A Study on the Banded Iron-Formation Hosted Iron Ore Mineralization in Gandhamardan Hill, Keonjhar District, Orissa, India

Abstract

Banded iron-formations (BIF) of the Iron Ore Group (Archaean greenstone belts) of Jharkhand-Orissa region, India hosts a good number of large iron ore deposits (Fe wt % > 62). Iron ore mineralization of Gandhamardan Hill (Lat.21°36’0” and 21°40’30”; Long 85°29’0” and 85°31’32”), Keonjhor, Odisha is one of them where iron ores occur in two stratigraphic levels within a thick BIF unit which forms the top of the hill. One is strictly confined within banded iron formation (stratabound mineralization) with irregular geometry, and show fracture filling and replacement vein-type mineralization along the fringes of hard massive ores of the core. This type of mineralization is exposed along the western slope of the hill. Hard massive and laminated ores dominate this mineralization. The other type occurs as low dipping sheet like body within the upper part of the BIF horizon and covered by laterites forming the top of the hill. Flaky ores dominate this mineralization with formation of hard goethitic crust near the top. Both the mineralizations contain mineralized banded iron-formation. BIF core-stones are surrounded by hard massive or flaky iron ores. Hard massive ores are entirely represented by martite-microplaty hematite mineralogy. Hard laminated ores contain microplaty hematite and martite grains representing early magnetites of the banded iron-formation. Flaky ores are high porosity ores produced by leaching of silica, martite and microplaty hematite. Hard goethitic ores are developed due to replacement of martite and microplaty hematite by goethite or precipitation of goethite in the pore spaces.
The Gandhamardan iron ore bearing BIF is underlain by volcanics and different clastic and volcaniclastic rocks which provide important information of basin evolution. The geochemical studies of basal igneous rock indicate an OIB setting near to back-arc basin. Presence of rounded chert grains and rounded goethitised hematite, martite grains within underlying sandstone indicates that the sedimentary succession postdates a BIF-iron ore bearing succession. The undeformed and unmetamorphosed iron ore bearing BIF that overlies the studied sedimentary succession represents a younger unit, possibly the youngest in the region.

Occurrence of iron ores within banded iron-formation horizon close to vertical faults, hydrothermal brecciation and replacement of jaspery blocks by iron ores, presence of mineralized banded iron-formation core-stones within the massive hard ores and martite-microplaty hematite rich mineralogy of the ores strongly advocate in favour of hydrothermal origin for the Gandhamardan iron ore mineralization. The enrichment of REE from normal BIF to ore through mineralized BIF indicates a gain of REE related to hydrothermal mineralization. Iron bearing reducing and alkaline basinal or deeply circulated meteoric water may be held responsible for the hydrothermal mineralization. The ore fluid became oxidizing with cooling. Such hydrothermal ores, especially the top ore, recorded further leaching and goethitization under supergene environment.
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