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A 65 ka precipitation record from the hyperarid Atacama Desert in northern Chile

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The Atacama Desert in northern Chile is one of the major and assumed to be the oldest hyperarid deserts on Earth. Precipitation rates in the central Atacama are below 2 mm/yr, but experience significant spatial and temporal intensity shifts. The onset and the permanency of hyperarid climate conditions in the Atacama Desert are still controversially discussed. Hyperaridity is thought to have persisted at least since the Miocene, but is frequently punctuated by pluvial phases. Longer-scale precipitation reconstructions derived from sedimentary archives from the central Atacama Desert are rare and mostly restricted to the Miocene/Pliocene or the late Pleistocene.
In this study, we focus on a ∼4 m long sediment record (HUIII) from the hyperarid core of the Atacama Desert recovered from a tectonically blocked basin at the western fringe of the Huara Batholith (clay pan 'Huara') in the Coastal Cordillera (20°04'34"S, 69°55'02"W) in order to reconstruct the regional paleoclimate history. The pilot coring was carried out in spring 2015, followed by an extensive geophysical site-survey in autumn 2018.
The geophysical results suggest a well-stratified sediment infill of the basin with a maximum thickness of about 30 m. According to a multi-disciplinary dating approach, the uppermost ∼4 m of these sediments, represented by core HUIII, were accumulated over the past ca. 65 kyrs. The sequence mainly consists of fine-grained sediments, whose sedimentological, geochemical, geophysical and biological characteristics suggest formation under arid conditions with only sporadic precipitation. Intercalated coarser-grained horizons probably represent periods of wetter climate conditions, causing multiple phases of local alluvial deposition from the interior catchment area into the clay pan. The findings from core HUIII are in agreement with data from the adjacent meander system, which suggest that the entire sediment sequence in the 'Huara' clay pan was deposited over the past 500 – 700 kyrs, making it a promising target for longer-term reconstructions of the regional paleoclimate history.