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ST.001
Sulfide Mineral Chemistry Integrated with Principal Component Analysis to Constrain the Ore Genesis of the Morro Agudo Pb-Zn District, Brazil

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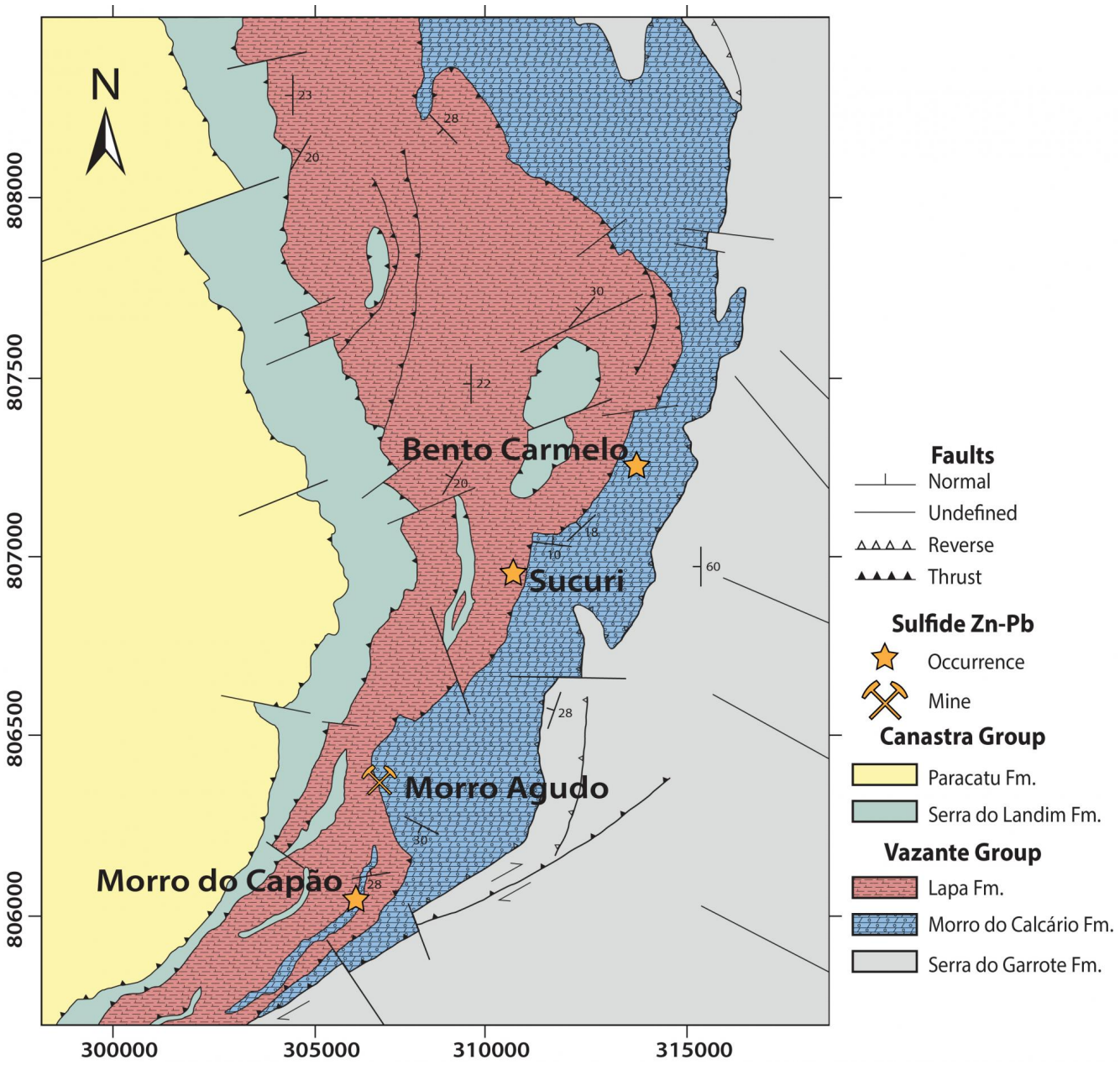
The Vazante-Paracatu Pb-Zn mineral belt in central Brazil accounts for the majority of Brazilian base metal production. The Mesoproterozoic (1.3-1.1 Ga) Upper Sequence of the Vazante Group hosts distinct styles of mineralization, including the world-class silicate zinc deposits (Vazante and North Extension) and sulfide deposits (Morro Agudo, Fagundes, Ambrósia, and Bonsucesso) and occurrences (Bento Carmelo, Sucuri, and Morro do Capão). The mineralization is hosted in dolomitic rocks in the northern (sulfide zinc-lead) and southern (silicate-zinc) parts of the belt. This study focuses on the Morro Agudo District where the interpretation of the processes and timing related to the formation of the sulfide deposit is controversial (coeval with sedimentation or with the Neoproterozoic Brasiliano Orogeny) and little is known about the other occurrences. The main ore minerals throughout the district are sphalerite and galena associated with micritic and sparitic dolomite, hydrothermal dolomite, pyrite, and quartz. The compositions of sphalerite and pyrite were determined by electron microprobe analyses (EMPA) with the objective to understand the processes related to ore formation during the evolution of the district. Sphalerite grains were selected from each of the occurrences and from the various orebodies at Morro Agudo Mine (Basal, JKL, M, and N) in various sections of the deposit (483, 580, 350) to identify spatial variability. To identify element associations and populations within the district, principal component (PCA) and cluster analyses were applied. Three end-member populations of sphalerite were identified: Fe-rich, Cd-rich, and Cd-Fe-poor. The variation of the sphalerite composition was not controlled by host rock composition, indicating that high fluid-rock ratio and additional factors such as physical-chemical conditions of the metalliferous brine or mixing of fluids influenced the composition. The lower orebodies of Morro Agudo, the JKL and the Basal, display great variability in composition but primarily fall between the Fe-rich and Cd-rich end-members, suggesting that fluid physical-chemical conditions changed during deposition. This could be related to multiple episodes/events of fluid-rock interactions or fluid mixing. However, the Basal orebody in section 580 and the JKL orebody in section 350 are poor in Fe and Cd. This composition is similar to samples from Morro do Capão and likely formed from a distinct fluid composition compared to other orebodies. The upper orebodies, M and N, display lesser variability between Fe-rich and Cd-rich end-members. The sphalerite composition of Sucuri is similar to those of Morro Agudo and likely formed from similar fluids. Bento Carmelo has a unique mineral chemistry with intermediate contents of Zn and Cd and elevated contents of Hg, Cu, and Ni, suggesting the fluid-rock interactions and processes related to ore formation were unique at this location. This is consistent with whole-rock lithogeochemistry and ore-related mineralogy. The results show that the history of metalliferous fluids is complex and likely represents either episodic/multiple fluid events or fluid mixing.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Bento Carmelo
Sucuri
Morro Agudo
Morro do Capão
23
28
20
30
22
20
18
10
60
28
30
28
Faults
Normal
Undefined
Reverse
Thrust
Sulfide Zn-Pb
Occurrence
Mine
Canastra Group
Paracatu Fm.
Serra do Landim Fm.
Vazante Group
Lapa Fm.
Morro do Calcário Fm.
Serra do Garrote Fm.