The preliminary study on vertical variation of mineral composition of layered gabbros in the northern Oman ophiolite

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The vertical variations of mineral compositions have been examined by several researchers for layered gabbros in Oman ophiolite. Pallister and Hopson (1981) and Smewing (1981) showed the pattern with a zigzag variation in mineral compositions and proposed a huge magma chamber in which the magma was repeatedly supplied. Browning (1984) defined 14 cyclic units in layered gabbros of the Rustaq block of the central Oman ophiolite and calculated the height of liquid column as 100m. Based on this result, Browning (1984) proposed two possible models of the magma chamber. However the recognition of the cyclic units is based on the analyses of 30 samples of layered gabbros for 600m thick (1sample every 20m), and the majority of the units are defined by only two samples. If more fine-scale units existed, the cyclic units cannot be detected by this accuracy. Therefore the liquid column calculated about 100m is also doubtful. Kelemen et al. (1998) presents a simple physical and theoretical models for the periodic formation of melt-filled fractures originating in a melt lens. They claimed that Oman gabbros supported models in which much of lower crust forms by crystallization in sills at a variety of depths, from the dike/gabbro transition to the base of the crust. The vertical variations of mineral compositions obtained from various positions in layered gabbros from Wadi Sudum (Adachi and Miyashita, 1999), Wadi Hilti (Tomatsu, 2004MS) of Hilti block and Wadi Thqubah (Adachi, 2003MS), Wadi Fizh (Adachi and Miyashita, 1999) of Fizh block in the northern Oman ophiolite were examined.

The lithological and vertical variations of mineral compositions in layered gabbros are shown as follows. In Wadi Sudum, 3 cyclic units were identified from the 40m column. The lower unit from 0 to 10m heights shows intensive modal layering. The middle unit from 10 to 22m heights is characterized by predominant appearances of melanocratic gabbros. The variations of mineral compositions (i.e. plagioclase An%, clinopyroxene Mg# and olivine Fo%) are narrow throughout these units. However Cr2O3 contents of Cpx in the middle unit are higher than lower and upper unit (Adachi and Miyashita, 1999). In Wadi Hilti, 6 cyclic units were identified from the 70m column. The lithology from the base to the unit 5 varies from leucocratic gabbros, melanocratic gabbros then layered gabbros with fine-scale layering. The unit 6 mainly consists of slightly melanocratic gabbros. The vertical variations of mineral compositions in these units are characterized by the appearance of the most primitive values in both major and minor elements occur at the central part of each unit (Tomatsu, 2004MS). In Wadi Thqubah, 4 cyclic units were identified from the 35m column in the upper stratigraphic position and 4 cyclic units were identified from the 60m column in the basal part of the gabbro unit. In the column from the basal part, the lithology becomes gradually melanocratic gabbros with increasing olivine upward. In the column from the upper position, leucocratic gabbros are predominant. Vertical variations of mineral compositions are in consistent with lithological variation. The mineral compositions vary rapidly from evolved to primitive composition at the unit boundary (Adachi, 2003MS). In Wadi Fizh, 9 cyclic units were identified from the 350m column, which rests immediately on the MOHO transition zone. The mineral compositions vary remarkably from base to top in each unit and change rapidly from evolved to primitive values at the unit boundaries (Adachi and Miyashita, 1999).

Therefore the cyclic units defined by variations of mineral compositions have generally 10-15m heights at various areas and stratigraphic positions.