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Tectonic setting of the Lohit Granitoid Complex (LGC) in Trans Himalayan Belt, Arunachal Pradesh, India: A Geochemical approach

Adhikary,D.,^{1*} Kumar,R.,² and Das,S.,³

1. Geological Survey of India, State Unit: Andhra Pradesh, Southern Region, Hyderabad, India
2. Geological Survey of India, State Unit: Bihar, Eastern Region, Patna, India
3. Geological Survey of India, State Unit: Uttarakhand, Northern Region, Dehradun, India

*Corresponding author. Email id: debapriya.adhikary@gmail.com

Abstract:

The Lohit Granitoid Complex forms the most conspicuous unit in the eastern Arunachal Pradesh. It consists of multivariant plutonic rocks which includes diorite, granodiorite, tonalite, hornblende-biotite granite and leucogranite. The distribution of Lohit Granitoid, when plotted on AFM diagram and SiO_2 vs K_2O distribution diagram, shows that the magma is dominantly calc-alkaline in nature with $\text{Na}_2\text{O}+\text{K}_2\text{O}+\text{CaO}$ value ranges from 8.09 to 5.8. The differentiated units of Lohit Granitoid Complex shows signature of mantle fraction and syn to pre plate collision. The lithounits of Lohit Granitoid Complex is dominantly metaluminous to weakly peraluminous in nature. The REE pattern shows enriched in LREE with a decreasing trend from La-Nd with a moderate to feeble Eu anomaly, whereas the HREE (Er to Lu) shows almost a linear trend. Distribution pattern of REE varies slightly from granodiorite to diorite. Granodiorites exhibits slightly enriched REE pattern with (La/Yb) and LREE pattern with (La/Sm), very low to almost flat HREE pattern with (Tb/Yb). Whereas diorite shows moderately enriched fractionated pattern with (La/Yb), moderately enriched LREE pattern with (La/Sm) and almost flat HREE pattern with (Tb/Yb). Granodiorite exhibits very little Eu anomaly, similar to diorite which also exhibits weak Eu anomaly. This indicates the presence of plagioclase in the parent rock. Hence if the rare earth shows negative Eu anomaly then it can be said that the magma has generated at a depth less than 30 km that means from the crustal level. In this case the Eu anomaly is expected to be much steeper but the Eu anomaly is moderate to shallow, which may be attributed to the involvement of mantle material within it. So, it can be said that either the magma has a mixed origin involving both crustal as well as mantle material or magma has been generated at a depth near to the mantle. Negligible Eu anomalies, depletion in MREE (Middle REE) and HREE (High REE) indicates equal amount of clinopyroxene and plagioclase or twice as much plagioclase as hornblende in the residual melt. Microscopically the rock is coarse grained and composed of plagioclase, quartz, biotite, muscovite, hornblende, chlorite and epidote. Quartz and plagioclase are the dominant mineral phases present in the rock. The geochemical character indicates that the granitoids have generated either by partial melting of mantle or by melting of rocks of intermediate composition like basaltic rocks. According to trace element discrimination diagrams, the granitoids shows significant depletion in Rb, Ba, U, & Hf and high content of Th and Sr with respect to UCC. The samples of Lohit Granitoids are enriched in Th and Ce relative to Rb, Ta and Hf. Further Hf has very low value relative to normalizing composition. The pattern is indicative of similarity with Volcanic Arc Granite (VAG). Low value of Co, Ni and Cr rule out the possibility of a peridotite parental source since higher value of Ni, Co and Cr are good indicators of parental magma from a peridotite mantle source. On combining and correlating all the geochemical parameters, the magma has mixed origin involving both crustal component as well as mantle material forming in a subduction zone environment.

