

Genesis of Molybdenite Mineralization in the Khetri Area, Assam-Meghalaya Gneissic Complex, North-Eastern India

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This study investigates the genesis of molybdenite mineralization within the Khetri area of the Assam-Meghalaya Gneissic Complex (AMGC) in northeastern India. This region, geologically significant due to its complex tectonic history with Precambrian basement exposures, hosts a complex suite of granitoids, pegmatites, and migmatites that play a crucial role in understanding regional metallogeny. Molybdenite occurrences were identified within pegmatites associated with alkali feldspar granite and migmatite in the Helagog and Khaloibari areas. These pegmatites exhibit notable mineralogical features, including, presence of biotite, orthoclase, smoky quartz, tourmaline, fluorite, and apatite, including the presence of molybdenite as hexagonal and triangular platelets, frequently along the basal planes of biotite and cleavage planes of orthoclase.

Detailed geological mapping, petrography, ore petrography, geochemical analyses (XRF and ICP-MS), and fluid inclusion studies were carried out to delineate the mineralization processes. Field relationships suggest that molybdenite-bearing pegmatites are spatially related to plutonic margins, often displaying hydrothermal alteration features such as greisenization and boron metasomatism. Petrographic analysis reveals molybdenite's intimate association with fluorapatite, suggesting that fluorine-rich fluids contributed to Mo-complexation and transport. The association of molybdenite with fluorapatite and the presence of accessory minerals like tourmaline, beryl, and zircon indicate a magmatic-hydrothermal origin facilitated by late-stage fluid activity.

At least four generations of granitoids were identified in the area and posited that the porphyritic monzogranite and alkali feldspar granite are the most likely sources of molybdenum-bearing fluids. The presence of greisen veins, metasomatic tourmaline, and enriched fluorine levels further supports the role of evolved, volatile-rich melts in ore deposition. These findings highlight the potential of the AMGC as a prospective terrane for granite-related Mo and granophile element exploration contributing significantly to India's strategic mineral resource framework.