Paper Number: 360

Growth of intermediate olivine (Fo $_{49-62}$) within Mg-rich olivine (Fo $_{82-90}$) of basaltic lava of active Barren volcano, -- an unusual product of terrestrial rock

Pal,T[1] and Bhattacharya, A[2]

1.Geological Survey of India, North Eastern Region, Shillong-793003, India, tapanpal_in@yahoo.co.uk

2. Geological Survey of India, Central Petrological Laboratory, Kolkata-700016, India

Exsolution like growth of iron rich olivine within Mg rich olivine host is extremely rare in terrestrial rocks besides some chondrites and experiments [1, 2, 3] . Such iron rich olivine has so far been reported as ferriolivine or Fe^{3+} fayalite (liahunite) occurring as rim, lamellae and vein within forsteritic olivine [1]. The causative factors for such growth, iron source and the reactions of iron-rich olivine are still not clearly known. The debate is still going on whether oxidation or reduction affects the system for such growth. Petrographic documentation of the different mode of occurrences and composition of such iron rich olivine and associated phases are still limited to infer about the processes involved for such growth.

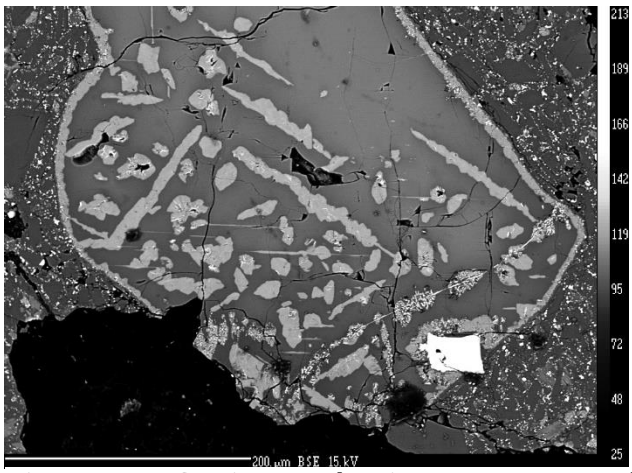

Figure 1: BSE image showing occurrence of intermediate olivine (lighter tone) as thick lamellae (olivine B-l type) oriented along particular planes with forsteritic olivine (darker tone). Grain of iron metal transgresses the boundary of olivine grain

Growth of the olivine of intermediate composition within Mg-rich olivine is very unusual in terrestrial rocks as oxygen fugacity in mantle conditions prevents the formation of such intermediate olivine. In the present study the detailed petrographic observation, mineral chemistry of olivine grains of the basaltic lava of the active Barren Volcano, Andaman Sea, hints about the iron source and the processes for the growth of intermediate olivine within Mg-rich olivine host. Olivine phenocrysts of vitrophyric Barren basalt display growth of intermediate olivine (Fo_{49-62}) within forsteritic olivine (Fo_{82-90}) grains in different forms viz. a) thin (<0.5µ) lamellae or impersistent blebs along some crystallographic orientation, b) as collar (5-10µ thick) around forsteritic olivine and c) irregular patches at the central part of the olivine grains. Petrographic features are indicative of replacement textures rather than exsolution. Petrography and EPMA result indicate that Mg-Fe rich olivine was the major source for iron of intermediate olivine. Olivine with homogenous Mg+Fe composition crystallised initially from the melt. At great depth in reducing environment Fe^{2+} got released from the olivine structure and mixed with the magma. With the up rise of magma, reducing condition changed into oxidizing condition and cleavage planes, fractures, grain boundary of the host olivine provided pathways for oxidising iron rich, solution to precipitate intermediate olivine. During the violent eruption in the active Barren Volcano, lava moved with high velocity and preserved the early record of reduction along with the later oxidising milieu of phenocrystic olivine.

References:

[1] Khisina NR et al. (1995) Phys Chem Mineral 22: 241-250

[2] Zolotov MY et al. (2006) Meteoritics Planetary Sci. 41-11: 1775-1796

[3] Janney DW and Banfield J (1998) Am Mineral 83: 799–810