Petrogenesis of regional variation of the Moho transition zone in the northern Oman ophiolite

Yoshiko Adachi[1]; Teruhisa Hashimoto[2]; Sumio Miyashita[3]

[1] none; [2] Sci and Tech, Niigata Univ.; [3] Dep. Geol., Fac. Sci., Niigata Univ.

The thickness of crust-mantle transition zones (MTZ) is highly variable in the Oman ophiolite (Nicolas and Boudier, 1996). The onset of the MTZ is defined by appearance of dunite (and wehrlite) as a predominant lithofacies, and the upper limit is shown by predominant occurrence of layered gabbro. The MTZ is composed mainly of dunite and wehrlite with minor gabbros. There are two interpretations of the origin for the MTZ. One interpretation is an ultramafic cumulates crystallized from primitive magma at the basal part of magma chamber, and another interpretation is a reaction product between mantle peridotite and melt. Because recent geophysical observations showed absence of large magma chambers beneath fast-spreading ridges, the latter interpretation seems to be more likely. Because the almost all MORB melts passed through the MTZ, so that its composition would be highly influenced by reaction and fractionation in MTZ. Using along axis variation in geology and petrography of MTZ in the northern Oman ophiolite, we investigate the melt transport and fractionation processes in MTZ.

In the Oman ophiolite the direction of paleo ridge axis is represented by the intruding trends of sheeted dike complex, that is similar to the elongated direction of the ophiolite. Thus, we can detect the along axis variation by use of lateral variations of Oman ophiolite. Nicolas and Boudier (1996) reviewed a regional variation in thickness of gabbro layer and MTZ for whole Oman ophiolite, and showed that the thickness of the gabbro layer tends to be thinner at the segment center and thicker away from the segment center. In contrast to this, they showed that the MTZ is thickest at the segment centers and thinning toward the segments margin. This indicates that segmentation structures affect seriously for the genesis of the MTZ.

In the northern part of Oman ophiolite, we have proposed segment structure on the basis of lateral variation in composition and intruding trend of sheeted dike complex (Miyashita et al., 2003; Umino et al., 2003) and discontinuity of gabbro sequence (Adachi and Miyashita, 2003; Tomatsu, 2004MS). We have studied a detailed vertical variation from mantle harzburgite (ca, 200-300 m), through MTZs to the basal part of layered gabbro along 7 routes. These 7 routes are Wadi Sudum, Hilti, Thuqbah, Hayl, Fizh, Fizh-north and Zabin, from south to north. Thickness of the MTZ is systematically varied depending on the location in the segment structure, thickest (300m) at the segment center (Thuqbah) and thinning toward the southern margin (Sudum) and the northern margin (Fizh) up to only 10 m thick. However, we found that very thick MTZs up to 250-300 m appear also at Fizh north and Zabin routes located at the most northern end of the ridge segment.

In addition to above variation in thickness of the MTZs, systematic changes in lithofacies and structural features are recognized. Harzburgites just beneath the MTZ at the segment margin areas (Sudum, Fizh, Fizh north and Zabin) are characterized by abundant appearance of veins and impregnations of plagioclase and clinopyroxene. Whereas, underlying harzburgites beneath MTZ from the segment center area are nearly free from such veins and impregnations. Furthermore, structural features shown by foliation and lineation are also changed depending on the location in the segment structure. Apparent foliation and lineation are well observed at near the segment center, but they are not apparent near the segment margins, i.e. become to massive occurrence toward the segment margin. These lines of evidence described above suggest that melt extraction from upwelling mantle is efficient at the segment center and less efficient at the segment margins. Mineral compositions of the basal part of layered gabbros are consistent with this assumption.