Geophysical Research Abstracts
Vol. 19, EGU2017-13716, 2017
EGU General Assembly 2017

Geochemistry of pillow lavas and sheeted dikes from Nain and Ashin ophiolites (Central Iran)

Emilio Saccani (1), Tahmineh Pirnia Naeini (1), and Ghodrat Torabi (2)

(1) University of Ferrara, Physics and Earth Sciences, Ferrara, Italy (tahmineh.pirnia@gmail.com), (2) Department of Geology, University of Isfahan, Iran

An extensive, worldwide database on the geochemistry of basalts from well-known tectonic settings is available. Knowing the chemistry of basalts on one hand, and the tectonic setting of their origin on the other hand, resulted in the development of tectonic discrimination diagrams. Recently developed discrimination diagrams allow us to determine the tectonic setting of volcanics with almost neglectable probability of misclassification (<1%). One major application of these diagrams lies in discriminating the tectonic setting of formation of ophiolites, particularly in poorly-known areas. A good example is the Inner ophiolite belt of Iran, located in Central Iran. The geodynamic significance of the inner ophiolites is still poorly known. From the Inner ophiolites, either no volcanic section is reported, or, the data are highly limited and poorly-reliable due the high degree of alteration of the studied samples. We have been able to overcome this problem by spotting relatively well-preserved outcrops of pillow lavas and sheeted dikes from two ophiolite mélanges of Central Iran, Nain and Ashin ophiolites. The two mélanges are located in the west of Central-East Iranian microplate. In total, 28 samples have been collected from the pillow lavas and sheeted dikes outcrops. The studied volcanic rocks consist mainly of basalts and minor ferrobasalts and basaltic andesites, all showing a clear subalkaline nature (e.g., Nb/Y = 0.03-0.21). Two samples from the Nain ophiolite are characterized by N-MORB normalized incompatible element patterns showing marked Th positive anomalies and Ta, Nb, Ti negative anomalies. Chondrite-normalized REE patterns show LREE/HREE (light REE/heavy REE) enrichment, with LaN/YbN=3.2-4.3. These rocks are chemically similar to the calc-alkaline basalts (CAB), as also highlighted by many discrimination diagrams. These rocks are interpreted to have generated in a cordilleran-type volcanic arc setting.

All other samples from both the Nain and Ashin ophiolites display a wide range of chemical composition. However, the relatively less fractionated basalts are characterized by low TiO_2 (0.60-1 wt%), P2O5 (0.03-0.08 wt%), Zr (23-75 ppm) and Y (9-27) contents. Cr (38-619 ppm) and Ni (22-220 ppm) contents show a wide range of variation. N-MORB normalized incompatible element patterns show rather flat trends and a general depletion (from 0.4 to 0.8 times N-MORB composition) coupled with a slight Th enrichment (1-3 times N-MORB). Chondrite-normalized REE patterns are generally flat and are characterized by either a slight depletion or a slight enrichment in LREE compared to HREE (LaN/YbN=0.7-1.2). These overall chemical features resemble those of island arc tholeiites from many ophiolitic complexes. The depletion in incompatible elements compared to N-MORB suggest that these rocks were derived from partial melting of a depleted mantle source. Th enrichment with respect to Nb (ThN/NbN = 2.6-12.4) suggests that mantle sources underwent enrichment in subduction-derived chemical components prior melting. Our data suggest that the Nain and Ashin ophiolites were formed in a subduction-related tectonic setting during the Late Cretaceous. The chemistry of the studied rocks is compatible with transition zone either from forearc to arc or from arc to backarc.