Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.33147

Structural control and paragenetic evolution of Co–Ni–Fe–bearing arsenide mineralization in the Bou-Froukh Massif (Bou Azzer El Graara inlier, Anti-Atlas, Morocco)

MS. MARIEME JABBOUR, PHD STUDENT[1], CAROLE CORDIER[2], ZOUBAIR EL OUAD[3], PROF. SAÏD ILMEN[4], MOHA IKENNE[5], MR. MOHAMED AIT ADDI, PHD[6], DOMINIQUE GASQUET[7], MUSTAPHA SOUHASSOU[8], NOURDDINE IBNAHMAD[9], YOUNES MOUNDI[10], ABDELHAQ KARFAL[10] AND LHOU MAACHA[11]

[1]LAGAGE, Ibn Zohr University, Agadir, Morocco
[2]CNRS, Université Grenoble Alpes
[3]2GBEI Laboratory, Polydisciplinary Faculty of Taroudant, Ibn Zohr university
[4]Ibn Zohr University
[5]Ibn Zohr University, Agadir, Morocco
[6]Faculty of Sciences, Moulay Ismail University
[7]EDYTEM, Université de Savoie- Mont Blanc, CNRS, F 73376, Le Bourget du Lac Cedex, France
[8]Polydisciplinary Faculty of Taroudant, Ibn Zohr university
[9]MANAGEM Group
[10]MANAGEM Group, Twin Center, 20000, Casablanca
[11]Managem Group, Twin Center, Tour A, B.P. 5199, Casablanca 20000

The Bou-Froukh sector, at the western margin of the Bou Azzer–El Graara inlier (Anti-Atlas, Morocco), preserves a representative slice of the Bou Azzer cobalt system where Co–Ni–Fe arsenides are structurally focused along serpentinite–quartz diorite contacts. New field mapping documents a fault network dominated by E–W to WNW–ESE sinistral faults (Méchoui–Mokhazni system), ENE–WSW reverse faults, and later N–S to NE–SW brittle faults. These structures intersect reactive lithologic boundaries between serpentinized peridotite and quartz diorite, localizing lens-shaped contact ores and steep quartz–carbonate veins.

Petrography shows a complete arsenide paragenesis with skutterudite, safflorite, löllingite, cobaltite and arsenopyrite, accompanied by minor Ni arsenides (nickeline ± rammelsbergite) and late sulfides (chalcopyrite, sphalerite, pyrite) in a quartz–calcite–dolomite gangue. Serpentinite proximal to ore is pervasively silicified and carbonated (listvenite-like), grading outward to talc–chlorite alteration; chromite commonly alters to ferritchromite and Cr-carbonates, attesting to sustained fluid–rock interaction. Electron-microprobe analyses and micro-XRF elemental maps resolve systematic metal zoning at grain- to lens-scale: Ni-rich cores (nickeline, Ni-rich skutterudite) are overgrown by Co-rich skutterudite–safflorite and, finally, Fe-rich löllingite–arsenopyrite rims. Sulfur is restricted to sulfarsenides and late sulfides, whereas Cu–Zn are fracture-controlled and minor. These data define a robust three-stage sequence—early Ni-arsenides, a dominant Co-arsenide/sulfarsenide stage, and a late Fe-arsenide ± sulfide–carbonate overprint—consistent across Mokhazni and Lakhder.

Integrating structure, alteration, and mineral chemistry, Bou-Froukh records the district-scale hydrothermal evolution wherein saline, CO_2-bearing brines were focused by reactivated Pan-African faults, chemically trapped at serpentinite–diorite contacts, and progressively evolved from Ni- to Co- to Fe-arsenide precipitation. The results refine sector-scale vectors for exploration in the western district: serpentinite–diorite contacts within E–W fault corridors, silica–carbonate (listvenite) footprints with chlorite breccias, Co–As cores with peripheral Ni.