Multi-scale detection of buried mineralization through cover using interfaces and indicator minerals

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The Yilgarn Craton in Western Australia is a deeply weathered terrain. Here, mineral exploration through Permian to Quaternary aged cover is chalenging as footprints of buried mineralization are obscured. Traditional surficial sampling methods have limited applications in areas of > 20 m deep transported cover. Drilling through cover to sample basement rocks is also costly. However, if carefully studied, the transported cover may provide an opportunity for exploration due to sublte geochemical dispersion from mineralization into the cover. Selective sampling is required to target the appropriate materials that record geochemical dispersion in the cover. These include physical and chemical interfaces that can be sampled near-surface or by shallow drilling.

Sampling at or close to an unconformity (physical interface) between the transported cover and the underlying rock is significant in identifying mechanically dispersed remnants of weathering, such as ferruginous duricrust, indicator mineral grains, lithic and gossan fragments. Physical interface sampling has shown tranlocated anomalies where their sources were determined by the topography of the interface. Another application of using the physical interface sampling is to identify wider dispersion haloes in the cover than secondary and hypogene anomalies in the underlying weathered profile and fresh rocks. Indicator minerals such as detrital sulphides were recovered unweathered from the base of the Permian glacial sediments and above the fresh bedrock near Agnew and Lancefield North Au deposits. Indicator sulphide minerals were also preserved as inclusions in cassiterite and rutile higher in the residual weathering profile over the Scuddles VMS deposit and mechanically dispersed in the overlying reworked ferricrete at surface.

Hydromorphic dispersion of target and pathfinder elements occurred after deposition of the transported cover. This was mainly controlled by groundwater percolating through cover and formation of several paleo-redox fronts (chemical interfaces). This mechanism may also bring the metals near surface and anomalies are detected in ferricrete, mottled zone, soils (particularly the ultrafine clays and Fe oxides) and vegetation. Both physical and chemical interfaces have a proven success in mineral exploration through cover in Australia.