The Hydrochemical Evolution of Shallow Brines

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Abstract

Shallow water is of great importance as a major water source for domestic, agricultural, and for oil and gas exploration uses. Understanding the hydrochemical evolution of these shallow waters can play an important role in water resources developments and managements. Accordingly, this study develops a multi-tracer workflow to identify the origin and mechanism of salinization in shallow- water brines. This workflow includes a combination of geology, stratigraphy, geochemistry, and radioactive and stable isotope applications. Stratigraphic data suggests that major cycles of transgression and regression of paleo-seawater formed a lagoonal environment in the area. This is supported by a remarkably high presence of marl and clay deposits, which are known to settle out of stagnant waters with occasional shallow water conditions in a coastal lagoon environment. In this lagoonal setting, autochthonous brine aquifers were formed by the entrapment of evaporated paleo-seawater during the depositional time of these geological formations. Since then, the trapped paleo-seawater has been evolved through waterrock and redox reactions. More recently, the entrapped paleo-seawater has been flushed out by fresh meteoric waters during the Late Pleistocene and Early Holocene periods.