

Petrogenesis of Late Cretaceous Lava Flows from Raskoh Arc, Pakistan

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The Raskoh arc occurs in the Balochistan province of Pakistan. It is about 250 km long, 40 km wide and trends in an ENE direction. The oldest rock unit in the Raskoh arc is an accretionary complex (Early to Late Jurassic), which is followed in age by Kuchakki Volcanic Group: the most wide spread unite of the Raskoh arc.

This Kuchakki Volcanic Group is mainly composed of basaltic to andesitic lava flows and volcanoclastics including agglomerate, volcanic conglomerate, breccia and tuff with subordinate amount of shale, sandstone, limestone and chert. The lava flows generally occur 3-15 m thick lenticular bodies or beds, which rarely reach up to 300 m. These lava flows are generally found as intercalations within the volcanoclastic rocks. The petrological studies of various lava flows revealed that these are mainly basaltic-andesites (52.95-56.82 wt.% SiO₂) with minor basalts (47.88 to 50.65 wt.% SiO₂) and andesites (59.63-59.95 wt.% SiO₂). The main textures exhibited by these rocks are hypocrystalline porphyritic, subcumulophyric and subintersertal. The phenocrysts of mainly augite and plagioclase (An₄₄₋₅₀) are embedded in a micro to cryptocrystalline groundmass having the same minerals.

Petrochemical studies based on major, trace and rare earth elements suggest that these are oceanic island arc tholeiites. Their low Mg # (42-56), higher FeO (total)/MgO (1.24-2.67) ratios indicate that the parent magma of these rocks was not directly derived from a mantle source but fractionated in an upper level magma chamber. The trace element patterns show enrichment in LILE and depletion in HFSE relative to N-MORB. Their primordial mantle-normalized trace element patterns show marked negative Nb anomalies with positive spikes on K, Ba and Sr which confirm their island arc signatures. Slightly depleted LREE to flat chondrite normalized REE patterns further support this interpretation. The Zr versus Zr/Y and Cr versus Y studies show that their parent magma was generated by 20-30 % partially melted depleted mantle source. The trace elements ratios including Zr/Y (1.73-3.10), Ti/Zr (81.59-101.83), Ti/V (12.39-30.34), La/YbN (0.74-2.69), Ta/Yb (0.02-0.05) and Th/Yb (0.11-0.75) of basaltic flows are more consistent with oceanic island arcs rather than equivalent rocks of the continental margin. On the basis of these studies it is concluded that Raskoh arc is an ancient oceanic island arc which was formed due to the intra-oceanic convergence in the Ceno-Tethys during the Late Cretaceous rather than constructed on the southern continental margin of Afghan block, as previously claimed by several workers. It is further suggested that all the Tethyan oceanic island arcs including Semail, Zagros, Chagai-Raskoh, Muslim Bagh, Waziristan, and Kohistan-Ladakh were developed in a single but segmented Cretaceous Ceno-Tethyan convergence zone.