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Geochemical exploration in regolith-covered terrains: a case study from the periphery of the Zijinshan copper–gold mine, southeastern China

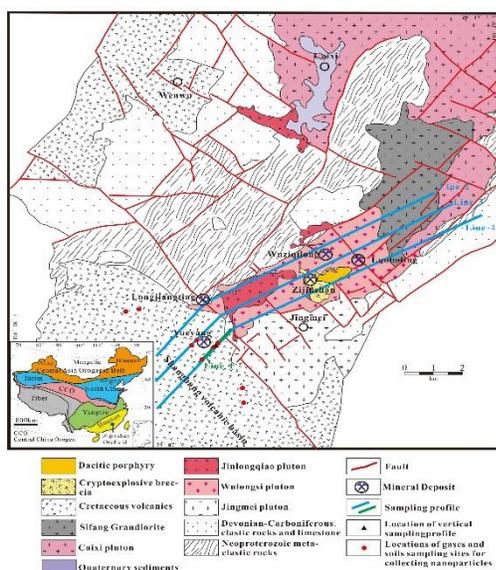
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The diverse regolith-covered terrains provide a geochemical challenge for mineral exploration in China [1]. In recent years, geochemical exploration are now concentrating on concealed deposits covered by laterite at the periphery of the Zijinshan Cu-Au mine, a volcanogenic hydrothermal-type deposit and one of the largest Au deposits in southeastern China [2]. Recently, near the Zijinshan deposit, a concealed Ag–Au–U deposit was discovered below volcanic sequences in the Yueyang Basin to the east of Zijinshan and a blind porphyry Cu–Mo deposit was found in the Luoboling Basin to the west of Zijinshan.



In this study, sampling of a regolith profile was undertaken at a spacing of 25 m across the Yueyang Ag–Au–U mineralisation. Samples collected from the soil B horizon, generally at a depth of 5–30 cm, were then sieved to <75 μm and analysed by near-total digestion (four-acid digestion) and selective leaching digestion techniques in order to compare the effectiveness of the two methods. Later, additional geochemical research for concealed deposits was carried out across the Yueyang Ag–Au–U, Zijinshan Cu–Au, Wuziqilong Cu, and Luoboling Cu–Mo deposits. Sampling of regolith profiles was undertaken at a spacing of 50–100 m. Samples were also sieved to <75 μm and analysed by near-total digestion.

Figure 1: Simplified geological map of the Zijinshan mineral field. Also shown are the locations of the sampling profiles described in this manuscript.

The results show that (1) the two methods of total and selective leaching analyses of fine-grained samples reveal similar geochemical anomalies and both effectively locate the concealed Ag–Au–U mineralisation in the Yueyang Basin, and (2) that the spatial distribution and suites of elements are consistent with the mineralisation types, i.e., Ag–Au anomalies occur above the Yueyang Ag-dominated polymetallic deposit, Cu–Au–Ag–As anomalies occur at the Zijinshan Cu–Au deposit, Cu–Ag–Au–As anomalies occur at the Wuziqilong Cu deposit, and Cu–Mo–W anomalies occur over the Luoboling Cu–Mo deposit.

Au–Cu-bearing nanoparticles were observed in geogas from above a concealed Ag–Au mineralisation using a transmission electron microscope (TEM) equipped with energy dispersive spectroscopy. The

results imply that fine-grained soils with clays in regolith inherit minerals derived from in situ weathering of surface rocks and can adsorb mineralisation-related elements migrating from underlying deep-seated ore bodies. Total and partial analysis of fine-grained soils can be used for geochemical exploration to locate concealed deposits in areas covered by barren rock sequences.

References:

[1] Wang X et al. (2016) *Ore Geol Rev* 73: 417-431

[2] Jiang S et al. (2013) *Ore Geol Rev* 53:287-305

