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Hydrothermal Fluid Evolution and its Implication on the Gold Mineralization associated with Chandil Formation within the North Singhbhum Crustal Province, Eastern India

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The North Singhbhum Crustal Province (NSCP) is a 200 km elongated arcuate belt lying within the Singhbhum Crustal Province of Eastern India. The study area belongs to the Chandil Formation within the NSCP and is demarcated at its southern margin by the Dalma volcanosedimentary belt. The Tamar-Porapahar Shear Zone (TPSZ) separates the Chandil Formation from the Meso/Neoproterozoic Chhotanagpur Granite Gneissic Complex (CGGC) at its northern boundary. The Chandil Formation comprises of meta-volcano-sedimentary and meta-volcanic rocks like, quartz-mica schist, phyllites, carbonaceous phyllite, quartzite and high Mg-basalts. These rocks are intruded by multiple generations of auriferous quartz veins.

The present work represents the study of the fluid inclusions associated with the auriferous quartz veins to understand the evolution of hydrothermal fluids responsible for the gold deposition within the area. Fluid inclusion types have been classified on the basis of phase, geometry, degree of fill and chemical composition at room temperature and attempts have been made to analyze fluid inclusions to interpret the composition, salinity and density of the fluid combined within dependent P-T estimates. Study of fluid inclusions from different generations of quartz veins from the area indicate the homogenization temperatures (Th) varying between 220º to 480º C. The temperature of final melting (Tfm) of the ice ranges between -14º to -30º C and suggests progressive evolution of hydrothermal fluids. Fluids, considered to be responsible for the gold mineralization in the Chandil area are aqueous rich H_2O-CO_2-NaCl system. Fluid inclusion geothermometric study suggests that the gold mineralization within the Chandil Formation is of mesothermal type comprising of highly saline H_2O–NaCl fluids and is comparable to the typical Iron Oxide Copper Gold (IOCG) type of deposits.