

REE minerals from Higashimatsuura basalt, Kyushu, Japan

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1. Introduction

The Higashimatsuura basalt, distributed throughout the Higashimatsuura peninsula, consists of five lithological units based on the period of activity, and the most recent stage has yielded three new minerals; kimuraite (Nagashima et al., 1986), kozoite-(Nd) (Miyawaki et al., 2000) and kozoite-(La) (Miyawaki et al., 2003). The Higashimatsuura basalt is the only basalt reported to include these rare earth minerals, and the regional distribution and detailed mineralogy of these minerals except type localities of new minerals have yet to be investigated.

2. Experimental

Samples were collected from 36 localities, and analyzed with respect to chemical compositions and crystallography by X-ray diffractometer, SEM-EDS, TEM-EDS (Kyushu University HVEM Lab.), EPMA and CHN analyzer in order to clarify the regional distribution and mineralogy of rare earth minerals.

3. Results

3-1. Regional distribution

REE minerals were found from 13 localities include type localities of new minerals. In previous studies, REE minerals were found from only the 5th stage basalt. This is the first time that REE mineral found from the 1st stage basalt and the 2nd stage basalt. Eleven species of REE minerals are found (tengerite, lokkaite, kimuraite, lanthanite-(La), -(Nd), kozoite-(La), -(Nd), calcio-ancylite-(Nd), and rhabdophane-(La), -(Ce), -(Nd)) and three candidates of new REE mineral ("hizenite", "calcio-ancylite-(La)" and "rhabdophane-(Y)").

3-2. Tengerite family

Kimuraite often occurs independently and its aggregate have some morphology (spherical, radial, small spherical, covering and lepidic aggregate). Tengerite and lokkaite usually form radial or hemispherical aggregate and those associate very closely each other. The REE/Ca ratio of kimuraite varies 1.46 to 2.33 and that of tengerite and lokkaite also vary from ideal formula. It is estimated that these varieties of the REE/Ca ratio are caused by stacking fault of the layer structure and by substitution of $\text{Ca}^{2+} + \text{H}_2\text{O}$ for $\text{Y}^{3+} + \text{OH}$. The candidate of the new mineral "hizenite" ($\text{Ca}_2\text{Y}_6(\text{CO}_{311})?14\text{H}_2\text{O}$) is found from Mitsukoshi where the type locality of kozoite-(La). It is orthorhombic, $a = 0.6295(1)$ nm, $b = 0.9089(2)$ nm, $c = 6.349(1)$ nm. It is estimated from chemical composition and lattice parameters that hizenite has alternated layer structure consists of kimuraite (2.4 nm) and lokkaite (3.94 nm) on one to one relation along c axis.

3-3. lanthanite group

Lanthanite occurs as a pink platy crystal and sometimes pinkish-white earthy crystals surround the surface of the platy crystal. Pinkish-white earthy crystals are La-rich than inner platy crystal part, and lanthanite which occurs in aggregate of kimuraite and tengerite have higher content of La than other lanthanite. A partially altered texture which is estimated to halfway of alteration to kozoite was observed in some crystals.

3-4. Ancylite group

Aggregates of kozoite-(Nd) are partially Ca-rich. Ca substitute with REE and the most Ca-rich part is into the calcio-ancylite-(Nd) composition. Chemical compositions of spherical crystals of

kozoite-(La) center to boundary of calcio-ancylite-(Nd), calcio-ancylite-(La), kozoite-(Nd) and kozoite-(La). It is estimated that these difference chemical features between these two kozoites reflects difference of crystallization process. This is the first time that the ancylite group mineral which have the composition of calcio-ancylite-(La) in the nature.

3-5. rhabdophane group

The rhabdophane group minerals ("rhabdophane-(Y)", -(La), -(Ce) and ?(Nd)) were found in 9 localities. 4 localities are in the 5th stage basalt, 4 localities are in the 2nd stage and one locality is in the 1st stage. It occurs very widely compare to REE carbonates. This is the first time that rhabdophane group mineral which predominant REE is Y in the nature.

Keywords: REE, Higashimatsuura, basalt, kimuraite, kozoite, rhabdophane