

The Late Ediacaran Imourkhssen Cu-Mo-Au-Ag porphyry system: Geochemical and geochronological insights

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The Imourkhssen Cu-Mo-Au-Ag deposit is located at the Ouzellagh-Siroua Salient within the juncture between the central Anti-Atlas and the central High Atlas. Geologically, the area consists of volcanic rocks belonging to the Sagro Group (620–600 Ma), intruded by numerous Late Ediacaran magmatic suites (LEMS) of the Ouarzazate Group (580–539 Ma), hosting a porphyry style mineralization. The LEMS consists of (i) the Assarag Suite, (ii) the Amassine Suite and (iii) the Ougougane Suite. New Zircon U-Pb dating of the Imourkhssen granite (Amassine Suite) and the ore-bearing granite porphyry (Ougougane Suite) shows that these intrusive rocks were emplaced at 558 ± 1 and 550 ± 2 Ma, respectively. These new dates allow to discriminate the ore bearing intrusion and to rename it as the Imourgane granite, and subsequently to define it as a part of the Ougougane Suite. The entire set is intruded by the Zaghar mafic dyke swarms.

Geochemical analysis (whole-rock major and trace elements) of the LEMS constrain a high-K calc-alkaline I-type composition with fractionated LREE and flat HREE patterns, consistent with an emplacement in a post-collisional setting. The compositional variation between SiO_2 and MgO , FeO , CaO , TiO_2 , K_2O , Sr , V , Rb and Th suggests that the crystal fractionation played a key role in their genesis.

The ore bodies reveal a sulfide mineralogy consisting of molybdenite, pyrite, chalcopyrite, galena, tennantite barite dissemination. Moreover, a NNE sulfide bearing system comprises pyrite, chalcopyrite, hematite, scarce chenguodaite traces, bornite, covellite, digenite, galena, and native gold. The supergene stage is achieved by hematite, malachite, azurite, barite and chrysocolla. The results argue with an unique Late Ediacaran porphyry style mineralization formed during the Pan-African Extensional Collapse, contemporaneous with the emplacement of the Ouarzazate Silicic Large Igneous Province (OSLIP). This context contributed to the formation of various porphyry and epithermal ore deposits all over the Sagro