

Paleohydrology of Late Quaternary floods in the Atacama Desert and their paleoclimate implications

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The Quaternary fluvial succession in the Copiapó Valley (northern Chile) have not been deeply studied even though they record a large amount of palaeoenvironmental and paleoclimate information in an area of great interest as the Atacama Desert. The city of Copiapó is located at the confluence between Quebrada Paipote (the most important tributary of the middle course) and Copiapó River which has been dry during the last decades due to the surface and groundwater exploitation for agricultural and mining activity purposes upstream. Despite that, historical chronicles describe numerous flooding events in the city during the last 400 years due to snowmelt during the summer months or unusually intense rains during any time of the year. The most recent event occurred on March 25, 2015 when 70% of the city flooded and more than 2.2 million m³ of sediment accumulated, mostly coming from Quebrada Paipote. The sedimentological analysis of the lower fluvial terrace of the Copiapó River has allowed us to identify a fluvial system that abruptly changes upward to paleoflood and aeolian deposits. The latter constitute the top of the lower fluvial terraces on which the city of Copiapó is built. The fluvial facies are mainly formed by imbricated to massive conglomerates and poorly sorted pebble and cobble sized conglomerates with laminated sandstones that probably were deposited in a braided gravel-bed river. The overlying deposits are constituted by several levels of massive sandy siltstones and well sorted fine sands of aeolian origin that are interpreted as overbank flood events linked to flooding episodes that alternate with long episodes of eolian dunes and sand sheets development that buried almost the entire alluvial plain. This sharp change in the facies association record an abrupt climate change in the southern Atacama Desert during the recent Quaternary towards more arid conditions, with a dominance of floods and aeolian morphogenesis over the typical fluvial system processes in a semiarid environment. Several authors have proposed two episodes of regional changes in groundwater recharge tied to long-term changes in precipitation in the Atacama Desert when wet periods were terminated by pronounced dry periods, from 9 to 8 ka and from 3 to 0 ka. The change recorded in the fluvial succession of the Copiapó Valley can probably be linked to one of this climate event what would be confirmed by means of the deposits dating. In addition, this will provide more information for the estimation of the recurrence period for this catastrophic processes.