

Geochemistry of arsenic and other trace elements in a volcanic aquifer system of Kumamoto Area, Japan

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Total arsenic (As), As(III) species, dissolved organic carbon (DOC), methane (CH₄), sulfur isotope ratios of sulfate ($\delta^{34}\text{S}_{\text{SO}_4}$), major ions and trace elements were measured in groundwater collected from boreholes and wells along the flow lines of western margins of Kumamoto basin, at central part of Kyushu island in southern Japan.

In this study, we used trace elements data and $\delta^{34}\text{S}_{\text{SO}_4}$ values for better understanding the processes that are likely controlling mobilization of As in this area. 40% samples from the Kumamoto plain area exceed the maximum permissible limit of Japan drinking water quality standard (10 µg/L). High As concentrations occurred in anaerobic stagnant groundwaters from this plain area with high dissolved Fe, Mn, moderately dissolved HCO₃, PO₄, DOC and with very low concentrations of NO₃ and SO₄ suggesting the reducing condition of subsurface aquifer. Moderately positive correlation between As and dissolved Fe, Mn and strong negative correlation between As(III)/As(V) ratio and V, Cr and U reflect the dependence of As concentration on the reductive process. The wide range of $\delta^{34}\text{S}_{\text{SO}_4}$ values (6.8 to 36.1‰) indicate that sulphur is undergoing redox cycling. Highly enriched values suggesting the process was probably mediated by microbial activity. However; it is less clear about co-precipitation or sequester of As with Fe and sulfide ion. It is evident that As distribution in subsurface geological media is not controlled by single solid phase. Probably, dissolution-desorption from different phases contributes to the total As in groundwater. The data are consistent with the possibility that microbial mediated reactions and reductive dissolution of Fe-oxyhydroxides are the important processes to mobilize arsenic in this area.