Alkaline magmatism in a fore-arc region: igneous activity in relation to the Ashizuri igneous complex, SW Japan

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A-type granitic rocks are basically developed in anorogenic tectonic setting and relatively alkaline composition (e.g. Cremens et al., 1986; Bonin, 2007 and references therein). These rocks are volumetrically insignificance compared with the vast amounts of I- and S-type rocks exposed in various parts of the world, but their genesis plays one of important roles in understanding of evolution of granitic rocks through Earth’ s history because the granite rocks exist in only the Earth within the Solar system that may represent the specificity of the Earth.

Ring igneous complex exposed in Shikoku is called Ashizuri igneous complex (Murakami et al., 1983; 1989), and is composed mainly of felsic lithology with subordinate amount of alkaline gabbro and dolerite (Murakami et al., 1983; 1989; Stein et al., 1996). The felsic rocks are classified into the A-type granite. They are a close genetic relation with the opening of Japan Sea and the commencement of subduction of the young and hot Shikoku Basin of the Philippine Sea plate during the Neogene period (e.g. Kimura et al., 2005; Shinjoe et al., 2010; 2019). Thus, identifying the formation process of Ashizuri igneous complex leads to a greater understanding of the alkaline magmatism in arc-trench systems. A lot of studies for the genesis of the Ashizuri igneous rocks have been reported so far, however, there are no unified views on this issue (e.g. Kimura et al., 2005; Shinjoe et al., 2010; Yoshikura, 2012).

Igneous zircon is one of powerful tools to elucidate the origin of the parental magmas because the trace elements of zircons could vary depending on the parent melt compositions controlled by some physicochemical processes such as crystallization, differentiation and dehydration (e.g. Grimes et al., 2007; 2015; Yang et al., 2012). Moreover, U–Pb dating of igneous zircons can be used to constrain the timings of igneous activity. In this study, we report new U–Pb and geochemical data of the zircons separated from three granitic and two gabbroic rocks in the Ashizuri igneous complex by the using laser ablation ICP mass spectrometry. Moreover, zircon data from sandstone sample in the Paleogene Shimizu Formation intruded by the Ashizuri igneous complex is also reported. Finally, we would like to discuss the origin of the alkaline magmatism in fore-arc regions as illustrated by a case study of the Ashizuri igneous complex, based on our new data integrated with previous geological and geochemical data reported by other researchers.

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