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Pb-Pb Sulfide Age Constraints on the VHMS Zn-Pb Deposit of the Mundo Novo Greenstone Belt, NE Brazil, and the Metallogenic Implications Along the Contendas-Jacobina Lineament

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Thermal ionization mass spectrometry (TIMS) Pb-Pb geochronologic data allow the determination of the timing and genesis of the volcanic-hosted massive sulfide (VHMS) Zn-Pb deposit located at Coqueiro Farm and hosted in the Neoarchean Mundo Novo greenstone belt (MNGB), eastern São Francisco Craton, NE Brazil. The mineral deposit is inserted in the Rhyacian-Orosirian Contendas-Jacobina Lineament, which extends approximately 300 km at a north-south trend between Paleoarchean tectonic blocks, causing a broad metallogenic interest along this regional structural feature, in which is also located other important Neoarchean terrain named the Contendas-Mirante metavolcano-sedimentary belt (CMB). The basement of the MNGB comprises tonalite-trondhjemite-granodiorite orthogneisses, migmatites, and subordinate Paleoarchean metarhyolites and metagranites tectonically emplaced between supracrustal rocks. The metavolcanosedimentary rocks of the VHMS deposit were initially formed in an ocean floor setting and comprise the western metabasalts, calc-silicate rocks, aluminous schists, metacherts, banded iron formations and tremolitites of the middle sequence, and the metasedimentary siliciclastic rocks of the upper sequence of the MNGB. The western metabasalts host two hydrothermal alteration zones: one carbonate (calc-silicate rock), proximal, hosting massive sulfides (8 m thick) composed mainly of sphalerite and galena with minor chalcopyrite; and another sericite-chlorite (aluminous schists), distal, hosting mainly disseminated chalcopyrite and traces of galena and sphalerite. Pb-Pb galena, chalcopyrite, and sphalerite data on the massive and disseminated zones in the Coqueiro Farm deposit yield model ages of 2804 ± 11.15, 2794 ± 11.2, and 2767 ± 11.1 Ma, respectively, and the Pb contained in these minerals was sourced from the upper crust based on uranogenic and thorogenic diagrams. The Pb-Pb isochron crystallization age of 2747 ± 16 Ma obtained from the chalcopyrite and sphalerite samples from the massive and disseminated zones suggests that the sulfides are coeval and were not strongly affected by later metamorphic-hydrothermal events. The crystallization age of the sulfides is also in agreement with the previous Neoarchean crystallization age obtained from MNGB volcanic rocks. Therefore, the VHMS deposit in the MNGB would have formed from Neoarchean ocean floor volcanic exhalative processes, and the Rhyacian-Orosirian tectonic event compressed the deposit between Paleoarchean blocks along the Contendas-Jacobina Lineament, preserving the sulfides from remobilization processes. Evidence of Neoarchean hydrothermal alteration zones coeval with ocean floor exhalative processes, all amalgamated along the Rhyacian-Orosirian Contendas-Jacobina Lineament, are important rules for the discovery of new settings that host VHMS-type deposits similar to those described in the MNGB. In this sense, the new metallogenic perspectives opened along the Contendas-Jacobina Lineament extension include the Neoarchean volcanic lithological associations formerly described in the CMB in addition to other similar and cogenetic settings that eventually may be discovered along the lineament based on the new exploratory parameters resulting from MNGB studies.

Fig. 1. A) São Francisco Craton, NE Brazil. B) MNGB and CMB in the Contendas-Jacobina Lineament and the structural lineaments of the eastern São Francisco Craton. C) Geologic setting in which the MNGB and VHMS deposit are inserted and the Paleoarchean blocks of the eastern São Francisco Craton.