

PETROGRAPHY AND GEOCHEMISTRY OF THE LEAST ALTERED BANDED IRON-FORMATION OF
THE ARCHEAN CARAJÁS FORMATION, NORTHERN BRAZIL

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Abstract

The Carajás area is in the southeastern part of the state of Pará, Brazil, and includes one of the largest iron ore deposits in the world, located about 600 km south-southwest of the city of Belém. The total iron ore resources are estimated at 17.8 billion tons with an average total Fe content of 66.1 percent. The iron ore deposits are hosted in the Carajás Formation, which is a 400-m-thick sequence of banded iron-formation (BIF) and minor dolomitic rocks, intruded by some irregular mafic rocks. Single zircon dates from a mafic sill that cuts the sequence constrain the age to a minimum of 2740 ± 8 Ma. The samples of this study occur in the N4E deposit that lies at the northern limb of a synclinorium. The metamorphic grade is greenschist facies. The BIF occurs as relict, hard “jaspilite pods” (protore for the deposit) in the hematite open pit mines and is also intersected in places in diamond drill cores. The bulk chemistry of these BIF samples is very simple and consists mainly of SiO_2 and Fe_2O_3 . Their REE show an overall trend of relative enrichment in the light REE, a well-defined positive Eu anomaly in three of the samples and a slight hint of a positive Eu anomaly in one more sample. The REE profiles for the Carajás BIF have background trends similar to those reported for some other Archean BIFs such as Isua, Greenland, and the Nova Lima Group of Quadrilátero Ferrífero, Brazil. However, these background trends are quite different from those reported for the Early Proterozoic Transvaal BIFs in South Africa, which show a positive background slope with relative depletion in the light REE and relative enrichment in the heavier REE. The common presence of positive Eu anomalies in the Carajás BIFs is concluded to be the result of input from suboceanic hydrothermal solutions. These solutions are considered to have transported the iron and SiO_2 to the BIFs, from deep-sea spreading center sources of the Carajás Rifted basin. Such a deep-sea hydrothermal origin is similar to that postulated for other Archean and Proterozoic BIFs worldwide.