

Arsenic anomalies in shallow groundwater and sediments (Venetian Plain, Italy)

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A pilot area within the Venetian Plain was selected to assess the arsenic contamination of groundwater and sediments. The area represents a typical residential, industrial and agricultural organization of most western countries, and is also devoid of hydrothermal, volcanic or anthropogenic source of arsenic. The unconfined aquifer reservoir varies from a predominantly gravel composition in the north to a sandy and silt-clay composition further south, including peat layers. The hydrochemical features of groundwater are rather homogeneous, featuring low mineral content and a Ca-bicarbonate signature. In contrast, the redox state is highly variable: oxidizing conditions are predominant in the northern and coarse parts of the aquifer, whereas reducing potentials prevail in the southern and silt-clay parts. Several well waters contain arsenic in excess of drinkable limits (10 ppb), and most of these wells are located in the southern area. A large portion of the studied area has a high probability of containing nonpotable water (up to 150 ppb As). Remarkably, arsenic “hot spots” (As >300 ppb, up to 431 ppb) were identified at the transition from gravel to silt-clay sediments. Some private wells are used for farm activities and domestic purpose, especially where the public pipe network is absent. The analyses of sediments point out that the expected covariance of As and Fe (observed in many young sedimentary aquifers) is absent, whereas a regular increase of arsenic content and organic matter is detectable throughout all lithologies (sand, silt, clay and peats). The highest concentration of arsenic in peats is about 300 ppm, whereas the average in organic-poor sediments is 11 ppm (n = 10, std.dev. = 8.4, organic matter < 1%). The organic sediments in the area are a candidate source of arsenic in groundwater and this feature represents a prospecting tool in search of safe water. Another effective help in this task is the downhole decrease of arsenic in groundwater [1]: below 200m the average arsenic content in the area is 8 ppb.

[1] BGS & DPHE (2001) British geologic survey report WC/00/19, vols 1–4, BGS, Keyworth

Tracing Lead sources and chronologies in sediments and coral cores in Kuwait

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The objective of this study was to reconstruct detailed input chronologies of Pb and other trace metals in the Kuwaiti marine environment, influenced by the Shatt-al-Arab River’s load (SaAR), using seawater, and sediment and coral cores. Pb concentrations were determined by plasma mass spectrometry using resin preconcentration and isotope dilution (ID) for seawater, a “Graney leach” extraction and ID on sediments, and cleaning, dissolution and ID on corals. Pb isotopic distributions in seawater, sediments and corals were determined using multicollector magnetic sector plasma mass spectrometry after anion exchange purification of Pb.

Seawater Pb concentrations are high in the northern stations, including Kuwait Bay (KB). They show combined anthropogenic and riverine sources, while waters at a coral reef near Qaruh Island (QI) show high Pb.

Comparing the Pb concentration and isotopic fractionation in two sediment cores near KB and near the SaAR outflow with a coral core near QI helped us discern trends, potential sources, and some events for the past ~60 years in the region. The coral core shows more pointed events and trends, which resemble more the data from the anthropogenic-influenced station near KB than that from the lower-Pb concentration SaAR station. The QI coral core and the KB sediment core data suggest a decreasing trend in the Pb concentrations after 1990, possibly linked to Pb phase out in the Kuwait area, which agrees with the increasing Pb206/Pb207 ratios. The change of lead isotopic signal in the coral lags the change of lead concentration signal by 3-4 years.

Pb data from two more cores and surface sediments upstream the SaAR are currently being analyzed, and will be added to the current interpretation, as well as data for other metals (Cd, Cu, Ag, U) from the sediment and coral cores.