Groundwater flow and chemistry of the oases of Al Wahat, NE – Libya

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Abstract

The quality and geochemistry of groundwater are significantly affected by the depositional environment of aquifer sediments. Miocene sediments in Al Wahat area (Jalu, Awjilah and Shakherah Oases) in the Libyan Desert at the north-east of the country have been deposited in fluvial marginal-marine and marine environments. The purposes of this paper are to describe the areal distribution of the dominant water quality constituents, to identify the major hydro-geochemical processes that affect the quality of water and to evaluate the relations of sediment-depositional environments and groundwater flow to the quality and geochemistry of water in aquifer sediments of Post-Eocene. The area involved in this study is within the boundaries 28°N-29°N and 21°E-22°E. Eighteen wells are selected in the area and 10 samples were analysed from wells used for domestic and agricultural purposes. Results show high and significant increase of total dissolved solids, especially Na^+, Cl^- , SO_4^{2-} and NO_3^{-2} compared to the previous years.

The chemical results for the groundwater samples in Al Wahat are classified according to the Stuyfzand groundwater classification system; the water type is mostly brackish and brackish-saline NaCl in the downstream direction and fresh-brackish $NaHCO_3$ upstream. These water types indicate that groundwater chemistry is changed by cation exchange reactions during flushing of the diluted saline aquifer by freshwater from the south. The different stages of cation exchange produce a chromatographic sequence of groundwater types, theses cation exchange reactions during the freshening process occurring mainly in the intercalated clay, resulting in a Na^+ increase, and peaks of K^+ and Mg^{2+} in the aquifer. In the north, the synsedimentary marine influence on the groundwater is stronger and the abstraction for irrigation is higher.

High rate of pumping, evapotranspiration and anthropogenic pollution may contribute significantly to the aquifer water quality. Calcite equilibrium and gypsum dissolution are also important hydrochemical process in the aquifer.