

Post Hercynian circulation of brines in the central Jebilet: The Bir N'has, Sarhlef and Bramram Pb-Zn deposits, Morocco.

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The Bir N'has, Sarhlef and Bramram Pb-Zn deposits are located in the Central Jebilet, few tens of kilometers (< 35 km) north of Marrakesh, Morocco. The same vein types are observed in all these deposits: early NE-SW quartz (\pm tourmaline, chlorite) veins crosscut by E-W quartz-carbonates ore veins. Mineralogical and fluid inclusion studies have shown the presence of two stages of fluid circulation and mineral deposition: - Stage (1): Early white-grey deformed quartz associated with small amounts of pyrite, followed by a microcrystalline quartz; this stage is associated to the circulation of N_2 - CH_4 \pm CO_2 metamorphic fluids (salinity: 7 % to 22 wt % NaCl equiv, Th: mostly > 410°C); - Stage (2): started with siderite deposition ($\delta^{13}C$: - 9.2 to - 6.9 ‰_{V-PDB}; $\delta^{18}O$: 21 to 24.4‰_{V-SMOW}) followed by feathery quartz, saccharoid quartz, then calcite ($\delta^{13}C$: - 14.1‰_{V-PDB} at Bramram), dolomite, locally barite (at Sarhlef), then Fe-rich sphalerite followed by galena (respectively $\delta^{34}S_{V-DT}$: + 12.9 ‰ and + 8.6 ‰ at Bir N'Has). Galena is synchronous with small amounts of chalcopyrite and Fe-dolomite. Ore fluids (Zn-Pb fluids) in all of those deposits are brines (9 wt % to > 27 wt % NaCl equiv) with Th from 70° to 210°C. Cooling seems to be the major deposition mechanism. According to isotopic data, carbonates formed from fluids with organic carbon and sulfur originates from seawater or evaporites. Similarities in veins and fluid types, mineralogy and isotopic data suggest that these deposits result from the same regional mineralizing event. The latter corresponds to the circulation of moderate to high salinity/low temperature brines. This event is post Hercynian likely associated with the pre-Atlasic to Atlasic extension related to the Central Atlantic opening.