EPMA Trace Element Mapping and Invisible Gold in Pyrite from the Kundarkocha Gold Deposit, Eastern India

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Gold mineralization at Kundarkocha is hosted in sheared grey quartz (+ carbonate) veins that were emplaced in carbonaceous pyrite-bearing phyllite, which occur with other low grade metamorphic rocks such as chlorite-biotite schist, talc-chlorite schist and fuchsite quartzite. The ore minerals in the veins are pyrite, pyrrhotite (± pentlandite flames), arsenopyrite, chalcopyrite, along with minor sphalerite and galena. These occur with gangue phases such as carbonates (calcite and ankerite), albite, chlorite, rutile and rare epidote. Gold occurs as enclosed grains within sulfides and free grains in quartz.

Pyrite exhibits excellent concentric growth zoning, manifested by varying reflectivity and silicate inclusion contents. X-ray maps for Co, Ni and As largely corroborate the observed optical zoning. The elemental zoning pattern includes (i) preservation of As-rich (and rare Co-rich) cores that correspond with double-concentric Ni zones, and (ii) Ni-rich (often Co-poor) rims, with multiple enrichment of As. Although Au content increases in the As-rich cores, there are also Au-rich zones, not correlated with As enrichment or depletion. Maximum concentrations of the trace elements (in ppm), obtained by EPMA line analyses are 22620 (Co), 14170 (Ni), 7040 (Cu), 22120 (As), 440 (Se), 6910 (Mo), 870 (Ag), 7320 (Te) and 600 (Au). The study demonstrates multiple growths on syn-sedimentary pyrites during diagenesis, low grade metamorphism and shearing, along with leaching of the lattice bound invisible gold by later fluids.