Microbial and organic controls on the reductive dissolution of heavy metals from soil

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Most divalent trace metals are generally adsorbed on the Fe/Mn oxides and lesser present as discrete solid phases. Redox changes in soil either lead to dissolution or precipitation of the Fe/Mn oxides, which supply sites for metal adsorption and the dissolution of the oxides causes desorption of divalent metals, subsequently. Iron reducing bacteria such as *Shewanella* sp. (HN-41) utilize Fe(II) as an electron donor and therefore integrated control of such microbes along with soil organic matter and carbon sources are of great importance in understanding the geochemical control on the behaviour and speciation of trace metals in soil.

60-days column experiment, under semi-reducing condition, has been run using defined medium amended with various combination of humic acid and anthraquinone-2,6-di-sulphonate (ADQS). Based on the previous study, glucose was used as the most efficient carbon source for the experiment. Dissolution of iron and manganese increase with time and the trace metals increased simultaneously. However, some metal concentrations decreased or were relatively constant, implying some precipitation processes such as complexation with ligands or microbes.

Geochemical significance of $^{87}Sr/^{86}Sr$ ratio of high-temperature deep groundwater in a fractured granite aquifer at Dongrae area, Korea

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The Dongrae thermal water area located at the southeastern marginal part of the Korean Peninsula is one of the oldest hot springs in Korea, which has been used as a spa for more than 1,200 years. Here we report $^{87}Sr/^{86}Sr$ ratios from the deep thermal water, shallow groundwater, surface water and rain water in order to discus their geochemical significance in groundwater cycle in the Dongrae area. The bed rock of the thermal water-bearing aquifer is composed of Mesozoic granitoids. The Dongrae thermal water at the highest temperature of up to 71°C is of Na-Cl type with an electric conductivity of 876-2560 μS/cm, whereas the chemical composition of the shallow cold groundwater is Ca(-Na)-HCO_3 type. The $^{87}Sr/^{86}Sr$ rstios of the thermal waters are in the range 0.705651±11 – 0.705696±12, which are nearly unchanged during last 4 years (2004-2007). The $^{87}Sr/^{86}Sr$ rstios of the shallow cold groundwater, surface water and rainwater are 0.705781±26 to 0.705789±12, 0.706700±14 and 0.707375±11, respectively. The $^{87}Sr/^{86}Sr$ ratios of the thermal water in Dingrae area are lower than those of shallow groundwater, surface water and rainwater as well as aquifer bearing granite. Our results suggest that the circulation rate between thermal water and current meteoric water including groundwater, surface water and rainwater in the Dongrae area should be very slow. Therefore, our data suggest that the Dongrae thermal water might be derived from paleo-groundwater reservoir with high temperature rather than the thermal waters derived from circulation of current meteoric water. Our data also indicate that the $^{87}Sr/^{86}Sr$ ratio from the groundwater may become an important indicator for clarifying the time lag of groundwater cycle between deep groundwater and shallow groundwater in the fractured granite aquifer system.