Influence of surface condition on data quality of U–Pb zircon dating

M. TAKEHARA[1]*, K. HORIE[2], T. HOKADA[2], H. KAIDEN[2] AND S. KIYOKAWA[1]

[1]Kyushu University, 6-10-1, Hakozaki, Higashi-ku, Fukuoka 812-8581, Japan (*correspondence: 3SC12025R@s.kyushu-u.ac.jp, kiyokawa@geo.kyushu-u.ac.jp)

[2]National Institute of Polar Research, 10-3, Midoricho, Tachikawa, Tokyo 190-8518, Japan (horie.kenji@nipr.ac.jp, hokada@nipr.ac.jp, kaiden@nipr.ac.jp)

U–Pb zircon dating using microbeam such as SIMS and LA-ICP-MS has played a pivotal role in geochronology. Many analysts empirically believe that accuracy and precision of microbeam analysis strongly depend on surface condition of analytical spots. Especially, existence of cracks within the analytical spots decreases quality of results, but there is no quantitative evidence that the crack decreases the data quality. In this study, we quantitatively discuss influence on the data quality from the surface condition of the analytical spots. AS3 and FC1 zircons collected from gabbroic anorthosites of the Duluth Complex, Minnesota, USA, were used in this study. Previous work reported that some grains in AS3 zircons yield discordant data due to Pb loss caused by thermal diffusion [1].

Observation of thin sections by optical microscope and electron microprobe reveals chloritization of amphibole in AS3, which suggests hydrothermal alteration. U–Pb analyses of some AS3 zircon grains yielded discordant data. The analytical spots that yield discordant data can be classified into (1) altered domains characterized by high contents of LREE and non-formula elements, such as Ca, Al, and Fe, and (2) domains containing undersurface cracks. In the case that analytical depth is close to the undersurface cracks, the second domains also show high LREE contents. When the cracks in zircon worked as channels of hydrothermal fluid [2], there are possibilities that some residuals of the fluid exist in the cracks and/or that areas around the cracks was altered by the fluid. Therefore, selection of the analytical spots for U–Pb zircon dating should be based on observation of cracks not only on the surface but also under the surface. When AS3 and FC1 zircon are used as U-Pb standard material, it is important to carefully choose analytical spots on the basis of the backscattered electron and optical microscope images for achieving more precise analysis.

[1] Schmitz *et al*. (2003) *Geochim Cosmochim Acta* **67**, 3665-3672. [2] Carson *et al*. (2002) *EPSL* **199**, 287-310.

Lower crustal metasomatism of the NE-Japan arc inferred from crustal xenoliths from Ichinomegata crater

MIYUKI TAKEUCHI[1]* AND SHOJI ARAI[1]

[1] Dept. Earth Sci., Kanazawa Univ., Kanazawa 920-1192, Japan (*correspondence: takeuchi-miyuki@stu.kanazawa-u.ac.jp)

Ichinomegta crater, Megata volcano, the NE-Japan arc is a famous locality of ultramafic-mafic xenoliths, and there have been a lot of studies about mantle metasomatism (= metasomatism on mantle-derived ultramafic xenoliths) (e.g., Abe *et al*., 1992, Abe *et al*., 1999). However, there have been little documents on metasomatism in crust-derived xenoliths.

Coarse-grained mafic xenoliths from the Ichinomegata crater contain a large amount of pargasite. Some of the pargasite grains are obviously of secondary origin, replacing primary clinopyroxene in hornblende-pyroxene gabbros and pyroxene gabbros. And clinopyroxenes in pyroxene-spinel symplectites, which are a reaction product of olivine and plagioclase, are also replaced with pargasite.

Plagioclase shows a wide raige of Ca content (An87-98 in hornblende-pyroxene gabbros, An64-90 in pyroxene gabbros), and are poor in Na around the rim. Pargasites are depleted in TiO_2, but discrete pargasite grains show higher TiO_2 contents (1.0-2.4 wt.%) than secondary grains (0.8-1.7 wt.%). Spinels have been enriched with Ti and Fe (especially Fe^{3+}), and separated into two phases, Ti, Fe^{3+}-rich magnetite and Al-rich spinel by cooling. Ti has been also added to the mineals in pyroxene-spinel symplectites.

The metasomatic formation of hydrous minerals was accompanied with addition of, at least, Ti, Na and K. Clinopyroxenes contain very low amounts of Rb, Ba, Nb (below detection limits of our LA-ICP-MS). The secondary pargasite is enriched in these elemants, but not in HFS elements relative to clinopyroxenes. The hydration is characterized by enrichment of LIL elements but not of HFS elements. This was caused by infiltration of fluids related to hydrous arc magmas.

Hydration and cooling processes observed in the lower crustal gabbros are also recorded in peridotite and websterite xenoliths of upper mantle origin from the Northeast Japan arc. This means widespread modification of mineral chemistry and mineral assemblage from the upper mantle to the lower crust beneath the arc.

DOI:10.1180/minmag.2013.077.5.20