

SEG 2026 Conference in Salt Lake City, United States

Decoding Multiple Mineralisation Styles Using Routine Geochemical Data, an Example from West Africa

Harry Brookes¹, Simon Griffiths¹, Aidan Kitchener¹

¹Third Planet Exploration Services, Bristol, United Kingdom

Systematic collection of four-acid digest, ICP multielement data at mineral exploration projects allows for an enhanced understanding of the mineral system being explored. In turn, this knowledge can lead to improved targeting and early recognition of material domains for consideration in metallurgical testing.

In this study, we apply methodical geochemical data processing workflows to diamond drill core data from a complex magmatic-hydrothermal system in West Africa. The project exhibits overlapping alteration and polyphase mineralisation, presenting challenges for visual logging, necessitating an objective approach to geochemical modelling.

We employed our geochemical workflow to resolve lithology, alteration phases and mineralisation assemblages of the deposit. Immobile element ratios were used to geochemically classify host rock type and assess magmatic fertility. Then we defined the hydrothermal footprint through application of molar element ratios and ternary classifications to delineate alteration in each lithogeochemical group. Variations in fluid/rock interaction, temperature and pH of fluids result in distinct geochemical groupings which allow for the classification of alteration zones. Mineralisation assemblages were identified with pathfinder elements and their relationship with sulfides (Fe:S). This allows us to distinguish between mineralising events and inform the design of metallurgical testing.

Finally, we compile and overlay the geochemical layers from downhole plots to build long- and cross-sections for spatial validation of our observations. Such characterization of the system results in a robust understanding of the orebody including favourable host-rock lithology, key contacts, alteration phases and inference of structures and controls on mineralisation.

Our work demonstrates the adaptation of routine exploration data to significantly enhance orebody knowledge. Linking the geochemical model to mineral system processes resulted in development of fertility proxies and vectors to direct future drilling. Ultimately, this robust geochemical framework optimizes the probability of successful exploration and project evaluation, thus shortening the time to discovery and development of the mineral deposit.