

# SEG 2024 Conference: Sustainable Mineral Exploration and Development

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## Nickel-Copper Sulfide Mineralization in the Maibele-North Ni Sulfide Prospect, Central-Eastern Botswana

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The Maibele Ni-Cu (PGE) prospect in central-eastern Botswana represents partially metamorphosed mafic-ultramafic intrusions. In this study we focus on the detailed description of sulfide mineralization and petrologic characterization of the partially metamorphosed mafic-ultramafic host rocks aiming at better constraining the geodynamic context of the prospect. The Maibele prospect occurs within the Magogaphate shear zone, which marks the boundary between the Zimbabwe craton and the central zone of the Limpopo Complex. Host rocks in the Maibele prospect can be divided in two: (1) the amphibolites herein referred to as meta-gabbros; (2) ultramafic zone (UZ) characterized by pyroxenite cumulates intruded into granitic gneisses. Petrographic observations reveal a crystallization sequence for the UZ comprising olivine, orthopyroxene, plagioclase and minor clinopyroxene. The Ni-Cu sulfides occur as disseminated and massive mineralization within the UZ and the meta-gabbros. The main sulfide assemblage comprises pyrrhotite, pentlandite, chalcopyrite and pyrite. The mineralized pyroxenites feature variable forsterite (Fo) contents of olivines ranging from Fo 82.4 to 88.2 suggestive of a primitive parental magma source composition. The olivines are Ni depleted and exhibit sulfide fractionation trends suggesting that magmas from which the sulfides at the Maibele prospect precipitated underwent sulfide extraction, resulting in Ni-depleted olivines. S/Se ratios extend beyond typical mantle compositions. Ratios of trace elements including  $(Th/Yb)_{PM}$  and  $(Nb/Th)_{PM}$  are unlike those of typical mantle rocks and interpreted to indicate significant crustal throughput by the magmas. Together with the S/Se ratios, the trace element ratios likely suggest that crustal sulfur played a role in the sulfide saturation at the Maibele prospect.