Boninitic dikes intruding into lower crust of the Oman ophiolite: Evidence from ocean ridge environments to subduction initiation

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Large clinopyroxenite to melagabbronorite complex which would be corelated to plutonic facies of V2 (=Alley volcanics) (Adachi and Miyashita, 2003), appears in the southern part of Wadi Fizh to Wadi Bani Umar Garabri, which was previously regarded as the largest body of the ubiquitous wehrlite intrusions (Juteau et a., 1988; Reuber, 1988). However, this complex is distinguished by earlier appearance of clinopyroxene and orthopyroxene than plagioclase, depleted featrues of clinopyroxene chemistry, extremly high An-contens of plagioclases and abundant appearance of igneous amphiboles compared to common whelritic intrusions, as described by Adach and Miyashita (2003). Furthermore basaltic andesite to andesitic dikes which are metamorphosed into amphibolite appear in this complex. These dikes are usually accompanied with leucocratic veins which surrounded and intruded into the dikes (Adachi and Miyashita, 2003).

We found boninitic dikes, about a few tens of cm in thickness, from five locations. Although most of boninitic dikes are metamorphosed into amphibolite, the boninitic dikes preserving original minerals and textures are found from two localities. They trend NS to NW and dip steeply west, highly oblique to general structures. Furthermore, boninitic dikes intruding into host layered gabbros are also found along Wadi Khabiyat. It should be emphasized that some boninite dikes preserving an original basaltic texture have a chilled contact against host plutonic rocks, indicating that the dikes intruded after considerable cooling of the host plutonic rocs which itself is later intrusion. On the other hand, many dikes are metamorphosed to amphibolites, suggesting that they intruded still very hot conditions. Therefore, there should be some time span for the intrusion of boninitic dikes.

Boninitic dikes are also found from WNW trendind dikes at Wadi Fizh area which cut NS trending sheeted dike complex of the ophiolite sequence as similar to boninitic dikes reported by Ishikawa et al. (2002).

The boninitic dikes are classified into two groups (primitive and evolved groups) based on mineral assemblages and bulk rock compositions. The weakest altered sample (02Kh23) consists of olivine phenocryst and clinopyroxene microphenocrysts set in groundmass of acicular clinopyroxene and devitrified glass. Olivine phenocrysts replaced by serpentin minerals are subhedral to euhedral with 1.0 to 0.5 mm in diameter. Small spinels appear in olivine pseudomorps or in matrix. The second group is distinguished from the first group due to lower bulk rock Mg# and appearance of orthopyroxene as phenocrysts. Clinopyroxe phenocerysts and small amount of olivine phenocrysts (pseudomorph) occur in weakly metamorphosed samples. A small amount of plagioclase may occur as phenocryst. An contents of the plagioclases are highly calcic and ranges from An 90 to 94 in the core compositions.

Depleted signatures of the boninitic dikes are represented by Cr-spinel and clinopyroxene compositions. Cr# (Cr/Cr+Al) of the Cr-spinel ranges from 0.74 to 0.82 and within the compositional ranges of the boninitic rocks from the Troodos ophiolite and western Pacific areas. TiO2 contents of the spinel are very low less than 0.3 wt%, indicating also highly depleted features of the boninitic rocks. Furthermore TiO2 and Na2O contents of clinopyroxene phenocrystsare extremly low. The core of crystals are low as about 0.1 wt% in TiO2 and less than 0.1 wt% in Na2O. These extremly depleted features of clinopyroxene are due to low concentraion in TiO2 and Na2O of the melts from which the boninitic dikes crystallized. Despite of the latest appearance of plagioclase, extremly high An contents of the plagioclase are consistent to low concentration in Na2O of the melts.

Occurrence of the boninitic dikes as later magmatic event would give a significant constraints for the genesis of the Oman ophiolite.