

## **The Application of SWIR and Multi-Element Geochemistry in Exploration at the Fisoka Cu ± Au Porphyry System, Halkidiki, N. Greece**

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Short-wave infrared (SWIR) spectroscopy and multielement whole-rock geochemistry can provide a rapid and cost-effective method for prospecting for porphyry-type magmatic-hydrothermal systems. The Fisoka Cu ± Au porphyry is located 5 km northeast of the Skouries Au-Cu porphyry deposit and 2 km south of the Stratoni fault that hosts the Mavres Petres, Madem Lakkos, and Piavitsa Au-Ag-Pb-Zn deposits of the Kassandra mining district in Halkidiki, Greece. The Fisoka porphyry system consists of a series of poorly exposed, pipe-shaped, fine- to medium-grained equigranular to porphyritic diorites and granodiorites, likely connected at depth. The Oligocene (29.6 Ma) intrusions form an NE-trending belt that cuts amphibolite, carbonaceous biotite schist, and gneiss of the Kerdyllia Formation. Along the southeast contact of the intrusions, polymict intrusion-matrix breccia zones occur. Hypogene Cu mineralization occurs in both igneous and metamorphic rocks beneath a 20- to 60-m-thick Cu enrichment blanket averaging 0.33%. Despite the deeply weathered (depth range 20–50 m) host rocks, dominant and locally pervasive hypogene quartz-white mica-pyrite alteration can be mapped in both soils and drill core through SWIR analysis. Widespread hydrous mineral abundances (muscovite, illite, paragonite, phengite) allowed mapping changes in white mica composition using the wavelength of the 2,200-nm absorption feature corresponding to the Al-OH bonds; values of about 2,195 nm (paragonite-muscovite) occur in the micas in the northeast, indicative of higher-temperature acidic hydrothermal fluid conditions, while values of about 2,220 nm (phengite) are located in the southwest, suggesting more neutral pH conditions lateral or distal to the porphyry center. White mica crystallinity is also higher in the northeast, further supporting higher temperature conditions in this area.

Whole-rock analyses utilizing four-acid digestion were used in both soils and drill core to assess alteration and weathering effects. The northeast is characterized by elevated Cu-Mo-Bi-Te-Rb-Cs in soils and drill core, supporting the proximal porphyry center interpretation consistent with the SWIR data. High Tl-Li-Mn-Sr values, associated mainly with chlorite-phengite alteration, were identified to the southwest of the interpreted porphyry center that zones outwardly to distal kaolinite-associated Pb-Zn-As-Sb polymetallic carbonate veins. Application of these techniques in surface samples as well as in drill core provides an insight of the hydrothermal footprint of the Fisoka Cu ± Au porphyry system in three dimensions and valuable data to generate potential drilling targets.