

Vertical variation and segment structure of the layered gabbros in the northern Oman ophiolite

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The segment structures in the Oman ophiolite were documented based on following point of view; 1) flow patterns of mantle sequence, 2) lateral variation of thickness of mantle-crust transition zone (Moho-transition zone) and gabbro layer, 3) petrology of gabbroic sequence and 4) definition of the segment boundary suggested by appearance of penetrating dikes into crustal succession.

Wadi Thuqbah area is supposed corresponding to the center of segment which was characterized by thick Moho-transition zone, predominance of melanocratic layer and intensive development of mineral lineations. Wehrlite and dunite with some melanocratic olivine gabbro and olivine gabbro layers compose the Moho-transition zone. In the lower part of the layered sequence, melanocratic layers are predominant and there are 3 melanocratic to ultramafic units. Upper part of the layered sequence consists of relatively uniform olivine gabbros.

Wadi Fizh area located about 20 km northern part of Wadi Thuqbah area is characterized by thin Moho-transition zone, rare appearance of melanocratic unit, and gabbro blocks intruded by dolerite dikes and upper gabbros. These lines of evidence indicate that this area correspond to the segment boundary. Melanocratic units appear only just above the Moho-transition zone. Upper part of this unit is composed of relatively uniform olivine gabbro and thin melanocratic olivine gabbro layers.

The mineral compositions of layered gabbros in the two areas are Fo %: 86.1-77.9, 90.3-77.8, An %: 86.4-78.4, 91.3-79.7, Mg# of clinopyroxene: 0.883-0.817, 0.911-0.801, respectively (the former is Fizh area, the later is Thuqbah area). The gabbros in Thuqbah area have more primitive composition than that in Fizh area.

The mineral compositions in both areas vary depending on stratigraphy and lithology. The vertical compositional variations attain about 10% in Fo, 0.1 in Mg# of clinopyroxene, 15% in An from the top to the bottom of the layered gabbros.

In Fizh area the cyclic units are defined by gentle decrease in above values toward the top and rapid increase at the base of next unit. Minor elements of olivine and clinopyroxene show also concordant variations with major elements in the cyclic unit. There are 9 cyclic unit across 350 m height in the lower gabbro in Fizh area. It is noted that the boundary between the cyclic units of this area does not correspond to a lithologic change. The differences of mineral composition of melanocratic and leucocratic layer were smaller than that in each unit. Thus the compositional variations in each units are larger than those on different layers defined by mode compositions.

The unit boundary in the lower part of gabbro layer in Thuqbah area corresponds to the lithologic boundary. The mineral compositions abruptly became primitive at the boundary from leucocratic units to melanocratic unit. The units are approximately 10 m thick and consist of numerous cm scale layers represented by a modal difference. Within these units mineral compositions change in a narrow range and the vertical variation patterns are different from Fizh area. Furthermore, minor elements of olivine and clinopyroxene vary roughly concordant with major elements but sometimes show discordant behavior with major elements. The upper part of layered gabbro in this area is relatively uniform as the same as Fizh area. However, the variation in that horizon is narrow.

The variation patterns of mineral compositions on in the cyclic unit may reflect the genesis and solidification processes of layered gabbros. The variation patterns in the two areas are different in respect to lithologic unit and behavior in a small scale variation patterns. These different suggest difference processes of the two areas.