

# Geochemical and isotopic evidence of the aquifer-lagoon interaction during Holocene (Almería, SE Spain)

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## ABSTRACT

Variations in sea level along the Quaternary have affected both the piezometric level and the position of the mixing zone in coastal aquifers throughout the world. At the end of the Last Glacial, these salts have been washed, although in confined or low-permeability coastal aquifers part of the saline water can be retained. The study area corresponds to the small coastal aquifer of Cabo de Gata, which has surface area of only 16 km<sup>2</sup>, located in south-eastern Spain. It is a multi-layer aquifer, formed by Plio-quaternary sands and conglomerates, which means that the unconfined aquifer becomes semi-confined towards its base, comprises Pliocene silts lying at 80 m depth. The hydrogeochemical characteristics of this aquifer were studied in an attempt to explain the anomalous salinity of its groundwater; in some cases the salinity exceeds that of seawater. Two groups of water have been identified. Group 1 is represented in the upper part of the aquifer (samples taken in the top 30 m of the aquifer), where the proportion of seawater, calculated with its <sup>18</sup>O concentration, varies between 10-60%, while waters identified as Group 2, taken from the lower part of the aquifer, contain 60-70% seawater. In addition, hydrogeochemical modelling was applied, which reveals that the waters have been subject to evaporation between 25-35%. There was good agreement between the modelled results and the observed water chemistry. For SO<sub>4</sub>, the results of the modelling were not optimal. The aquifer has suffered antropogenic pollution from the intense agricultural activity in the area, which contributes an additional source of SO<sub>4</sub>.

The rates of evaporation modelled would imply that the water corresponding to Group G2 was, at some point in the past, surface water. This evaporation would have occurred during the Holocene, in a coastal lagoon environment. Sediments characteristic of this type of environment have been identified in this location; this lagoon would have been active between 8 and 3 kyr BP. The hydrogeochemical and isotopic results have allowed to identify this lagoon and reconstruct its interaction with the aquifer.

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