

Shoreline dating of the former Quillagua-Llamara Lake, N-Chile – Implications of global teleconnections to the hydrology of the Atacama Desert

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Cosmogenic nuclide exposure dating of ancient lake-level shoreline terraces of the Quillagua-Llamara Lake in the central Atacama Desert (N-Chile) provides new insights in the paleohydrology of the driest desert on earth. The lake developed from a paleo-exohereic drainage system in the Central Depression, before it opened towards the Pacific and an endohereic drainage system became established due to incision by the Rio Loa. The duration of the lake stages was long enough to cut erosive shoreline terraces into exposed islands. These shoreline features are preserved due to 250 m uplift of islands (Cerro Soledad, Cerro Mogote). Exposure dating of the shorelines reveals the existence of pluvial lake stages in the Atacama Desert during parts of the Late Pliocene and several Pleistocene interglacials (MIS 7, 9, 11, possibly 31, 87-93). These interglacials at least partly coincide with episodes of strong sea-ice retreat or even collapse of the West Antarctic Ice Sheet. This correlation is traced back to dramatic changes in the oceanographic and atmospheric circulation system in the Equatorial-SE Pacific with implications for global climate. A strong reduction in West Antarctic sea ice, followed by a weakening of the Peru-Chile Current and reduced supply of cold water, may have enabled expansion of the Pacific Warm Pool and thus increased sea-surface temperatures along the west coast of South America. These long-lasting, El Niño-like conditions may have in turn decreased the temperature inversion and enabled moisture transport towards the western Andean flanks. Our findings are compatible with evidence from the ANDRILL 1B record from the Ross Sea, Antarctica, and warm-water faunal assemblages on marine shoreline terraces from northern Chile. Furthermore, the exposure ages of the pluvial lake stages narrow the maximum incision age the of Rio Loa canyon and break through the Coastal Cordillera, and imply rock uplift rates of isolated islands in the Central Depression in the Quaternary that are significantly higher than previously suggested.