ANAIS

VI SIMPÓSIO BRASILEIRO DE
METALOGENIA
17 A 20/8/2025 - SALVADOR - BA

A Metalogenia para o Desenvolvimento do Setor Mineral Brasileiro.

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Salvador, 17 a 20 de agosto de 2025

Organizadores:

Comissão Organizadora do VI Simpósio Brasileiro de Metalogenia

ADIMB – Agência para o desenvolvimento Tecnológico

Salvador, Bahia, Brasil

2025

Ficha Catalográfica

Dados Internacionais de Catalogação na Publicação (CIP)
(Câmara Brasileira do Livro, SP, Brasil)

Simpósio Brasileiro de Metalogenia
(6. : 2025 : Salvador, BA)
Anais do VI Simpósio Brasileiro de Metalogenia [livro eletrônico] : a metalogenia para o desenvolvimento do setor mineral brasileiro / organização Poliana Iara de Freitas Toledo, Simone Cerqueira Pereira Cruz. -- Salvador, BA : ADIMB, 2025.
PDF

Vários autores.
ISBN 978-65-988953-0-3

1. Geologia - Brasil 2. Minerais - Brasil I. Toledo, Poliana Iara de Freitas. II. Cruz, Simone Cerqueira Pereira. III. Título.

25-304917.0 CDD-549

Índices para catálogo sistemático:

1. Rochas e minerais : Mineralogia 549

Eliane de Freitas Leite - Bibliotecária - CRB 8/8415

STRUCTURAL CONTROL, TRACE ELEMENT COMPOSITION AND ISOTOPIC CONSTRAINTS ON THE PALEOPROTEROZOIC HYDROTHERMAL EVENTS AT THE JAGUAR NICKEL DEPOSIT, CARAJÁS PROVINCE, BRAZIL.

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The Jaguar hydrothermal nickel deposit, situated in the Carajás Mineral Province (Brazil), represents a valuable case study for understanding the interplay between tectonic deformation, hydrothermal fluid evolution, and nickel sulfide ore formation. The nickel mineralization is hosted by felsic porphyritic subvolcanic rocks at the Jaguar South orebody (JSO) and granitoid and mafic-ultramafic rocks at the Onça Preta orebody (OPO). High-strain zones associated with the E–W sinistral transpressional McCandless Fault control the distribution of these orebodies. The N–S shortening generated foliation and boudin necks that acted as loci for fluid flow and sulfide mobilization. The hydrothermal nickel mineralization was accompanied by widespread Fe–Ca alteration zones with apatite, which serves as a key tracer of hydrothermal fluid evolution. In JSO, two apatite (Ap) types were identified. Ap (I) is fine-grained and aligned with biotite, actinolite, pyrrhotite-(pentlandite), and millerite. Ap (II) occurs as coarse-grained crystal within chlorite-quartz halos. Both apatite types show negative Eu anomalies in chondrite-normalized REE patterns. Ap (II) has lower LREE contents and higher Sr/Y ratios, evidencing dissolution-reprecipitation processes. At OPO, apatite associated with magnetite, cummingtonite, talc, and sulfides shows high ∑REE, a slightly fractionated LREE pattern, and a similar negative Eu anomaly. Apatite geochronological data reveal two distinct Paleoproterozoic hydrothermal events. In the JSO, U–Pb ages range from ca. 2. 22 to 1. 88 Ga, while Lu–Hf ages span from ca. 2. 13 to 1. 91 Ga. In the OPO, U–Pb and Lu–Hf ages are Orosirian (ca. 1. 84 to 1. 88 Ga, respectively). Rb–Sr isochron analyses of the JSO yielded consistent ages of ca. 2. 00 Ga, with initial $^{87}Sr/^{86}Sr$ ratios of 0. 28, suggesting a relatively closed system at the time of alteration. More detailed $^{87}Sr/^{86}Sr$ analyses in apatite reveal contrasting isotopic behavior. The JSO samples display highly radiogenic signatures (0. 87 to 0. 822), reflecting interaction with radiogenic crustal fluids and isotopic disturbance likely caused by multiple overprinting hydrothermal events. In contrast, the OPO sample shows a less radiogenic and more uniform $^{87}Sr/^{86}Sr$ ratio (0. 23), consistent with a simpler event and a more internally consistent isotopic system. These findings highlight a complex metallogenic history involving an early hydrothermal stage (ca. 2. 2–2. 0 Ga) likely related to the reactivation of the McCandless Fault, foliation development and ore mobilization at JSO, followed by a younger remobilization event (ca. 1. 91–1. 84 Ga) involving fluid-assisted mechanical processes. The integrated structural, geochemical, and isotopic evidence enhances our understanding of nickel sulfide formation and nickel mobilization by crustal fluids in transpressional tectonic settings, providing critical insights for mineral exploration in similar Precambrian terranes.