



Occurrence of arsenic in sediment pore waters in the central Kanto Plain, Japan

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The Kanto Plain is known as the largest plain in Japan, where marine sediments are widely developed because of cyclic iteration of global sea-level changes even 50 km or more inland from the present shoreline. In this area, dependence on groundwater for water requirements is relatively high; in particular, around 40 % of the municipal water supply is dependent on groundwater. Arsenic levels greater than that permitted by the environmental standards of Japan have been detected in groundwater in this area. Therefore, to evaluate occurrences of arsenic and other related elements in pore waters contained in natural sediment layers, we measured the levels of various inorganic chemical substances such as arsenic (As), iron (Fe), and sulfur (S) and major dissolved ions such as sulfate (SO_4^{2-}), calcium (Ca^{2+}), and sodium (Na^+). Pore waters were collected from sediment samples that were obtained by a drilling from the river bottom down to 44 m depth; pore water samples were obtained immediately after extraction of sediments. The sedimentary facies in the vertical profile are continental, transitional, and marine, including two aquifers. The upper aquifer (15–20 m) contains fine to medium sand, whereas the lower aquifer (37–44 m) contains medium to coarse and gravelly sand. Arsenic and other inorganic elements were measured by an inductively coupled plasma mass spectrometer (ICP/MS) and an inductively coupled plasma atomic emission spectrometer (ICP/AES), and major dissolved ions were measured by an ion chromatograph analyzer. The total content of chemical elements was measured by X-ray fluorescence analysis using solid sediment samples. We obtained the following results. The arsenic concentrations in pore waters in marine silt and clay sediments (approximately 0.04 mg/L) were about five times higher than that in continental sediments (approximately 0.008 mg/L). The highest concentration of arsenic (0.074 mg/L) was detected at a depth of 13 m, which is immediately above the upper aquifer. Visual observations confirmed that this level is under oxidizing conditions. Thus, it regards that arsenic was adsorbed to iron hydroxide in the sediments. On the other hand, in the top part of the section, from the river bottom to a depth of approximately 3 m, arsenic concentrations in the pore waters were clearly high and decreased gradually and continuously with depth. This is considered to be the result of anthropogenic impact on the river.