

SEG 2024 Conference: Sustainable Mineral Exploration and Development

Trace Element Systematics of Auriferous Sulfides and Its Implications on the Gold Mineralization Within the Vempalle Dolostone of the Cuddapah Basin, India

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Tummalapalle is well known for the uranium mineralization hosted within the Vempalle dolostone of Cuddapah Supergroup, southern India. The present study deals with the pyrite hosted invisible gold mineralization within the uraniferous dolostone. Petrographic studies reveals the presence of various sulfide phases i.e. pyrite, arsenian pyrites and chalcopyrite. On the basis of textural characteristics and trace elemental distribution (Co/Ni values), three generations of pyrites (Py1, Py2, and Py3) are identified. Py1 is fine grained and early to syn-diagenetic to the uranium minerals. Py2 is late diagenetic and show overgrowth texture. Py3 is euhedral in shape and is of hydrothermal origin. Py3 shows higher gold concentration among all the three pyrite generation. The sub-microscopic gold is present in association with the other trace elements i.e., As, Sb, Hg, Tl, and Cu. The Au/As ratio of all generations of pyrite indicate that, gold within the Vempalle dolostone occur as solid solution. Gold within the Py3 precipitated as solid solution from Au-As rich hydrothermal fluid, which is evident by the well-developed As rich zones over Py2. This study reveals that pyrites hosted gold mineralization within the Vempalle dolostone of Tummalapalle area was of sedimentary origin during the initial stages, but latter on remobilized and enriched by the hydrothermal fluid. It is inferred that the nanoscale gold mineralisation in the host sulfide is triggered by the combined effects of dissolution, transportation, precipitation, and biological activities, which is evident from the preservation of the stromatolitic cluster in auriferous sulfide bearing dolostone. This study is the first report on the pyrite hosted invisible gold occurrence within the uraniferous Vempalle dolostone of the Cuddapah sedimentary basin in and around Tummalapalle area.