

## Groundwater high salinity in Geropotamos basin (Crete, Greece): Sea water intrusion or Miocene evaporites water interaction processes?

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The aim of the study is to determine the origin of the high salinity groundwater of Geropotamos carbonate aquifer, located in an important touristic and agricultural area, on the central-northern coast of Crete (Greece). The main aquifer is composed by fractured and karstic carbonate rocks of Tripolis and Ionian tectonic nappes. Suggestions that Miocene Evaporites led to groundwater salinization were implied from previous studies, but they were unconfirmed. Water samples from 22 wells and 2 springs were analysed. The water temperature ranges between 18.1 and 22.9°C and the pH values ranging from 6.7 to 8.07 (slightly basic water). Cl, Ca, Na, HCO<sub>3</sub> and SO<sub>4</sub> concentrations are generally higher than Mg and K. The hydrogeochemical results showed different levels of mixing between a shallow end-member with bicarbonate-alkaline composition due to the leaching of carbonates rocks, and deeper fluids rich in Na and Cl. The Cl and Na contents are well correlated ( $r^2=0.996$ ) with an average Na/Cl ratio of 0.3, which is lower than Tyrrhenian Sea ratio (Na/Cl=0.56) and the dissolution of halite (Na/Cl=1) as well. The different Na/Cl ratio can be explained either by a depletion of Na, due to anionic exchanges processes with Ca between water and clay minerals, occurring in study area, or because of high salinity of the Cretan Sea (high Cl values). From this study we inferred that the sea water intrusion is the main contamination source to the aquifer, probably caused by increased over-pumping.

## Experimental study of the factors that influence titanium dioxide nanoparticle adhesion to mineral surfaces

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The adhesion of titanium dioxide nanoparticles onto mineral surfaces was measured as a function of pH, ionic strength, nanoparticle concentration, and nanoparticle size. With the rapid expansion of the nanotechnology field, nanoparticles are being introduced into the environment before we have a clear understanding of the controls on their fate and mobility. Our objective was to determine the environmental factors that influence TiO<sub>2</sub> nanoparticle adhesion onto geosorbents.

Batch TiO<sub>2</sub> adhesion experiments were conducted, measuring the extent of adhesion onto fixed concentrations of Al<sub>2</sub>O<sub>3</sub>, silica, or kaolinite grains, using NaClO<sub>4</sub> to buffer ionic strength at set intervals between 0.001M and 0.1M. Adhesion isotherms were measured at fixed pH with values for each set of experiments ranging from 3 to 8, and with TiO<sub>2</sub> concentrations ranging from 10-200 mg/L. Experiments were conducted as a function of TiO<sub>2</sub> particle size, with average diameters of 16, 26, and 50 nm. After reaction with the mineral sorbents and separation of the mineral grains, unattached nanoparticle concentrations were determined using a UV/visible spectroscopy method with standards that were closely matched to the pH and ionic strength of the samples. Matrix matching of standards to samples is crucial for nanoparticle suspensions due to the sensitivity of nanoparticle aggregation behavior to pH and ionic strength.

The experiments exhibited typical isotherm behavior, with increasing nanoparticle adhesion onto each geosorbent studied with increasing nanoparticle concentration. Solution pH, ionic strength, and particle size each exerted significant influences on the extent of adhesion to each mineral, and the general adhesion behavior can be related to the surface charging behavior of the mineral in question. These results suggest that a combination of environmental conditions, as well as the individual characteristics of the nanoparticles, govern adhesion onto geosorbents and that each of these factors must be accounted for in order to construct accurate models of nanoparticle fate and transport in geologic systems.