

**Abstract** Lode gold mineralization at the El-Sid mine area is associated with the *ca.* 600 Ma Fawakhir granite intrusion, which cuts the ~737 Ma ophiolite nappes in the Central Eastern Desert of Egypt. The mineralized quartz veins are hosted by ~E- and NE-trending fault/fracture sets cutting the western boundary of the intrusion and sheared ophiolites. The results of electron microprobe analyses of gold-associated hydrothermal sulfide and silicate minerals suggest that Au was mobilized alongside Ni, Co, Cr and As from the adjacent ophiolitic serpentinite. After granite emplacement, hydrothermal fluids interacted with the sheared serpentinite, leaching metals and re-depositing them in the faults/fractures and adjacent wall rock in a cyclic process. Low-salinity aqueous-carbonic fluids with significant quantities of volatile species ( $\text{CO}_2$ ,  $\text{CH}_4$ , and  $\text{N}_2 \pm \text{H}_2\text{S}$ ) leached and transported Au from deep to shallow crustal levels. Carbon dioxide had a buffering effect on the Au-bearing hydrothermal solution, maintaining its pH within a narrow near-neutral range, where elevated gold concentration was transported by complexation with reduced magmatic sulfur in a reducing environment. Gold deposition along fault/fracture conduits in the Fawakhir granite and adjacent serpentinite resulted from interplay of pressure drop, fluctuations in oxygen and sulfur fugacities, and exsolution of the volatile phases. Infiltration of meteoric water may have contributed to the formation of the late stage gold-sulfide mineralization that formed at shallower levels during terrane uplift. Sulfidation of the Fe-rich magmatic minerals was, on the other hand, the overriding process in the wall rock as evidenced by abundant disseminated sulfides with gold inclusions. Considering the structural control by regional shear zones (fluid conduits) and the voluminous granitic and ophiolitic rocks (metal sources), a high tonnage gold deposit amenable to open pit mining at the El-Sid mine area is very likely.

**Keywords** El-Sid gold deposit · Egypt · Metal and fluid sources · Deposition mechanism