Geophysical Research Abstracts
Vol. 13, EGU2011-470-1, 2011
EGU General Assembly 2011

Geochemical Signatures of Bazman Volcano: Evidence from Makran Subduction Zone, Southeast Iran

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Bazman is one of the Plio-Pleistocene volcanoes in the southeastern Iran. Lavas from its last eruptions have covered quaternary sediments adjacent to this volcano. Bazman volcano is located about 420 km northern of coast line of Oman Sea. A crater with 500m diameter and 3400m high has been created on the main summit of this volcano which has been classified as a stratovolcano. This stratovolcano consists of different volcanogenic strata including lavas ranging from basaltic andesite, andesite to dacite and pyroclastic deposits ranging from ash to blocks.
All of the rock samples on the TAS and AFM diagrams plot in sub-alkaline and calc-alkaline field, respectively. This volcanic suite has not been affected by extensive chemical alterations because of its young age. Strong and meaningful correlations between major oxides such as MgO vs. CaO (0.87), MgO vs. SiO2 (-0.88), and MgO vs. TiO2 (0.93), indicate that this suite is co-magmatic, and evolved magmas have probably been controlled by fractional crystallization. To clarify the role of fractional crystallization in this suite, we selected samples whose represent maximum values of compatible elements (Mg, Ni, and Cr) as parental magma compositions. Calculations show that this primitive magma may have been experienced $\sim$30% fractional crystallization to generate more felsic rocks in the Bazman volcanic suite. Alternatively, more felsic rock samples may be generated by partial melting of subducted oceanic lithosphere. In addition the high concentration of LIL elements such as U, Th, and Ba may be controlled by crustal contaminations. PM-normalized diagram in the Bazman samples represents steep REE pattern and hence in this suite the concentration of La and Yb are more than those of PM by a factor 35 and 3, respectively so the REE and incompatible elements have strongly been fractionated. Depletion in heavy REE and low (Nb/Ta)n ratios, mean=0.59, as well as high (La/Yb)n ratios, mean=9.8, requires that garnet and/or amphibole occur in the restite, whereas absence the negative Eu anomaly in the REE pattern and moderate Sr values, mean= 417ppm, allow little, if any, plagioclase in the restite. Moreover, these rocks show negative anomalies on Nb, Ta, and Zr as HFS elements similar to those of typical subduction related volcanism. Meanwhile, on the Th-Hf-Nb discrimination diagram our samples fall into the field of arc volcanism.
In the southeastern Iran, Makran, there is an active convergent movement where Arabian oceanic lithosphere is moving northward under the Iranian continental sub-plate with approximately rate of 3.5 cm/y. Dehydration of this subducted oceanic lithosphere that generally accompanies oceanic sediments, has enriched mantle wedge from LREE and LILE as well as H2O to produce slab-derived component which may have been the main source of the Bazman magmas. The subduction component provides enrichment in LIL elements, but strong depletion in HFS elements in the source melt which make it unique from magmas emplaced in the other tectonic setting. Consequently, it seems that large volcanic centers including Bazman, Taftan, and Soltan represent a continental-margin arc located along Makran subduction zone.

Keywords: Bazman volcano; Continental-margin arc; Subduction related volcanism; Stratovolcanoes; Metasomatized mantle wedge