ABSTRACT

PETROLOGY AND GEOCHEMISTRY OF THE PANJAL TRAPS, PAHALGAM, KASHMIR

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The Panjal Traps of Kashmir cover a vast expanse in terms of area and geological time. Except for a few random attempts by some geologists, these rocks have largely been ignored and no detailed petrographic and geochemical investigation has been done.

The present study was conducted to study in detail the mineralogy and chemistry of these rocks to determine the nature of magma and the environment of eruption. Since, the Panjal Traps occur along the northern boundary of the Indian plate and also the erstwhile Gondwana supercontinent, the study of the geochemistry of these rocks may have an important bearing on many tectonic problems of the region.

Thirty-three flows were delineated on Mount Kayol, Lidderwat, forming a steep cliff of bedded sequence of the Panjal Traps. The flows have chilled contacts.

Excluding two basal flows, which are plagioclase porphyritic, all the other flows are fine grained rock comprising mainly of plagioclase and pyroxene showing subophitic relationship. The composition of the plagioclase phenocrysts is highly calcic (An_{56}-An_{82}). Less calcic plagioclase are

confined to groundmass phase. Plagioclase predominated over pyroxenes throughout. In early flows, pyroxene is Ca-rich but shows a trend towards Fe-rich variants in successive upper flows. Olivine is conspicuously absent throughout. Alteration of some plagioclase and pyroxene crystals to epidotes, chlorites and tremolite-actinolite, but still retaining primary textural features, is noted. Secondary albite and biotite ~~with~~ cross-cut ~~relationship with~~ primary textural features, and probably have an origin associated with the alkali metasomatism, ~~are~~ also observed.

The nature of alteration seems to be isochemical except for ~~the~~ concentration of alkalis. The enrichment of alkalis caused the undersaturation of normative composition and also masked the original magma character on silica-alkali and MFA diagrams. However, evaluation of chemistry based on other elements indicates that these rocks are relatively evolved tholeiitic basalts which have fractionated to a maximum of basaltic-andesite stage. These rocks have striking uniformity in composition. The evolved nature of the magma is attributed to the separation of olivine (and may be some part of pyroxene) during the slow rise of magma from deeper sources in the mantle to crustal reservoirs. The separation of olivine and pyroxene, both anhydrous phases, probably resulted in the enrichment of Ca and Al relative of Mg and Fe, and the built up of volatile concentration which on forceful release caused the formation of Agglomeratic slate that preceded the main lava outpour. The release of water pressure coupled with the

Ca - Al rich composition of the magma may have favoured the early precipitation of plagioclase, but this was soon disturbed by the eruption of magma which continued without any major pause giving rise to uniformally fine grained lava beds.

The results of the trace element data are in confirmity with the inferences drawn by major oxide composition. High Rb and Ba values favour extraneous addition of alkalis or internal migration whereas low concentration of Ni, Co and Cr favour separation of olivine and some part of pyroxene from the magma. High contents of Ga, Y, V, Cu, and Zr also support fractionated nature of the magma. Low Sr content, suggested to be related to the low Sr content of the source region in the mantle, shows resemblance with some continental and all mid-ocean ridge tholeiites. Plots of abundances and ratios of various trace elements indicate similarity of the Panjal Traps with ocean-floor basalts in the tectonic environment of eruption. However, presence of large and abundant vesicles and absence of pillow structures suggests subaerial environment of eruption. Plots on TiO_2 - K_2O - P_2O_5 diagram indicate that the oceanic affinity of the Panjal Traps may be due to the eruptions of these lavas along a ridge that was later aborted.

It is concluded that the Panjal Traps represent an extended phase of eruptions that occurred in a rifting environment during Permo Carboniferous period and finally culminated in the formation of a short-lived mid-ocean ridge in this region.