Geochemistry and P-T conditions of hydrothermal fluids associated with the Upper Miocene post-collisional magmatism at Wadi Belif (Northwestern Tunisia): Origin of metals and trace gold mineralization

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In Nefza mining district (Northern Tunisia), post collisional hydrothermal activity is manifested by exhumed porphyry-Cu (Au) breccia, epithermal Fe rich veins and phlogopite-rich skarn deposits (Ben Aissa et al. 2020). Regional surface geochemical prospecting and mapping indicate that poly-metallic anomalies are preferably localized along NNE-SSW and ENE-WSW directions that coincide with the major fault directions and the post-collisional magmatic outcrops of the region. Chemism is dominated by a matter transfer influenced by mantellic affinity elements (Ni, Co) and argues in favor of the deep rooting of these faults. Microthermometric measurements indicate that P-T trapping conditions are P= 38 MPa to 50 MPa, T= 198.22 to 259°C for epithermal phase and P= 110.0 MPa , T= 568 to 384°C with salinities ranging between 33.85 -50.84 wt% NaCl equiv for the porphyry–Cu (Au) phase. Such high salinity values indicate the prevalence of magmatic origin of fluids exsoluted during mineralizing process. Geochemical spider diagrams normalized to the upper continental crust showed three types of geochemical associations: (1) Au-Sb-(Ag-U) association for the porphyry –Cu (Au) phase, (2) As-Au (U) association for the Fe rich breccia and (3) As-Sb-Fe-(U) association for the epithermal Fe rich phase. These associations confirm the deep origin of metals that originated from a deeper level than the upper continental crust. La = f (As, Bi, U, Th, Pb and Ba) diagrams indicate the correlation between the degree of REE fractionation expressed by the high La content and the enrichment of mineralization in the majority of the metallic elements, reflecting the effect of hydrothermal leaching and metal transfer. Fe, Zn, Cu, Ti, S, As, Sr, Ba , Te, Se, Ag, Sn, Bi, Mo, W, U, Hg = f (Au) diagrams showed two populations. The first population linked with epithermal phase where Au content do not exceed generally 200 ppb, and where Au is correlated with a large number of elements and a second population linked with porphyry (Au) phase where Au content can exceed 200 ppb up to 850ppb and correlate with a limited number of elements including Mo, U, Sn, Fe, (Bi, Cu).

Mots-Clés : porphyry-Cu (Au), epithermalism, fluid inclusions, geochemical mapping, gold

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