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# Application of geophysical techniques in mineral exploration for potential sulphide deposits in Musina area

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Copper mining in the Musina area dates back to a couple of centuries, when the indigenous Africans used stone hammers and iron tools to mine the ore. Ancient smelting sites are still visible in the high ridges. However, modern mining dates back to 1906 when the Musina development company started mining the copper ore at the Campbell, Harper, Artonvilla, Messina and Spence mines. Since then over 40 million tons of ore was mined, recovering about 700,000 tons of copper. Copper was recovered from chalcopyrite, bornite and chalcocite. Mining stopped in 1992. The current study on the Musina deposits focused on the geology, geochemistry, mineralogy and structural setting of the deposits with much emphasis on the application of geophysical techniques in the exploration potential sulphide mineralization in area. Previous studies indicate that sulphide mineralization took place within quartz veins and also as disseminations within amphibolite's and metamorphosed limestone resulting in 2 types of ores; the veined and the disseminated ore deposits. The deposits appear to lie along linear trends stretching from east to west. These linear profiles coincide with known major faults in the area. This is the indication that, the deposits were structurally controlled, thus the structures acted as channel ways for the mineralized hydrothermal solutions. Sulphide mineralization took place within the crystallizing quartz veins. At the same time, the host rocks were heated up; hence the dissemination of sulphide minerals within amphibolite's and metamorphosed limestone. An integrated ground geophysical survey was conducted on the Aeromagnetic (EM), the geochemical anomalies and known geological structures. The reprocessed data from the geochemical study of soils and sediments in the area showing high concentrations of Cu and the known major faults in the area were used as target zones for geophysical exploration. Aeromagnetic data was used to identify possible lineaments in the area to select the profiles for ground geophysical surveys designed to run across these lineaments and known major faults for potential sulphide mineralization exploration. Ground magnetic, DC resistivity and induced polarizations techniques were used in the exploration to measure the associated physical parameters below the subsurface. All the geophysical techniques yielded good responses. The geophysical anomalies conform to the known delineated lineaments and faults in the area. Magnetic susceptibility, induced polarization and DC resistivity anomalies indicated that the potential sulphide mineralization are structurally controlled and major faults and the minor ones in the area are the likely potential zones of sulphide mineralization.

**Biography**

Milton Obote Kataka is a Senior Lecturer, Department of Mining and Environmental Geology, University of Venda, South Africa. His area of interest are Mineral Exploration, Application of Geophysical methods in mineral explorations, Seismic waves, Mining Seismology and Seismic waves interactions with Engineering Structures; Influence of Engineering Geological Conditions on Engineering constructions (roads, high rise buildings, dams, bridges, poles power line installations), Hydrological studies, Groundwater and Contaminant Explorations, Water quality assessment, Well Pump Test and installation, Interactions of Groundwater and Surface water, Groundwater Recharge Modeling.

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