Enriched Sr-Nd isotopic signatures of the amphibolites in the Oki-Dogo Island, Japan: Evidence for crust-mantle interaction by deeply subducted continental crust

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The Oki metamorphic rocks in the Oki-Dogo Island, western Japan, comprise mainly of high grade paragneisses and amphibolites. Petrological works have shown that the metamorphic rocks affected regional metamorphism of amphibolite facies, with granulite facies in part (Hoshino, 1979). Suzuki and Adachi (1994) has carried out CHIME age determination of monazite and zircon grains within the paragneisses and proposed a model that the protolith ages of the metamorphic rocks are Carboniferous-Permian and later experienced a metamor-phic event at 250 Ma. In this study we present geochemical and Sr-Nd isotopic characteristics for the amphibolites of igneous origin and focus our attention on their highly enriched isotopic signatures. The amphibolites analyzed show tholeiitic to alkaline chemical affinity, and are classified into two groups (Group I and Group II). Group I amphibolites are characterized by high TiO_2, Zr/Y, Nb/Y and Ti/Y, and fall in the category of within-plate basalt (WPB). Group II amphibolites, on the contrary, indicate low TiO_2 and low Zr/Y, Nb/Y and Ti/Y values. They are classified into volcanic arc basalt (VAB) or mid-oceanic ridge basalt (MORB). Assuming a protolith age of 300 Ma, initial $^{87}Sr/^{86}Sr$ for both amphibolites represent extremely high values (0.7153-0.7315). εNd values of Group I amphibolites are very low (-8.9 to –17.0), and those for Group II amphibolites are grouped into two:-13 for layered amphibolite and +0.2 to +1.1 for boulder-like amphibol-ites in psammitic gneisses. The paragneiss samples have more higher $^{87}Sr/^{86}Sr$ and lower εNd values than those of the amphibolites. Two component mixing calculation between primitive basaltic magma and upper crust requires more than 50 % of crustal component. This denies crustal contamination for the genesis of the amphibolite protoliths. The enriched Sr-Nd isotopic signatures of Group I and some Group II amphibolites are well explained by a contamination of subducted ancient continental crust within a mantle source. In this process the amount of crustal component is estimated to be 5 %.

Role of aluminum for precipitation of silica on the surface of microbe: The system of resins/aluminum/silicic acid

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Introduction

Microbes are considered to be one of the organic ligands in natural water, and have functional groups at the surface which act as binding sites of metal ions. Thus, aluminum is adsorbed and concentrated on the functional groups on the surface of microbes. It is well known that silicic acid has a high affinity for aluminum. As a result, silica concentration may be caused by aluinum combined on the surface of microbes.

It is reasonable to assume that cation exchange resin (Bio-Rex 70) with carboxylate groups and chelate resin (Chelex 100) with iminodiacetic acid groups are suitable model compounds of the microbe surface. In this study, the adsorption of aluminum ions on the resins and the adsorption of silicic acid on the aluminums combined on the resins were investigated.

Results and Discussion

The adsorption behaviors of aluminum ions were similar between the both resins. According to ^{27}Al MAS NMR spectra of aluminums combined on the both resins, all aluminums on the Bio-Rex 70 were present as monodentate species, while a part of aluminums on the Chelex 100 were present as tridentate species in addition with that of monodentate species. No adsorption of silicic acid occerred on aluminums combined on the Bio-Rex 70. While, silicic acids were adsorbed on the aluminums combined on the Chelex 100. During this adsorption of silicic acid, the proportion of monodentate aluminum decreased but the proportion of tridentate aluminum increased complimentarily. The monodentate aluminums were considered to react with silicic acid and were stabilized as aqueous silicato complexes of aluminum. It is suggested that monodentate ligand such as acetate is not important to strongly fix aluminum ions on the surface of microbes, and can not play an essential role for the precipitation of silica on the microbe. On the other hand, aluminum ions combined to iminodiacetate groups as tridentate species precipitated silicic acid from aqueous solution efficiently. In conclusion the chelate effect is considered to be essential to fix aluminum ions on the microbes and to precipitate silicic acid.