

# **Origin of shear zone-hosted copper mineralization at Aït Abdellah (Bou Azzer-El Graara, Anti-Atlas, Morocco): insights from mineral chemistry and fluid inclusions.**

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Through new field data, mineralogical investigations and fluid inclusions, we aim to specify the lithological and structural controls of the copper mineralization linked to the Ait Abdellah shear zone in the Bou Azzer inlier (Anti-Atlas, Morocco). The copper mineralization is hosted in feldspathic sandstones of the Tiddiline Group, which overlie the Bou Azzer ophiolite. The mineralization is localized within a NE-SW trending shear zone characterized by mylonitic fabrics, calcite veins, and fracture networks, shaped by an initial ductile deformation phase followed by a brittle phase with faults, brecciated veins, and stockwork zones. These tectonic features created pathways for fluid migration and copper sulfide precipitation, with mineralization dominated by chalcopyrite, pyrite, bornite, chalcocite, covellite, digenite, and Cu-bearing carbonates like malachite and azurite. Fluid inclusion analysis provides insight into the temperature and salinity conditions during mineralization. Primary inclusions in quartz from the host rocks show homogenization temperatures exceeding 300°C and salinities ranging from 5.5 to 11.22 wt.% NaCl equivalent, suggesting pressures between 1.5 and 2 kbar. Secondary inclusions in quartz-calcite veins exhibit moderate temperatures (195–310°C) and higher salinities (up to 23.2 wt.% NaCl equivalent), reflecting a cooler, shallower environment with pressures between 0.7 and 1.1 kbar. These results indicate progressive cooling and pressure reduction during mineralization. Overall, this study enhances understanding of copper deposit formation in the Anti-Atlas, emphasizing the role of the Precambrian basement and tectonic-volcanic processes in controlling mineralization.