Arsenic behavior in accretionary complex of Shikoku, Japan

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Arsenic is primarily derived from deep thermal fluids associated with igneous activity, then moved into the surface environment directly as hydrothermal fluids or indirectly via arsenic-bearing minerals, which followed by erosion, transportation and deposit through hydrosphere finally to marine sediment. Biological process also contributes to arsenic concentration in the sediment via deposition of arsenic-bearing organic matter (OM). The arsenic in the marine sediments return to the earth’s interior together with subducting oceanic plate. However, behavior of arsenic during the accretion, diagenesis and metamorphism occurring in the subducting sedimentary rocks is not well understood. In order to examine the distribution and behavior of arsenic in the subducting sediments, total of forty three rock samples of mildly metamorphosed Shimanto belt (Kure Bay to Susaki Bay) and high-pressure metamorphosed Sanbagawa belt (Asemi River and Oboke Valley) were studied. Arsenic concentrations of whole rock (total arsenic) and OM fraction were determined by ICP-MS analysis after alkali fusion of whole-rock samples and wet-digestion of separated kerogen, respectively.
Total arsenic concentration of the sedimentary rocks varies within 3 and 23 ppm. Generally, arsenic concentration was higher in the rocks of Sanbagawa belt than those of the Shimanto belt. Dark-colored mudstones and a coal-bearing sample were characterized with high arsenic content. These results are consistent with the known pattern of arsenic concentrations, which are concentrated in organic rich sediments and reinforce the importance of biogenic input of arsenic via organic matter deposition in marine sediments. The OM-associated arsenic to total arsenic was generally less than 10%, and much lower in the Sanbagawa belt samples than in the Shimanto belt samples. Thus, the arsenic mineralization likely progress in parallel with enhanced metamorphism up to the level of Sanbagawa samples, where the majority of OM-associated arsenic seem to have been released via decomposition.
Higher total arsenic concentration of the Sanbagawa samples would be attributed to either the primary arsenic concentration of the sediments or replacement of arsenic during diagenetic and metamorphic processes. The samples bearing quartz vein, which were frequently observed in Sanbgawa belt sedimentary rocks, were characterized by elevated arsenic concentrations.
The observation of this study suggests the arsenic redistributes in the accretionary complex associating with formation and migration of deep fluids through dehydration of hydrous minerals and also OM. The dehydrated water may supply deep fluid which flows through fracture and ultimately fueling mud volcano and potentially sourcing the arsenic accumulated in such settings.

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