Mechanism of formation, mineralogy and geochemistry of the oolitic iron ore deposit of Djebel Had, northeast Algeria

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Abstract

The Djebel Had Iron Formation (DHIF) is an eight meter thick stratiform sedimentary iron deposit, a part of the mining district of south Tebessa, in northeastern Algeria. Stratigraphic, lithological, structural and metallogenic similarities, suggest the DHIF formation may extend further into southwestern Tunisia. We show that mineralization occurs as layers of oolitic iron ore and inter-laminated iron marl within mid-Eocene gypsiferous marls. The more or less rounded, brownish-blackish oolites, of 2.0-100s of mm in dimension, are predominated by goethite, limonite, hematite, with traces of magnetite and piemontite. The grains display a smooth outer surface bound by an argilo-ferruginous layer embedded in siliceous-calcite cement. They are unusually friable, crumbling at the slightest shock. A high total iron (FeT) content of 50.12%, is dominated by up to 71.06% iron hydroxide (FeO(OH). Much of the iron is present as goethite, a common feature of iron-rich ooliths of North African origin. However, the lack of prominent chlorite minerals suggest the DHIF is not of a detrital origin. Instead, a negligible Ti and Al oxide concentration suggest a chemical provenance for the DHIF. The data suggest that ferruginous conditions developed in a potentially restricted/semi-restricted continental shelf margin where seafloor redox was sensitive to the alternating cycles of sea level change. We propose a new mechanism for the formation of oolitic iron ores, associated with shelf surface water eutrophication, bottom water anoxia promoted by sea level rise and the weathering of iron phosphate-rich rocks. Phosphorus and cerium enrichment, coupled to reconstructed redox depositional conditions and sediment mineralogy, suggest that intense biomass production stimulated the deoxygenation of shelf bottom waters and the deposition of the DHIF beneath a ferruginous water column.

Key words: Mineralogy; Geochemistry; Oolitic Iron; Ore; Tebessa

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DHIF: Djebel Had Iron Formation