

Petrological and structural examination of the origin of foliated gabbros in the Oman ophiolite

Masahiro Oikawa^{1*}, Yoshiko Adachi², Yutaka Nogawa³, Sumio Miyashita⁴

¹Graduate School of Natural Science, Niigata University, ²Center for Transdisciplinary Research, Niigata University, ³Mitsubishi Materials Techno Corporation, ⁴Department of Geology, Faculty of Science, Niigata University

The gabbro units constituting a lower part of fast-spread oceanic crust are divided into layered gabbro, foliated gabbro and upper gabbro in ascending order. Layered gabbro is generally characterized by modal layering but foliated gabbro lack conspicuous modal layering and is accompanied by a strong mineral preferred orientation. The upper gabbros show massive appearance free from layering, foliation and preferred orientation of minerals. The upper gabbro units are considered to be solidified products of thin melt lens which is root of sheeted dyke complex beneath fast-spread ocean ridges. On the other hand, genesis of the foliated gabbro units is controversial. Nicolas et al. (2009) considered that they are formed due to subsidence from the melt lens, while MacLeod and Yaouancq (2000) proposed that they are produced during buoyant up flow from underlying crystal mush where layered gabbros were formed. However, the definition between foliated gabbro and layered gabbro are not clear. Therefore, the quantitative analysis in respect to structural features of the various gabbro facies is required to understand for the genesis of foliated gabbro.

We have studied gabbroic unit from layered gabbro to massive gabbro, of the Hilti block in the northern Oman ophiolite in term of structural and petrological aspects. Configuration and preferred orientation of plagioclase on X-Y plane and X-Z plane of samples are analyzed. Mineral compositions are also analyzed. It is noted that some foliated gabbros lack a lineation. Furthermore, the degree of intensity of foliation which is defined by alignment and aspect ratio of plagioclase is varied due to the stratigraphic position; the foliation of foliated gabbro is strongly developed just above the layered gabbro. While, the foliation just beneath the massive gabbro is weak. Plagioclase compositions tend to evolve upward in the foliated gabbro unit. These lines of evidence suggest that the buoyant up flow model is appropriate for the genesis of the foliated gabbro. The zoning patterns of plagioclases are different in the foliated gabbro (normal zoning) and layered gabbro (reverse zoning). This may be interpreted by the difference in cooling rates between the foliated and layered gabbros.

References

- MacLeod, C.J. and Yaouancq, G., 2000, A fossil melt lens in the Oman ophiolite : Implications for magma chamber processes at fast spreading ridges. *Earth Planet. Sci. Lett.*, 176, 357-373.
- Nicolas, A., Boudier, F., Lyderic, F., 2009. Subsidence in magma chamber and the development of magmatic foliation in Oman ophiolite gabbros. *Earth Planet. Sci. Lett.*, doi:10.1016/j.epsl.2009.04.012.