

Neogene basin infilling from cosmogenic nuclides (^{10}Be and ^{21}Ne) in Atacama, Chile: implications for paleoclimate and copper supergene enrichment.

C. Sanchez¹, V. Regard¹, S. Carretier¹, R. Riquelme², P-H. Blard³, E. Campos², S. Brichau¹, M. Lupker⁴, G. Hérail¹

¹GET, IRD, CNRS, UPS, Université de Toulouse, France

²Depto. Ciencias Geológicas, Universidad Católica del Norte, Antofagasta, Chile

³CRPG, Nancy, France (4) ETH, Zurich, Switzerland

Whether supergene exotic copper deposits occur during stable periods of the relief geomorphological evolution or during uplift is a long-standing issue with implications for both economic geology, and the reconstruction of paleo-environments. A growing number of evidence suggests that exotic deposits emplace during periods of geomorphic quiescence and pulses of humidity in arid environments. We tested this idea in the Centinela District in Atacama, Chile. In two open pit mines (El Tesoro and Mirador) exposing Miocene sediment, we collected 14 sand samples between 110m and 15m depth. El Tesoro basin hosts two exotic layers and we sampled the lowest one. We inverted the ^{10}Be and ^{21}Ne concentrations by using a two-box model with an eroded source and a sedimentary pit basin, and by looking for the best erosion and sedimentation rates histories that explain our data. We found that the lower exotic layer is 14-10 Myr, 10 Myr younger than previously thought. This is the first time that so old sediment is dated with cosmogenic nuclides. Consequently, these ages demonstrate that two exotic layers were deposited in a narrow period of time between <14 Myr and 9.5 Myr. The dated exotic layer was deposited during or just before a sharp decrease in the sedimentation rates (0.5-5 m/Myr), which is consistent with published sedimentological and carbonate isotopic data in this district. This confirms the idea that exotic deposits form during a quiescence of the geomorphic activity. Furthermore, we found that the back-ground erosion rate that provided sediment to these basins between ~14 Myr and ~9.5 Myr was surprisingly high (> 300 m/Myr) for this arid environment. Such erosion rates can be explained by a relatively rapid back-scarp retreat providing most of the sediment to these basins and possibly wetter climate than current. This study documents the erosion rates versatility at local scale in arid environments with steep slopes. Then, during the period 10-7 Myr, the denudation rates decreased to > 40 m/Myr. This decrease may correspond to a progressive slope decrease of the hills around, or to a progressive aridification, or a combination of both phenomena.