



## **Geomorphic surfaces and supergene enrichment in Northern Chile.**

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Supergene enrichment of porphyry copper deposits in the central Andes is thought to be closely correlated with periods of relatively humid climate and the formation of regionally extensive paleosurfaces (e.g. Mortimer, C. 1973). In northern Chile, two such paleosurfaces have been proposed: the ca. 23 Ma Tarapaca paleosurface within the Coastal Cordillera, and the ca. 10 Ma Pacific paleosurface within the Longitudinal Valley. The Pacific paleosurface is regarded as a single stratigraphic horizon that formed due to either a marked increase in the aridity of the area (Galli-Oliver 1967), regional surface uplift that created a change in the locus of deposition (e.g. Mortimer and Rendic 1975), or a combination of the two. The formation of this surface has been associated with the timing of supergene enrichment throughout the northern Chile and southern Peru (Alpers and Brimhall 1988).

Multispectral satellite mapping of the Pacific paleosurface in northern Chile using Landsat, Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) and Digital Elevation Model (DEM) imagery, combined with seismic data (Jordan et al. 2010) indicates that the Pacific paleosurface is not a single chronostratigraphic surface, as previously thought, but an amalgamation of surfaces that have both an erosional and depositional history. New in situ cosmogenic exposure dating of alluvial boulders on the paleosurface is combined with previous data (Dunai et al. 2005, Kober et al. 2007 and Evenstar et al., 2009) giving ages ranging from ca. 23 Ma to <1 Ma, supporting a multiphase and much more continuous history.

By combining these apparent exposure ages with regional geomorphology, underlying sedimentology, and seismic sections, the geomorphic evolution of the Longitudinal Valley can be constrained. The results show a complex interplay between uplift within the Coastal Cordillera and Precordillera in the south and a distinct change in depositional pattern towards the north. The Longitudinal Valley is increasingly incised to the north and drains into the Pacific Ocean above 19°30'. The close temporal correlation between the formation of these paleosurfaces and supergene enrichment means that placing tighter constraints on their age and regional extent could help locate areas where the generation and preservation of supergene deposits is possible.