Phase Chemistry and Flow Correlations of Deccan Trap Lavas around Linga, Chhindwara, Central India

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Continental Flood Basalts (CFB) are considered to be variants of Large Igneous Provinces (LIPs) and they embrace large areas of continents covered by considerable thicknesses of laterally extensive lava flows that erupted from fissures over a short period of time in an extensional tectonic regime. The combination of high eruption rate and low viscosity permits pervasive lateral flows of CFB magmas over large areas of the Earth on a regional scale.

The Deccan volcanism, with a tremendous outburst of volcanic activity around 65 million years ago, marks an important episode in the geological history of Indian subcontinent, affecting nearly two-thirds of peninsular India. The fissure-fed, voluminous Deccan lavas were highly fluid in nature, covering an area of about 5,00,000 square km, both cumulatively and as individual flows in the northwestern, western, central, and southern parts of the Indian peninsula.

In voluminous flood basalt sequences, the primary volcanic structures that developed during the early stages of cooling and solidification of lava provide significant criteria for the identification and correlation of lava flows. Eight basaltic lava flows have been indentified in the study area on the basis of distinctly developed structural zones. The stratigraphic correlation of the lava flows was attempted on the basis of flow morphology, elevation, and intertraps.

Detailed petrographic studies of the lava flows represent inequigranular phenocrystal basalts characterized by development of phenocrystal phases including plagioclase, clinopyroxene and olivine whereas groundmass composition is marked by tiny plagioclase, clinopyroxene, opaques and glass. Electron microprobe analyses indicate that the olivine has a wide range from Fo_{20} to Fo_{66} revealing a wide spectrum of compositional variation. Pyroxene compositions are distinctly designated as Quad pyroxenes. Phenocrystal pyroxenes are mostly diopsidic, while the groundmass pyroxenes mostly correspond to augite with a minor pigeonite component. Pyroxene phenocrysts are characterized by a prominent Ti enrichment. The An content of plagioclase varies from $An_{39.2}$ to $An_{72.9}$. The phenocrystal plagioclase is found to be calcic, while a relatively sodic composition is observed for the groundmass plagioclase. Glass displays a wide compositional characters ranging from undersaturated foidite to oversaturated rhyolite attesting to a course of magmatic fractionation. Groundmass opaque minerals are characteristically found to be Ti-magnetite /ilmenite/pyrophanite.

Use of pyroxene thermometry reveals a temperature span of 850°C to 1280°C while olivineclinopyroxene thermometry yields a temperature range from 1040°C - 1160°C

for the investigated lava flows. Pyroxene compositions specifically indicate a tholeiitic to calc-alkaline nature of the parental magma in a non-orogenic setting.

Keywords: Continental Flood Basalts, Large Igneous Provinces, Deccan volcanism, Lava flows, Primary volcanic structure, thermometry