High temperature shear zone in the gabbro unit of the northern Oman ophiolite

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Oman ophiolite distributed in the eastern edge of the Arabia peninsula is the largest ophiolite in the world. Ductile shear zones with various scale are present from mantle peridotite to gabbro unit in Oman ophiolite (Boudier and Coleman, 1980; Pallistar and Hopson, 1981; Ruber, 1988; Boudier et al., 1982; Boudier et al., 1985; Boudier et al., 1988; Nicolas, 1989; Yanai et al., 1990).

There is few detailed analysis on shear zone in gabbro. Obara et al. (2000) reported several shear zones in the gabbro unit, and showed a sense of shear zone and the relationship between deformation and magmatism. Adachi and Miyashita (2003) proposed four stage of magmatism in the Oman ophiolite (ocean ridge axis stage, off axis stage, island arc stage and collision with continental crust/fix stage). Obara et al. (2000) clarified that the timing of mylonitization of shear zone in gabbro is after island arc stage in their stages because mylonitization occur after magmatism of island arc signature.

The gabbroic rocks in the shear zones were recrystallized accompanied with mylonitization. Studies on the shear zones from structural point of view were carried out by Obara et al. (2000), but studies for metamorphic conditions have not been done in detail. Therefore purpose of this study is to determine the metamorphic temperature conditions during the formation of the shear zones.

The width of the high temperature shear zones in the gabbro unit are few meter to about 50 meter at Wadi Zabin, Wadi Fizh and Wadi Sudum in the northern Oman ophiolite. In the Wadi Sudum, the largest high temperature shear zone surveyed so far is traced over 5 km with a NNW-SSE trend. In outcrop, the transition from undeformed host rocks to highly deformed mylonite is generally very rapid. We can observe that thin stretched reticular shear seams with few cm to 20 cm in width surround a undeformed gabbro at the boundary between the host gabbro and shear zone. Under microscope, clinopyroxene, amphibole and plagioclase occur as porphyloclasts, and pale green amphibole, actinolite and epidote occur in matrix. Clinopyroxene are also recrystallized in places. Based on the recrystallized mineral assemblage, it is considered that mylonitization occurred under conditions from upper amphibolite facies to lower amphibolite facies. Because clinopyroxene is replaced by pale green amphibole, and pale brown amphibole always occurs in matrix, mylonitization was accompanied by retrograde metamorphism. In the Wadi Sudum, we can trace the shear zone from deeper level at the moho to middle level of the gabbro unit, so that it is possible to detect different conditions depending on depth.