

Ore genesis of Gogi uranium deposit in Bhima Basin, Yadgir District, Karnataka, India

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Gogi Uranium Deposit in Karnataka, India, is located in the 40 km long E-W trending Kurlagere - Gundahalli (KG) fault in the southern margin of the Neoproterozoic Bhima Basin. The Uranium mineralisation is hosted by brecciated limestone and basement granite, in tectonised zone along the reverse KG fault. The basement granite has been thrust over the Bhima sediment along KG fault forming nose-like structure, resulting in intense brecciation and fracturing in limestone.

Uranium mineralisation in Gogi, hosted by the brecciated limestone and granite, occurs as veins, veinlets and fracture fillings. The mineralisation is intimately associated with sulphides and low rank bituminous organic matter of migratory type. The discrete uranium phases in both the host rocks are mainly coffinite and pitchblende, with minor amounts of U-Ti complex in granite. Two generations of pitchblende are identified, viz. the early-phase, which is partially replaced by coffinite, and the later phase replacing coffinite. The silica content in pitchblende has wide range from 1.7 to 10.2% due to varying degree of coffinitisation. The UO₂ content in pitchblende ranges between 74.56 and 87.22%, whereas the same in coffinite is in the range 64.18-84.65%. Both these minerals are characterised by negligible thorium (av. 0.04% and 0.02% respectively) and low REO content (av. 0.66% and 0.29% respectively), indicating low temperature (80 to 200 ° C) of formation.

Pyrite is the main sulphide mineral observed in the mineralised samples, with minor chalcopyrite, marcasite, arsenopyrite and galena. Pyrite occurs in various modes viz., coarse euhedral grains, reticulate network, oolitic, colloform / botryoidal, zoned and framboidal grains. The coarse cubic pyrite is brecciated with its microfractures filled with secondary calcite and limonite, whereas framboidal pyrite has overgrowths indicating solution activity.

The fertile basement granite in the area has anomalous uranium content in labile state, ranging from 10 to 110 ppm. Higher uranium values, upto 308 ppb, are also observed in the ground water from the granitic terrain. It is envisaged that the uranium from fertile granite was remobilised during deformation and transported as soluble carbonate complexes in the hydrothermal fluid. The spatial and textural relationship of sulphides and organic matter with uranium phases suggest that they have formed earlier and provided a strong reducing environment for the precipitation of uranium from hydrothermal fluids. Sulphur isotope study of pyrite revealed large variation in $\delta^{34}\text{S}$ from -13.9 to +25.3 ‰, indicating both biogenic as well as hydrothermal sources of sulphur. The mineral assemblage of pyrite, coffinite, pitchblende and calcite indicates that the mineralisation has taken place at Eh of -0.2 to -0.3 V and pH of 7 to 8.

The mineralogy of uranium minerals indicate a paragenetic sequence of pitchblende (early phase), followed by coffinite, later phase of pitchblende and U-Ti complex. The mode of occurrence, mineral assemblage, textural relationship, paragenetic sequence coupled with compositional characteristics suggest that the uranium deposit at Gogi is a fracture- controlled polyphase, epithermal vein type uranium mineralisation.

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