A study of minerals adsorbing rare earth elements in ion adsorption type ore

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Ion adsorption type ores existing mainly in southern part of China are important as a supply source of rare earth elements (REE) which are essential for cutting edge industries. However, it is unclear what kind of minerals adsorb REE in the ores because the concentrations of REE are relatively low (<2000ppm), and direct observations or analyses for monophase minerals have been rarely conducted. In the present study, we have attempted to clarify the minerals adsorbing REE and their adsorption state using various experimental apparatus. Weathered granite soil sample collected from an ion adsorption ore in Dingnan County, Jiangxi Province, China was prepared for the study.

XRD results indicated that the ore is mainly composed of quartz, k-feldspar and kaolinite. Besides, SEM-EDS analyses showed that the ore also contains micaceous mineral, Fe-oxide and ilmenite. Results of the analyses suggested that kaolinite basically exists as mixtures with other minerals in the ore. LA-ICP-MS measurements indicated that the “kaolinitic particle”, micaceous mineral and the Fe-oxide are relatively abundant with REE while quartz, k-feldspar and ilmenite are poor in REE. Thus, it can be suspected that the kaolinitic particles are major source of REE in the ore. We also found that micaceous mineral has stronger negative Ce anormaly than the other minerals. Elemental mapping for a kaolinitic particle by LA-ICP-MS showed that distribution of Ce is substantially different from that of the other REE in the particle. Further, elemental mapping with higher spatial resolution by FE-EPMA suggested that REE are heterogeneously distributed in the kaolinitic particle and the distributions are not exactly consistent even among REE other than Ce. In TEM and STEM-EDS analysis of the kaolinitic particle, k-feldspar, muscovite and hematite were found in addition to kaolinite. In the further study, the adsorption relationship between each mineral phase and REE needs to be investigated.

Keywords: Ion adsorption type rare earth ore, FE-EPMA, FIB-TEM, LA-ICP-MS

