

## **Exploration for gold under the Lake Rebecca, Western Australia**

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Saline lakes are widespread and cover several underexplored areas in Australia. The Lake Rebecca is located 150 km east of Kalgoorlie in Western Australia. It is covered by aeolian colluvial and lacustrine sediments that unconformably overlie deeply weathered granite and amphibolite. The weathering profiles consist of lower, greyish green saprolite and upper kaolinitic and mottled saprolite. The upper saprolite is truncated locally by paleochannel fluvial-infill sands and clays. Mineralogical, geochemical, and spectral analyses were conducted on rock chips collected from 72 drill holes using XRD, laser ablation ICP-MS, SEM, and HyLogger-3<sup>TM</sup>. The primary gold (Au-Ag electrum) mineralization is associated with Fe- and Cu-sulfides and Bi-Ag tellurides in amphibolite. Pure, coarse-grained gold is also associated with quartz veins. Concentrations of gold are highest where sulfides are oxidized to goethite, likely due to supergene enrichment of Au along faults. Gold was analyzed in all downhole samples of the weathering profiles using the fire assay (FA) and aqua regia (AR) digestion methods to identify anomalous zones in the regolith profiles. Using FA with a 10 ppb detection limit, gold is anomalous in the lower saprolite over amphibolite. Conversely, AR with a detection limit of 0.5 ppb revealed elevated Au concentrations near the unconformity (interface) between transported cover and residual regolith at approximately 10 m below the surface. Gold is restricted to basal gravels in the paleochannel's deepest topographic lows/traps. In comparison to the AR digestion, FA digestion revealed higher gold concentration in the gravels, suggesting the presence of gold locked within refractory minerals that are inaccessible for digestion. The presence of Au-bearing gravels above the Au-bearing lower saprolite may indicate that the source of the gravels is proximal, possibly derived from the reworking of the underlying saprolite. Faults structurally control the paleochannel geometry. Therefore, faults might indicate the location of such paleochannels, potentially making them valuable targets for future exploration endeavors. At Lake Rebecca, interface sampling using aqua regia is recommended to identify gold targets at shallow depths (<10 m) to reduce the costs for deeper drilling. However, in the areas characterized by paleochannels (>10m), it is advisable to utilize FA digestion.