[EE] Evening Poster | S (Solid Earth Sciences) | S-MP Mineralogy & Petrology

[S-MP34]Oceanic and Continental Subduction Processes

convener:REHMAN Ur Hafiz(Department of Earth and Environmental Sciences, Graduate School of Science and Engineering, Kagoshima University), Tatsuki Tsujimori(Tohoku University), Chin Ho Tsai
Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
This international session aims at bringing earth scientists from Japan and overseas to present their research related to the processes of oceanic and continent subduction, continent-continent collisions, metamorphism of crustal rocks, formation of the oceanic/continental arcs, and accretion/ tectonic erosion of material along subduction boundaries.

Topics such as role of the fore- and back-arcs in the subduction zones, process of accretion of volcaniclastic and terrigenous sediments along the subduction/collision boundaries, deformation and metamorphism of subducted crust, recycling of material via tectonic erosion and exhumation will be the main focus of the session. Exchange of ideas among geoscientists applying different approaches on problems related to the theme of the session are most welcome.

[SMP34-P08]The formation process of ultra-high pressure eclogite constrained from the origin mm-scale layering structure (Nové Dvory, the Moldanubian Zone of the Bohemian Massif)

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Eclogite from the Nové Dvory (ND), Czech Republic, in the Gföhl Unit of the Moldanubian Zone of the Bohemian Massif records extreme pressure and temperature conditions (>4GPa, >1000℃; Nakamura et al., 2004). The formation process of the ND eclogite is expected to give insights to understand tectonics of convergence zone at the deep depth. However, origins of the ND eclogite are controversial whether it was high-pressure cumulate (Medaris et al., 1995) or metagabbro (Obata et al., 2006). The controversy is partially due to ambiguous control factors of garnet zoning pattern in low-variant systems like bi-mineralic eclogite. For example, Nakamura et al. (2013) reported diverse zoning patterns of garnet within a thin-section scale of bi-mineralic eclogite. Their sample comprises a layer containing Fe-rich core garnet and another one containing Mg-rich core garnet. These zoned garnet grains show similar rim compositions. Nakamura et al. (2013) suggested that such zoning patterns are not only the result of changes in pressure and temperature conditions, but also in local bulk compositions. Yet, the origin of the mm-scale layering structure remained unclear. This study aims at revealing the formation process of the ND eclogite from the origin of the layering structure.

The study samples are bi-mineralic eclogite composed of garnet-rich matrix and pyroxene-rich layer. Within each sample, garnet grains vary core compositions by layers, but show identical rim compositions regardless of their locations. For example, ND0207 contains a 3-mm thick pyroxene-rich layer. In ND0207, garnet grains in the garnet-rich matrix more than 10mm apart from pyroxene-rich layer has Mg-Cr-poor core (Fe:Mg:Ca=35:32:33 and Cr_2O_3<0.1wt%), those in the garnet-rich matrix near pyroxene-rich layer has Mg-rich Cr-poor core (Fe:Mg:Ca=23:55:22 and Cr_2O_3<0.1wt%), and those in pyroxene-rich layer has Mg-Cr-rich core (Fe:Mg:Ca=30:49:21, Cr_2O_3=1wt%). These garnet grains show similar rim compositions (Fe:Mg:Ca ≈ 28:42:30, Cr_2O_3 <0.3 wt%), and contain omphacite only in their rim. Compositions of the omphacite inclusions are Na-rich in the garnet-rich matrix (Na_2O=4-5wt%, Cr_2O_3<0.1wt%, X_{Mg}=Mg/(Mg+Fe) = 0.83-0.87), and Cr-Mg-rich in pyroxene-rich layer (Na_2O=3-4wt%, Cr_2O_3<0.4wt%, X_{Mg}=0.85–0.90).

Chemical compositions of the layering structure are determined by a quantitative mapping technique using electron probe micro analyzer (Yasumoto et al., under review). The result revealed that garnet-rich matrix increases Cr_2O_3 (0.0 to 0.3wt%) and X_{Mg} (0.5 to 0.8) from the relatively homogeneous part of the garnet-rich matrix to pyroxene-rich layer. This trend is concordant to the variation of chemical compositions of the minerals.

The significant chemical variation of minerals suggests that the ND eclogite or its protolith was not produced only by accumulation. A comparison of (local) bulk compositions reveal that the garnet-rich matrix corresponds to the Gföhl eclogite (Beard et al., 1992; Medaris et al., 1995; Obata et al., 2006) and the gabbroic rocks from South Indian Ridge (Niu et al., 2002), whereas the pyroxene-rich layer corresponds to the Gföhl pyroxenites (Medaris et al., 1995). In addition, prograde relict amphibole is identified in the ND eclogite (Yasumoto et al., 2016), and the ND pyroxenite is considered to be accumulated from melt (Svojtka et al., 2016). These facts suggest that the ND eclogite was metagabbro that was partially infiltrated and metasomatised by pyroxenitic melt under high-pressure conditions. Chemical variation of garnet cores and lack of omphacite in the garnet cores indicate that the layering structure was present before the omphacite growth. In other words, the melt infiltrated before eclogite-facies metamorphism. Driving force of the changes in local bulk compositions can be prograde heating (Nakamura et al., 2013) or dehydration of amphibole during eclogitization.