

Segment discontinuity at depths: Curious structures found in the gabbro units, Oman ophiolite

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Geological structures and lithology of gabbroic units exposed in Wadi Sudum to Hilti area of the northern Oman ophiolite were studied. Gabbro units were classified into lower layered gabbro, upper layered gabbro and upper gabbro. The definition of lower and upper layered gabbros is due to the presence (lower layered gabbro) or absence of mineral lineation (upper layered gabbro) on the layering plane. Upper gabbro show massive or foliated appearance. Besides, pegmatitic gabbros with various sizes intrude into layered gabbro. We found several interesting phenomena during the course of field survey which may reveal temporal variation of melt lens and axial discontinuity at depths corresponding to the third or fourth discontinuity (Macdonald, 1989).

1. Temporal variation of melt lens and two stage of formation in crustal accretion

Temporal variation of melt lens (= roof of magma chamber) is shown by field occurrence in the transition zone between upper gabbro and sheeted dike complex (MacLeod and Rothery, 1989; Gillis and Coogan, 2002). If the melt lens becomes to dilate due to increase of melt influx into the lens, upper gabbro would invade the base of sheeted dike complex to produce xenoliths of the dikes in the upper gabbros. In contrast, if the melt lens becomes to contract due to cut-off or decrease in melt influx, thick upper gabbros would be produced. Then the upper gabbros were intruded by dike complex during a next pulse of melt influx.

We found that upper gabbros are intruded by sheeted dike complex at the north tributary of Wadi Sudum. At there upper gabbros with foliation dipping east were intruded and completely surrounded by dolerite dike swarm which dips steeply west. This is interpreted by subsidence of magma chamber roof (=contraction of melt lens), as mentioned above. At about 200 m lower stratigraphic positions from the transition, a large wehrlite complex attaining about a few hundred m, is intruded by basaltic dikes and upper gabbros. Since wehrlites intrude into a crustal succession at the flank of ridge axis (Jousselin and Nicolas, 2000; Adachi and Miyashita, submitted), this finding indicates that there are two stages in the formation of oceanic crust in this area.

2. Crosscutting structure in the gabbroic unit

We found also very curious occurrences of layered gabbros, which are displayed by cross-cutting layering each other. We call such cross-cutting part as a disturbed zone. The disturbed zone was observed at the southern part of surveyed area, that is, southern area of Wadi Sudum to Wadi Ahin area. It is noteworthy that the disturbed zones occur in the upper layered gabbro and extends about several hundred m in width. This disturbed zone is traced at least about 3 km in NW-SE direction. The disturbed zone is interpreted by huge gabbro blocks and their host layered gabbros. Usually the dips of layering of the gabbro blocks are steep and those of the host gabbros are moderate to gentle to east. The layering structures of the host rocks surrounding the blocks are complexly disturbed. However, these both layerings are not deformed. It is noticed that, pegmatitic gabbros are frequently observed in and around the disturbed zone.

In the northern part of the surveyed area, the disturbed zone is not observed so far, instead, steeply dipped layering zone occur in the northern area. This steeply dipped zone is traced in NS direction and may correspond to the disturbed zone in the south area. It is difficult to explain the disturbed and steeply dipped zone by later tectonic movement. Probably these zones show primary processes beneath ridge axis. Since gabbroic units continues without significant disruptions, these curious structures may be produced at the third or fourth order discontinuity. Because such discontinuity is not so large, tectonic disturbance would occur without major disruption of the gabbroic unit.