

TRACE ELEMENTS AND ISOTOPE GEOCHEMISTRY (C, O and Fe) OF THE CAUÊ IRON FORMATION, QUADRILÁTERO FERRÍFERO: EVIDENCE FOR MICROBIAL DISSIMILATORY IRON REDUCTION IN THE ARCHEAN / PALEOPROTEROZOIC TRANSITION.

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RESUMO: A great volume of Banded Iron Formations (BIFs) was deposited during the first Great Oxygenation Event (GOE) around 2.45 Ga, for example the BIFs of the Cauê Formation, Minas Supergroup, Quadrilátero Ferrífero (QF), Minas Gerais state, Brazil. Samples of carbonatic (dolomitic/ankeritic) BIF from this unit were collected from a drillhole core ca. 600 m deep in the Alegria region. These samples are unique as they represent the least deformed, least metamorphosed section of the Cauê Formation studied so far, besides presenting no sign of hydrothermal alteration, thus furnishing important information on iron deposition in the basin. The main mineral phases are magnetite, ankerite, dolomite, amphibole (riebeckite and grunerite) and quartz. The variable distribution of those minerals identifies a gradual variation between four main lithofacies: (1) carbonate-magnetite BIF, (2) carbonate-magnetite-quartz BIF, (3) carbonate BIF and (4) magnetite BIF. In all lithofacies, the main primary structure is a plane-parallel lamination, with magnetite-rich laminae interleaved with carbonate or quartz-rich laminae, generally with a very fine granulation (ca. 20 μm). Individual laminae are ca. 2 mm thick, but locally can reach up to 1 cm thick. Locally, syn-sedimentary folds (*slumps*) and microfaults can be recognized. The geochemical data are very homogeneous and similar for all facies. In general, they suggest a low clastic contamination ($\text{Y}/\text{Ho} = 37.74$) and geochemical signatures close to that of the seawater ($\text{Gd}_{\text{PAAS}}/\text{Yb}_{\text{PAAS}} < 1$, $\text{La}_{\text{PAAS}}/\text{Yb}_{\text{PAAS}} < 1$), with positive La and Y anomalies. No true Ce anomalies are found. The mean Eu/Eu^* value is 1.62, close to the mean of the paleoproterozoic BIFs. Values of $\delta^{13}\text{C}$ are between -9.95 and -4.42‰, while $\delta^{18}\text{O}$ values are between -24.60 and -16.75‰. Values of $\delta^{57}\text{Fe}$ are mostly positive, between 0.7 and 1.9. Those are the lowest $\delta^{13}\text{C}$ values ever found for carbonatic BIFs of the QF. Associated with the positive $\delta^{57}\text{Fe}$, those values suggest that the carbonates of the Alegria BIFs were not directly precipitated from the seawater, in which case they would yield $\delta^{13}\text{C}$ values close to zero, like those found in the Águas Claras mine. Consequently, authigenic processes must have played an important role in the isotopic fractionation of carbon, oxygen and iron and in the formation of dolomite and ankerite, excluding the hypothesis of a hydrothermal origin for those carbonates. A possible model that would explain both the low $\delta^{13}\text{C}$ and the high $\delta^{57}\text{Fe}$ is the actuation of microorganisms in the dissimilatory reduction of the precursor ferric oxides in the sedimentary pile, as suggested for sequences of similar age around the world (e.g. Kuruman, South Africa and Hamersley, Australia). Ongoing isotopic and geochemical studies (including Cr isotopes) will contribute to consolidate this model. This work was funded by FAPEMIG through grants n. APQ-00914-14 and PPM-00539-15.

PALAVRAS-CHAVE: DISSIMILATORY IRON REDUCTION, BANDED IRON FORMATION, CAUÊ FORMATION