitation, accumulation, retransportation/redeposition and melting of snow, play an important role. The cryogenic geomorphology of the Valle de Barrancas Blancas is varied and contains microforms such as patterned ground and microforms caused by cryoturbation, as well as mesoforms like rockglaciers and cryoplanation surfaces. Slopes are strongly affected by gelifluction. New cryoforms in South America and in the Southern Hemisphere like the Atacama Pingo (Pingo atacamensis) and Permafrosted Dunes (“Dunas heladas”) were found. Intense niveo-eolian processes participate in the erosion of preexisting landforms, in the formation of subterraneous ice layers, and the retransportation/redeposition of snow and sediments. Studies of this periglacial environment are crucial for the understanding of Tundrean paleoenvironments and Martian conditions.