

The Ekomédion U–Mo Mineralization Revisited: Uraniferous Mineral Phase Transformations and Fluid Evolution Constraints From Sulfur Isotopes

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This study investigates the petrographic and ore microscopic characteristics of granite-hosted U-Mo mineralization at the Ekomédion prospect, with the aim of constraining ore mineral phase transformations and the evolution of the ore-forming fluids. SEM-EDS and electron microprobe analyses identify molybdenite and uraninite as the dominant ore minerals, accompanied by minor phases such as zircon, monazite, xenotime, thorite, uranothorite, apatite, pyrite, chalcopyrite, galena and sphalerite. The prospect is defined by three molybdenite mineralization styles: massive, disseminated and quartz-vein related mineralization. Uraninite is the primary uranium-bearing mineral and is commonly altered to coffinite, U-Zr-Si, U-Ti and U-Fe-bearing phases. The ore minerals occur as euhedral to subhedral crystals, associated with quartz, K-feldspar, plagioclase, and muscovite. Uraninite grains in this study contain significant abundances of UO₂ (Av=77.321 wt%), ThO₂ (Av = 6.9876 wt%) and PbO (Av=5.265 wt%), and low concentrations of Ca, Si, Zr, Y and P (Av. typically < 1 wt%). Secondary phases have the lowest concentrations of UO₂ (Av = 14.408 wt%) and PbO (Av=0.099 wt%), and highest SiO₂ (Av=17.275 wt%), ZrO₂ (Av. 18.648 wt%), ThO₂ (Av = 13.042 wt%), Y₂O₃ (Av=4.841 wt%), CaO (Av=1.210 wt%) and P₂O₅ (Av=6.233 wt%). The variation in mineral chemistry is documented as a function of alteration during the post magmatic stages of the mineralization as evidenced by the increases in the concentration of minor elements in the different secondary phases especially along the microcracks and fractures in uraninite. Sulphur isotope composition of molybdenite varies from the disseminated, through the massive to the quartz-vein related demonstrating hydrothermal fluid evolution across different lithologies and provides evidence that the ore forming fluids are magmatic.