

Climate change and human occupation in the hyperarid core of the Atacama Desert

Claudio Latorre^{1*}, Calogero Santoro², Eugenia M. Gayó³, José Capriles², Paula Ugalde² & Pablo Marquet⁴

¹ LINCGlobal/Departamento de Ecología & Centro del Desierto de Atacama, Pontificia Universidad Católica de Chile, Santiago, Chile, clatorre@bio.puc.cl

² Instituto de Alta Investigación, Universidad de Tarapacá, Arica, Chile

³ CR2 & Departamento de Oceanografía, Universidad de Concepción, Concepción, Chile

⁴ LINCGlobal/Departamento de Ecología & Santa Fe Institute, Pontificia Universidad Católica de Chile, Santiago, Chile

Significant changes in available moisture have occurred in the hyperarid Atacama Desert throughout the late Quaternary. Paleorecords show that areas in the adjacent high Andes and western Altiplano have experienced significant increases in rainfall, likely the result of intensified summer systems associated with the South American Summer Monsoon, tropical Pacific sea-surface temperature gradients and the mean position of the Intertropical Convergence Zone. These past "pluvials" generated increased runoff, elevated groundwater tables throughout the region, and had far-reaching impacts from the Andes to the Pacific coast. Four different examples from our recent research show how such changes in climate bear on cultural evolution in the Atacama. First, there is now abundant evidence for an early colonization of even the Atacama's hyperarid core between 12-13 ka (thousands of calibrated 14C years BP). These sites have extraordinary well-preserved evidence for how this region was settled and the hydrological and ecological resources available. Second, increased groundwater supplies and abundant marine resources along the coast of northern Chile likely augmented Chinchorro hunter-gatherer populations to the extent that this may help explain their advanced technology and artificial mummification techniques. Third, increases in groundwater associated with minor pluvials during the late Holocene at 2.5-2.1 and 1.2-0.7 ka are coeval with major population expansion and development of "hydraulic societies". Finally, a recent long-term trend in aridity may explain the demise of Aymara populations in the precordillera of northernmost Chile. By using population size as a primary response to environmental change, we have developed a conceptual model that shows how these past social changes can be related to climate change.