UV Fluorescence as an Exploration Tool in Carbonate Replacement Deposits

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Carbonate replacement deposits (CRDs) are challenging exploration targets because alteration haloes in carbonate rocks around the deposits are often difficult to identify (known as cryptic alteration). This study aims to characterize, quantify, and map the cryptic alteration footprint around the Au-rich Olympias polymetallic CRD, Greece (combined reserves [proven and probable] and resources [measured and indicated] of 5.2 Moz Au, 96.8 Moz Ag, 1.0 Moz Pb, and 1.3 Moz Zn as of September 2022). The Olympias deposit is located in the Cenozoic Western Tethyan Magmatic Belt of gold-rich magmatic-hydrothermal deposits. The replacement-style orebodies are hosted in marble, which is interlayered with feldspar-biotite gneiss within the Paleozoic Kerdylia Formation of the Serbo-Macedonian Massif. The orebodies generally follow the gently dipping marble horizons and steep normal faults, such as the Kassandra fault. Mineralization occurred during the Late Oligocene to Early Miocene, synchronous with local magmatism. The ore mineralogy of the Olympias deposit mainly consists of sphalerite, galena, and arsenopyrite, with Ag and Au strongly associated with galena and arsenopyrite, respectively. A portable XRF instrument and a short-wavelength UV lamp were used on drill core and rock samples from Olympias to assess how carbonate mineral chemistry in veins and wall rocks varies with distance to known mineralization. Haloes of Mn enrichment around mineralization (and interpreted fluid pathways) were recognized from portable XRF measurements. Manganese-enriched calcite veins and marble layers typically fluoresce pink-orange colour under UV light with variability controlled by Fe content, making UV fluorescence a rapid, inexpensive, field-deployable tool for visualizing cryptic carbonate alteration.