Fine-grained gabbroic layers in the lower and middle crustal sections of the Oman Ophiolite (Holes GT1A and GT2A), ICDP Oman Drilling Project

*星出 隆志[1]、海野 進[2]、草野 有紀[3]、Kelemen Peter[4]、Teagle Damon[5]、高澤 栄一[6]、Coggon Jude Ann[5]、道林 克禎[7]、Party The Oman Drilling Project Phase1 Science[8]
*Takashi Hoshide[1], Susumu Umino[2], Yuki Kusano[3], Peter B Kelemen[4], Damon A H Teagle[5], Eiichi TAKAZAWA[6], Jude Ann Coggon[5], Katsuyoshi Michibayashi[7], The Oman Drilling Project Phase1 Science Party[8]

1. 秋田大学国際資源学部、2. 金沢大学、3. 産総研、4. Lamont-Doherty Earth Observatory、5. Southampton University、6. 新潟大学、7. 静岡大学、8. D/V CHIKYU
1. Faculty of International Resource Sciences, Akita University, 2. Kanazawa University, 3. Geological Survey of Japan, 4. Lamont-Doherty Earth Observatory, 5. Southampton University, 6. Niigata University, 7. Shizuoka University, 8. D/V CHIKYU

Discussion on the formation of the lower oceanic crust has been focused around the sheeted sills and the gabbro glacier models. Holes GT1A and GT2A were drilled by the Oman Drilling Project (supported by ICDP, Deep Carbon Observatory, NSF, IODP, JAMSTEC, and the European, Japanese, German and Swiss Science Foundations) from the lower and middle crustal sections of the Samail Ophiolite, Oman (Wadi Gideah area, in the Wadi Tayin massif). One of the major objectives of the project is to clarify the formation model of the oceanic crust at mid-ocean ridges. The drilled cores were analyzed at the laboratory in the IODP drilling vessel “Chikyu” during the period of 15th July to 15th August, 2017.

Both Holes GT1A and GT2A are mainly composed of olivine gabbro and olivine-bearing gabbro, with minor amount of other lithologies. Igneous layering caused by modal and grain-size variations was observed in the both drilled cores.

Fine-grained (about 0.5 mm in size) gabbroic layers are interbedded into medium-grained gabbros in some sections of the GT1A (e.g., GT1A_45Z-1, 47Z-1, 47Z-2 and 48Z-3). The contact between them is microscopically sharp. Both the modal composition and grain size change discontinuously at the contact. In the contact boundary, an interfingering texture between clinopyroxene of the fine-grained olivine gabbro and olivine of the medium-grained olivine gabbro is observed. The original modal olivine contents of the fine-grained gabbroic layers are 4 to 5 vol%, generally much lower than those of the surrounding medium-grained olivine gabbros.
We also found similar fine-grained gabbroic layers in Hole GT2A. Some of the fine-grained gabbros contain much larger plagioclase crystals than the matrix crystals. The large plagioclase “phenocryst” commonly displays a distinct zoned structure. The fine-grained gabbroic layers may suggest repeated injections of basaltic liquids into the oceanic crust.

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