

Sulfur Mineralizations of the Tichibanine Deposit (Bou-Azzer Inlier, Central Anti-Atlas, Morocco): Geology, Petrographic Investigations, and Sulfide Ore Chemistry

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The origins of numerous copper deposits within the Neoproterozoic to Cambrian formations of the Bou-Azzer inlier, remain a subject of ongoing debated. To contribute to this discussion, structural, petrographic, and geochemical investigations were conducted on the Tichibanine copper deposit. This deposit, situated in the extreme ESE of the inlier, is located within the northern domain, specifically the Tichibanine Ben-Lagrad Group. This domain is bounded to the north by the Ediacaran volcano-sedimentary formations of Ouarzazate Group and to the south by the sedimentary formations of Tiddiline. At the group scale, several mineralized zones, including Tichibanine, Tanaladat, and Ben-Lagrad, have been identified. Copper mineralization occurs both within altered volcanic lithologies (e.g., epidotized basalts and chloritized dacites) and in association with quartz and carbonate veins, which exhibit surficial malachite occurrences. Mineralized structures at Tichibanine display a variety of orientations, predominantly E-W, and define lithological contacts between chloritized dacites and spilitized basalts. These structures are sub-parallel to the major N120 fault and exhibit folding proximal to it. Field observations, drill core logging, and scanning electron microscopy petrography revealed diverse mineralization modes, including sub-massive veins, veinlets and disseminated forms within the rock mass. The mineral assemblage comprises chalcopyrite, pyrite, sphalerite, sulfosalts (+/- arsenopyrite), and iron oxides (magnetite, ilmenite, and hematite). Electron probe microanalysis (EPMA) point analyses were performed on ore samples to determine ore mineral chemistry. Additionally, laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) analyses were conducted on the pyrite and chalcopyrite from Tichibanine. Preliminary analysis of the LA-ICP-MS data indicates significant trace elements variability within the pyrites. Two pyrite generations were identified, with concentrations of As, Se, Te, Cu, Zn, and Pb decreasing from early-stage pyrite (pyrite 1) to late-stage pyrite (pyrite 2).