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Combining petrographic and geochemical studies to understand the mode of emplacement of Himalayan granites from Arunachal Pradesh, Northeastern India

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Arunachal Pradesh in the northeastern most corner of India exposes two mica bearing porphyritic granite gneiss (Bomdila and Zimithang Granite); biotite and microcline bearing granite (Salari) and a tourmaline bearing two mica granite (Higher Himalayan leuco granite).

The four episodes of granite activity in Arunachal Himalaya are characterized on the basis of the tectonic zones in which they occur, their spatial and temporal distribution, the peak of magmatic activity and detailed petrography and petrochemistry. The Magmatism was initiated during the middle Proterozoic times with the emplacement of Bomdila granite and culminated in the Miocene, with the intrusion of the leucogranite.

The Bomdila granite is essentially a protomylonite with augens of microcline. It is coarse grained, porphyritic and at places displays rapakivi texture. It comprises microcline (phenocryst and matrix), plagioclase, quartz, biotite, muscovite, tourmaline and epidote [1] Bhattacharjee and Nandy, 2008. It contains numerous mafic magmatic enclaves (MME) and synplutonic mafic magmatic dykes of dioritic composition. As per the major and trace element geochemical studies this granite is sub alkaline, per aluminous, calcic and relatively potassic (upto 8.12%) with high silica content. Tectonic discrimination diagrams indicate a destructive plate margin or volcanic arc stage tectonic setting. Textural and geochemical evidence indicate a mixing of a crustal with a mantle magma.

Zimithang Granite is a senso stricto granite with potash feldspar / perthite, quartz, plagioclase and minor amounts of tourmaline, muscovite, garnet, biotite, with accessories chlorite, apatite, monazite, zircon and xenotime. It is peraluminous, with trace element plot indicating syn-collisional setting. Chemical dating of xenotime of both the variants of Zimithang granite gave 291$\pm$ 41 Ma indicating a newly reported episode of granite magmatism during early Permian in Arunachal Himalaya. The Salari Granite comprises k-feldspar, quartz and biotite. It is undeformed and is emplaced along the Dirang Thrust. Geochemically it is sub alkaline, peraluminous and show strong S-type character. Tectonic plot indicates an emplacement in volcanic arc.

The last episode of granite magmatism in this area is emplacement of leucogranite within the Higher Himalayan crystallines. It occurs as a series of lensoidal intrusions and is essentially a two - mica granite with muscovite dominating over biotite. It comprises microcline, albite, perthite, quartz, muscovite, biotite, garnet and tourmaline and displays sharp contacts with their country rocks. It is peraluminous and resulted from the migmatisation of the Higher Himalayan crystallines. Tectonically this granite is syn-collisonal [2] (Pearce, 1984).

References:

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[2] Pearce, J.A., Harris, N.B.W., and Tindle, A.G., 1984, Trace element discrimination diagrams for the tectonic interpretation of granitic rocks: Journal of Petrology, v. 25, p. 956-983.