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Assessment of salinity and water-rock interaction in complex aquifers: the case of Aguadulce Unit (SE, Spain).

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The Aguadulce hydrogeological unit is part of Campo de Dalías aquifers, located between the southern slopes of Sierra de Gádor and the Mediterranean Sea (Almeria, SE Spain). This area is, at the moment, the more important economic district in Almeria thanks to intensive agriculture and, in smaller measure, tourism. The increasing number of greenhouses leads to a continuous rise of water extraction over time, which, together with the complex structure of the Aguadulce Unit, gives rise to problems of groundwater quantity and quality. In fact, several recent studies (e.g. Pulido-Bosch, 2005; Dominguez et al., 2000; Daniele et al., 2008) indicate that the aquifers of this unit are affected by seawater intrusion and contamination caused by agriculture.

Aguadulce unit is geometrically complex and not easy to delineate. It behaves as a multilayer aquifer when different formations stack one another: Triassic carbonates of Gador and Felix units, Miocene calcarenites and volcanic rocks, Pliocene calcarenites and marls and Quaternary sediments. Besides, some of these lithologies wedge abruptly and appear faulted and are not continuous over the whole unit. The carbonates of Gador and Felix are separated by phyllites in certain zones where they form two distinct carbonate aquifers, the deepest aquifer and the intermediate aquifers, respectively. Above them, and, in some cases with hydraulic connection, Miocene and Pliocene calcarenites are found, constituting a superficial aquifer (Vallejos et al, 2003). Under a natural regime these aquifers would be fed by Sierra of Gador. However, vertical movements of water fluxes have been observed in the overlapping areas depending on the hydraulic potential. Therefore, the hydrogeological study of Aguadulce unit allows for different hydrogeochemical processes to occur within each layer.

The aim of this study is to identify the hydrogeochemical processes that may occur along these karstic coastal aquifers, which include determining the sources of salinity and establishing the intrusion of seawater in the different layers. Several processes of water-rock interaction are evaluated using the software PHREEQC (Parkhurst and Appelo, 1999) in order to simulate water compositions under different scenarios of water-rock interaction and calculate their saturation indexes with respect to major minerals.

All water samples are supersaturated with respect to calcite and dolomite, nevertheless, the relationship between salinity and major ionic ratios discriminates the data from the different aquifers. Most water data from the deepest aquifer is less saline and has lower Mg/Ca ratios than that of intermediate and superficial aquifers.

Bibliography

Daniele, L., Pulido Bosch, A., Vallejos, A., Molina, L. 2008. Geostatistical analysis to identify hydrogeochemical processes in complex aquifers: a case study (Aguadulce unit, Almeria, SE Spain). Ambio 37(4): 249-253.

Domínguez P. (2000). Funcionamiento hidrogeológico y mecanismos de intrusión marina en sistemas carbonatados de estructura compleja: aplicación al AIN del Campo de Dalías. Tesis doctoral

Parkhurst D.L., Appelo C.A.J. 1999. User's guide to PHREEQC (version 2)-A computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations, U.S. Geological Survey Water-Resources Investigations Report 99-4259, 312 p.

Pulido Bosch A. (2005). Recarga en la Sierra de Gádor e hidrogeoquímica de los acuíferos del Campo de Dalías. Escobar Impresores s.l. (El Ejido) pp.337

Vallejos A., Pulido Bosch A., Molina L., Sánchez Martos F.y Gisbert J. (2003). Observaciones hidroquímicas en un área afectada por intrusión marina: Unidad de Aguadulce (Almería). Tecnología de la intrusión de agua de mar en acuíferos costeros: países mediterráneos. IGME, p. 357-363.