Wednesday Talk Series
Date: Wednesday, November 12, 2025
Time: 04:00 PM-5:00 PM
Venue: Mithal Hall, Department of Earth Sciences, IIT Roorkee

Genetic Constraints on Gold Mineralization in the metasedimentary rocks of the Lawa Gold Deposit, North Singhbhum Mobile Belt, East India.

Speaker: Paromita Banerjee

Abstract: The Lawa gold deposit in the Proterozoic North Singhbhum Mobile Belt (NSMB) is the only active gold mine in eastern India. There, mineralization is confined to a ~1000 m-long, NW SE-trending shear zone along the contact between ferruginous quartzite and phyllite of the ~1600 Ma Chandil Formation. A pervasive Fe-K-(Na-Ca) alteration assemblage, rather than discrete quart-veins, exerts primary control on mineralization. Stage-I alteration comprises albite + actinolite + pyrite-I + chalcopyrite ± magnetite and reflects infiltration of oxidized and acidic magmatic-hydrothermal fluids (>350°C). This is supported by Py-I geochemistry and in-situ $\delta^{34}S$ values of Py-I. Stilpnomelane + magnetite + chalcopyrite + carbonates ± native gold (Stage-II alteration) overprints the Stage-I assemblage and occupies pre-existing breccias. This Fe-K dominated assemblage and a lack of gold-sulfide association suggest transport of gold as $AuCl_2^-$ complexes. Fluid decompression along the preexisting breccias and H_2O-CO_2 unmixing raised fluid alkalinity and triggered native gold precipitation. Dolomite associated with native gold along brittle fractures and coeval stilpnomelane + magnetite (pH >7) supports this inference. The Stage-III alteration comprises abundant pyrite-II + chlorite + hematite ± chalcopyrite. Gold, exclusively occurring as Pb-Bi-Te-Au polymetallic inclusions along pyrite-II rims reflects remobilization of the pre-existing native gold as $AuHS^-$ complexes. Subsequent mixing of this fluid with meteoric water led to an increase in fO_2 and consequent deposition of Pb-Bi-Te-Au polymetallic inclusions. This contention is supported by the variable Co/Ni ratios, in Py-II and progressively lighter $\delta^{34}S$ values relative to Py-I.

Brief introduction: Ms. Paromita Banerjee is a Ph. D scholar in the Department of Earth Sciences, IIT Roorkee, working under the supervision of Prof. Rajarshi Chakravarti. Her work focuses on sulphide geochemistry and its applications in ore geology with emphasis on trace- element chemistry and in-situ sulphur isotopes and their role in discerning genesis of gold mineralization. She holds a B Sc. And a M Sc. Degree in Geology from Kumaon University, Nainital.