Trace element composition in zircons from A-type granitoids in the Cape Ashizuri, SW Japan: Implications for new source rock index using zircon

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Trace element composition in zircon is expected to be an important indicator of composition of host magma, especially of Hadean detrital zircons (e.g. Grimes et al., 2007). Some Hadean detrital zircons are suggested to be formed in continental crustal magma (e.g. Valley et al., 2005; Grimes et al., 2007), however, detail composition of host magma is still unveiled. Recent discoveries of granitic clast in meteorites in Early Solar System (lunar, HED and LL meteorite) showing anhydrous, alkali-rich A-type granitic affinities (e.g. Warren et al., 1983; Bonin et al., 2002; Terada and Bischoff, 2009) implies that A-type granitic rocks were present in the Hadean Earth (Bonin et al., 2007). Therefore, it is important to know trace element characteristics in zircons from A-type granite for exploring evidence of the ancient A-type granitic rocks.
To obtain primary features of trace element composition in zircons from A-type granite, we conducted *in-situ* LA-ICP-MS trace element analysis for 47 zircon grains from 4 samples of rapakivi granite, Qtz-syenite and melanocratic syenite in the Ashizuri complex. These alkalic granitoids in Ashizuri complex have characteristics of A-type granite (Loiselle and Wones, 1979) and within-plate granite (Pearce et al., 1984), and is suggested to be formed dominantly by crystal fractionation process from OIB-type basaltic magma (Stein et al., 1996).
Zircons from the Ashizuri A-type granitoids show oscillatory zoning, homogeneous dark core, disturbed texture and patchy texture in Cathodoluminessence images. Based on the typical igneous REE patterns (HREE enrichment, negative Eu anomaly and positive Ce anomaly) and its similarity each other in zircons from rapakivi granite and Qtz-syenite, it is suggested that the trace element composition of the zircons reflect those of the host magma. On the other hand, some zircons in melanocratic syenite show large variations of REE pattern and include obvious inherited cores, which imply contamination of surrounding rocks to host magma. To clarify characteristics of zircons crystallized from A-type granitic magma, we only use data from the rapakivi granite and the Qtz-syenite for comparison with previous data from other type (S-, I-, M-type) granitic rocks.
The magmatic zircons from the Ashizuri A-type granitoids show large Eu negative anomalies (Eu/Eu* = <0.004 –0.070), high Nb contents (2.85 –236 ppm), relatively high Y (423 –13520 ppm) and U contents (171 –7908 ppm), and relatively low Sr contents (0.08 –2.38 ppm). These trace element feature in the zircons probably reflect high HFSE, low Eu and Sr concentration in the host A-type granitic magma. The geochemical characteristics of the zircons from Ashizuri complex become more distinct in Eu/Eu*, Nb/Sr, U/Sr, Y/Sr closs-plot diagram, showing lower Eu/Eu*, higher Nb/Sr, U/Sr and Y/Sr ratio compared to those in zircons from other type granitic rocks. Previous trace element data in zircons from A-type granitoids in Delamerian Orogen, South Australia (Pankhurst et al. 2013) is also plotted on similar area to the Ashizuri A-type granitoids in Eu/Eu*vs. Nb diagram. Because high HFSE, low Eu and Sr contents are common feature in the A-type granitic rocks, these diagrams are probably useful for distinguish zircons crystallized in A-type granite from those in other granitic rocks.

Keywords: Zircon trace element composition, A-type granite, LA-ICP-MS, the Cape Ashizuri, SW Japan

