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西南日本内帯・瀬戸内の後期白亜紀花崗岩体のペグマタイトに含まれる放射性鉱物の記載岩石学的研究
Petrologic study of radioactive minerals in pegmatites in Cretaceous granitoids from Setouchi, Inner Zone of SW Japan

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In this study, radioactive minerals from three localities of pegmatite deposits in the Setouchi province, which belongs to the Inner Zone of SW Japan, were described by combining EPMA and LA-ICP-MS analytical data. This was done in order to discuss the distribution of trace elements and REEs between minerals. Late Cretaceous granitoids of the Inner Zone occur in east-west zone with lateral extension of ca. 800 km on the west side of the Itoigawa-Shizuoka Fault [1]. Previous K-Ar dating and Rb-Sr dating for granitoids of the Sanyo Belt from the southern part of Hiroshima Prefecture yielded the ages of ca. 78-89 Ma [2, 3].

Two groups of granitoids of the Sanyo Belt were collected from pegmatite deposits in the Mihara Mine area (Hiroshima Prefecture) and in the Omishima Mine area of the eastern Geiyo islands (Ehime Prefecture), respectively. The other one from the eastern part of Takanawa Peninsula (Ehime Prefecture) was also examined in this study. Micro-textures on thin sections were observed by using EPMA (JXA-8800), and CHIME dating for monazites on the textures was performed by using the other EPMA (JCXA-733). Zircon grains, which were extracted from the rocks, were analyzed for the preliminary examinations for investigating U-Pb ages and chemical characteristics by using ICP-MS with femt-second laser. The 91500 Zircon Standard was used for this LA-ICP-MS study.

Several radioactive minerals such as monazite (the ideal formula $CePO_4$, with LREEs, Y and Th etc.), zircon ($ZrSiO_4$), allanite [$(Ca,R)_2(Al,Fe,Ti)_3Si_3O_{12}(OH)$; R = Ce, Mn, La, Y and Th], apatite [$Ca_5(PO_4)_3(F,Cl,OH)$], xenotime (YPO_4) and thorite ($ThSiO_4$) were found commonly in some of the examined rocks from Mihara, Omishima and Takanawa. Titanite ($CaTiSiO_5$) was observed in others. On the basis of description in the present study, we confirmed that the amount of monazite is decreased remarkably with increase of allanite or titanite probably due to supply of Th and LREEs to these minerals.

The following micro-textures were described in the present EPMA study: the reaction of ”monazite => zircon + thorite + allanite + apatite” (Mihara); (2) the assemblage of thorite + xenotime and the outer rim of anhedral to subhedral zircon (Takanawa); (3) euhedral zircon with negative crystal growth due to coexistence with thorite (Mihara). All of these textures imply the influence by hydrothermal metasomatism in the latest stage of plutonic magma process. The LA-ICP-MS study demonstrated the chemical characteristic that Th/U ratio of zircons from Mihara was decreased toward rim (i.e. core: 0.8-0.4; rim: 0.5-0.2 or less) due to breakdown of monazite in later stage. Together with this, Th, P and LREEs were supplied to thorite, allanite and apatite. This result suggests that the Th-U distribution in zircon is caused by element partitioning between phases but not the difference between metamorphic or igneous processes. On the basis of CHIME dating, we confirmed that the primary monazite in a pegmatite from Mihara formed at the late Cretaceous age of 81.7 +/- 6.4 Ma (error: 2 sigma). To discuss precisely the process of crystallization differentiation of this plutonic magma, additional zircon dating might be required.

References: [1] Ishihara and Murakami (2006) Bull. Geol. Surv. Japan, 57, 89-103 (with English abstract); [2] Higashimoto et al. (1985) Geology of the Kure Distinct, Geol. Surv. Japan (with English abstract); [3] Nakajima et al. (1990) Contrib. Mineral. Petrol., 104, 381-389.

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