Resolving Bedrock Geology Using Multi-Element Soil Geochemistry - Examples from the Yilgarn Craton, W.A.

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Abstract:

Increasingly, mineral exploration is being carried out in areas with greater soil coverage and less geological exposure. The challenges of effectively exploring in such areas include obtaining accurate and reliable bedrock information. The use of compatible and incompatible elements (including rare earth elements) subsequent to hard rock analysis to discriminate felsic, intermediate, mafic and ultramafic rocks is well documented. By contrast soil geochemistry has not been widely used for defining geological substrate, although with modern partial digestion techniques, and the capabilities of ICPMS, over forty elements can be analyzed in any given soil sample. Many of these elements contain vital information about bedrock geology.

Mobile Metal Ion or MMI, is one such high resolution soil geochemistry technique. It has recently been applied to obtaining and resolving bedrock geology in various parts of the Yilgarn Craton. Soils over some "classic" rock locations on the Yilgarn have been used to confirm that the compatible element Ni, and the incompatible element Ce very effectively distinguish a number of the important rock types in this terrain. Using just these same two elements Ni, and Ce, bedrock geology of part of the Widgiemooltha Dome in the Eastern Goldfields has been mapped from soil geochemistry, in conjunction with obtaining information for commodity elements Au and Ni. Levels of Ni and Ce are used to assign soils to one of five categories. The inferred geology was ground-truthed against outcrop for parts of this survey where outcrop was available. For both areas with outcrop and sub-crop and the remainder of the survey area, classified as colluvium, the inferred geology map from soil geochemistry provided greater detail than was provided by 1:40,000 scale geological mapping.

The inferred geology map, shows a sequence of mafic and ultramafic flows, within which are felsic intrusives (outlined by high Ce, low Ni) and komatiite adcumulate channels (outlined by very high Ni) in soils. Soil geochemistry surveys in several areas on the western edge of the Yilgarn Craton, and in the Pilbara Craton have been undertaken with similar findings.