Geochemical and petrological interactions between felsic rocks and the host gabbros in the Oceanic Plate: An example from IODP Hole U1473A

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IODP-Hole U1473A was drilled on the summit of Atlantis Bank, Southwest Indian Ridge during Expedition 360 brought back for us a chance to get more information about the lower crust at the ultra-slow spreading ridges. Felsic veins rich in plagioclase, are common, though locally concentrated in the core. The veins occur as planar or branched networks with a variety of sizes in the gabbroic rocks. They are generally interpreted as formed from evolved melts in the late stage of crystallization of the gabbros. It has been recently accepted that reaction between the gabbroic mineral assemblage in the earlier stage of crystallization and migrating melts is an important process in melt evolution beneath mid-ocean ridge (Lissenberg et al., 2008, 2013). In order to expand our knowledge of nature of the lower crustal section of slow-spread ocean crust, we will present modes of interactions between felsic veins and the host gabbros. Based on X-ray mapping combined with EPMA analyses, we classified the felsic veins into three types following the nomenclature of Le Maitre et al. (2002): Granodiorite, quartz diorite and quartz monzodiorite. The veins contain mainly plagioclase with lesser amounts of amphibole, quartz; Fe-Ti oxides. Accessory minerals consist of apatite and zircon, ±biotite. Secondary minerals such as actinolite-tremolite, chlorite, are commonly present.

Plagioclase is the most abundant mineral in the veins, and has a large size range. Most crystals are subhedral or euhedral with normal zoning. Most grains have cores of oligoclase-andesine and rims of albite-oligoclase with the composition ranging from An_4 - An_{38}. Myrmekitic texture of albite and quartz occurs in some felsic veins. Amphibole is the second most abundant mineral in the felsic veins with 2 main categories: pale-green amphiboles and brownish-dark brown amphiboles. On the IMA classification scheme (Hawthorne et al, 2012; Locock, 2013), the amphiboles range from tremolite, to magnesio-hornblende and pargasite. Some quartz occurs interstitially between plagioclase crystals indicating that some might have crystallized from fluids rather than silicate melt. Zircon and apatite are present in all our 5 vein samples with different levels of concentration.

We find that the Hole U1473A felsic veins share a lot of similarities to those described by Robinson et al (2002) in ODP Hole 735B. We propose that the occurrences of these intrusions play a key role in the alteration processes of the host minerals and they could have some different origins as follows. The veins morphology and the myrmekitic textures as well as the abundance of zircon, apatite in all the felsic vein samples clearly demonstrates that they formed from the late magmatic melts. On the other hand, the continuous texture gradation between a felsic vein and the host olivine gabbro in one sample suggested a pseudomorphic replacement process in the lower crust.

Keywords: Atlantis Bank, gabbros, felsic veins, melts, fluids, replacements

