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Short-wavelength infrared spectroscopy as a tool for characterising hydrothermal alteration at the Geita Hill gold deposit, Tanzania

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Geita Hill is a world-class gold deposit located in north-western Tanzania and hosted within an ironstone-dominated sedimentary package, intruded by diorite dykes and sills. The host rocks were metamorphosed to greenschist facies and show a complex deformation history comprising early ductile, and late brittle-ductile events. The regional metamorphic assemblage at the deposit is characterised by Bt + Chl + Act + Kfs ± Phg ± Mt ± Po ± Py. The gold-related alteration overprints the regional metamorphism, and manifests as a series of silicification and sulfidation fronts, and/or microfracture and vein networks. Gold is closely associated with secondary pyrite, and occurs as free-Au and gold tellurides. The mineralized vein/microfracture networks contain Bt and Kfs as primary accessory minerals. The mineralising alteration is overprinted by barren, multiphase quartz-carbonate and carbonate-chlorite veins, characterised by the assemblage Ca + Sd + Chl ± Qtz ± Py ± Ba.

The close association between gold and biotite in the mineralized vein/microfracture networks and the scarcity of retrograde chlorite makes the Geita Hill deposit ideal to test the change of the biotite short-wave infrared (SWIR) spectral response with the proximity to the gold alteration. SWIR spectra were collected from three well-characterised drill holes that intercepted the gold mineralization and the results were compared to the gold grades. The SWIR data shows that there is a good correlation between the biotite spectral response and the gold grades. The position of the 2250 nm biotite absorption feature is changing systematically as a function of the ore proximity indicating that SWIR can be used to trace gold mineralization and has the potential to be a powerful exploration tool if used in conjunction with well characterised mineral paragenesis.