Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SRD051-02 Room: Function Room A Time: May 23 15:45-16:00

Geochemical characteristics of ion-adsorption type REE mineralization

Kenzo Sanematsu[1*], Hiroyasu Murakami[1], Yasushi Watanabe[1]

[1]GSJ, AIST

Ion-adsorption type REE (rare earth elements) deposits, which are identified only in southern China, are important sources of supply for heavy REE resources. Mined REE ore is clay-rich weathered crust of granite in these deposits. As REE are chemically adsorbed on ion-adsorption materials, they are recovered by using mildly acidic electrolyte solution. Therefore, in addition to REE content of weathered granite, adsorption ratio of REE (adsorbed REE concentration / whole-rock REE content) is required to be measured in order to assess the ion-adsorption type mineralization. In this study, we discuss geochemical characteristics of weathered granite in order to estimate the adsorption ratio by whole-rock chemical composition.

Sequential leaching of REE was conducted on twenty weathered granite samples with relatively high REE contents (419 - 3664 ppm) which were collected in southern China and Laos. REE-bearing phases are divided into four phases: ion-adsorption phase, Fe-Mn hydroxy-oxides, organic matter and residual materials. REE are present mainly in ion-adsorption and residual phases. The adsorption ratios of REE range from 0.14 to 0.73. Ion-adsorption phase exhibits a chondrite-normalized REE pattern with negative Ce anomaly because $Ce^{3+}$is oxidized to insoluble Ce^{4+}under oxidizing condition near the surface and other soluble REE transported to the lower part of weathered crust are fixed by adsorption materials. In contrast, Fe-Mn hydroxy-oxides tend to have positive Ce anomaly and organic matter show both positive and negative Ce anomalies. As REE concentration of ion-adsorption phase is higher than those of Fe-Mn hydroxyl-oxides and organic matter, whole-rock REE pattern strongly reflects the pattern of ion-adsorption phase. Consequently, samples with high adsorption ratio of REE tend to show negative to weakly positive Ce anomaly in whole-rock chemical composition of weathered granite. However, the adsorption ratio is not easily estimated from insufficiently weathered granite or hydrothermally altered granite.

In order to quantify the degree of weathering and alteration, CIA (chemical index of alteration) by Nesbitt and Young (1982) is applied to this study. According to a equation of CIA=[Al_2O_3/(Al_2O_3+CaO+Na_2O+K_2O)]*100(%), a CIA value of fresh granite is approximately 50 % and it increases up to 100 % with an increase in alteration minerals. Samples of low CIA values generally show low adsorption ratios of REE because REE minerals are not sufficiently decomposed as well as silicate minerals. In contrast, samples with high CIA values show high adsorption ratios of REE because some REE minerals are decomposed and soluble REE can be adsorbed. However, samples with extremely high CIA values have lower adsorption ratios of REE. This is attributed to the dissolution of REE by more intense weathering or hydrothermal alteration.

These results suggest that adsorption ratio of REE tends to be high in weathered granite showing negative to weakly positive Ce anomaly and moderate degree of weathering based on CIA value. These geochemical characteristics can be applied to an exploration of ion-adsorption type REE deposits.

Keywords: rare earth elements (REE), granite, weathering, adsorption, deposit, exploration