

## Sediment-groundwater interaction in a coastal aquifer affected by salinization (Ravenna, Italy)

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In 2010 an extensive hydrogeochemical study was carried out on the shallow coastal aquifer surrounding the Ravenna area (Italy), an area affected by subsidence and saline intrusion that threatens above all the biodiversity in natural areas. Water samples of 229 monitoring points of which 22 surface water and 207 groundwater from 63 wells were analyzed for their chemical composition as well as for the stable oxygen and hydrogen isotope ratios. In addition on 17 surface water, 109 groundwater and extensive analytical investigation was conducted for 70 chemical elements at ACME Labs. The investigation was completed by the characterization of the geochemical composition of 110 sediment samples from 20 selected well. Sampling was aimed at the characterization of the aquifer and at the investigation of the geochemistry of reactive sediments (peat layers, organic rich sediment, clay intervals). Bulk geochemical composition, organic matter content and grain-size analyses were conducted on these samples. The role of these "reactive" layers could be important in controlling the composition of groundwater and affect also the fate of dissolved trace metals. The reactive layers are interbedded in the sandy aquifer and reflect local changes in the coastal depositional environment.

Most of the water samples investigated are of the brackish to saline NaCl groundwater while only few samples at the top of scattered piezometers are Ca rich, comparable to freshwater. The dominant trend in the area seem to be toward salinization that severely affect groundwater quality. The stable isotope analysis and the analysis of hydrogeochemical tracers show that most ground water samples are a mix between fresh water similar to rain or irrigation, river or fresh dune water and water that is similar to current Adriatic Sea water. Evidence of anaerobic decomposition are clear in some sites, reaching the sulfate-reduction stage, complete removal of SO<sub>4</sub> and occurrence of H<sub>2</sub>S, this happens where reactive layers are thicker or more frequent.

Iron and Mn reach high concentrations (4.8 and 2.2 mg L<sup>-1</sup>, respectively), the occurrence of high concentrations of As is confirmed (up to 130 µg L<sup>-1</sup>). Active layers act as sink for many elements (e.g. Ni, Cu, Zn) as testified by the combined inspection of dissolved and solid profiles.

Salinization is clearly the major environmental issue in the area concerning the quality of the shallow groundwater system, however also other reactions are occurring which involve strong interaction with reactive components of the aquifer and affect the mobility of trace metals.

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