Geochemical classification of the Tanami Group – a tool for gold exploration

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Introduction

The Tanami Region on the border between the NT and WA is an orogenic gold province with several operating and past producing gold mines. Gold mineralisation is hosted by structural-controlled epigenetic quartz veins with a suggested mineralisation age of ~1795 Ma (Huston *et al* 2007; Bagas *et al* 2010). The quartz veins are emplaced in the Tanami Group, which consists of mostly greenschist metamorphic facies sedimentary and mafic rocks. The Tanami Group depositional age is between ~1900 and 1850 Ma, and was deposited in an oceanic back-arc basin setting (Bagas *et al* 2013). The lithostratigraphic evolution of rift basins with oceanic crust can be reflected in the geochemistry of the rocks. Early oceanic basin formation will be dominated by mafic rocks with interflow sediments between basalt flows. The geochemical signature of such sedimentary rock is more likely to be similar to mafic rocks. During basin deepening and development of continental shelfs and slope, sediments will be more likely sourced from the continental crust, which is generally felsic in composition. Using these principles, we can establish a relative younging sequence using whole rock geochemistry.

Project area

The Suplejack collaboration project between CSIRO Mineral Resources and ABM Resources is centred over the 15 x 10 km Suplejack lease, 13 km northeast of the Groundrush gold deposit. The project area is characterised by limited outcrop, abundant windblown dunes and a palaeo-drainage system. The project area and stratigraphy run parallel to the north-south of the Suplejack fault. The area hosts the 309 000 ounce Suplejack Resource (ABM Resources 2017a: 4.51 Mt at 2.14 g/t gold), and has been a focus of exploration for ABM Resources. Reverse circulation (RC) and core drilling in 2017 identified a new shoot position at Seuss, highlighting the potential for resource growth in the area.

Results

Systematic niche sampling was conducted on drill core and rock chips to create specific geochemical vectors by defining lithology based on petrography, geochemistry and mineralogy. These vectors, or parameters, were then applied to a dataset of ~1000 analysis and ~600 drillholes. For example, Ti versus Al vectors were used to clearly distinguish felsic sedimentary rocks from mafic suites (**Figure 1**). This is also reflected in the REE chondrite pattern, showing the gradual change from a mafic to felsic REE signature (**Figure 2**).

The results show that west of the Suplejack Fault the stratigraphy consists of near vertical dipping basalt flows with interflow sediments. The ratio between mafic and sedimentary rocks changes towards more sediment dominated rocks going west. The sedimentary rocks (lower greenschist facies) are predominantly siltstone and fine laminated shales, which transition from a strong mafic signature to intermediate, then felsic. The Suplejack fault shows a sharp contact between basalts with interflow sediments to felsic sediments, suggesting a structural offset along the fault. Once understanding the geochemistry of the non-mineralised host rock, we can then test for geochemical alteration halos. Such alteration is often identified along structures within in the basalt and mafic sediments.

Conclusion

The geochemical classification of the stratigraphic sequence at Suplejack confirms the mafic and sedimentary

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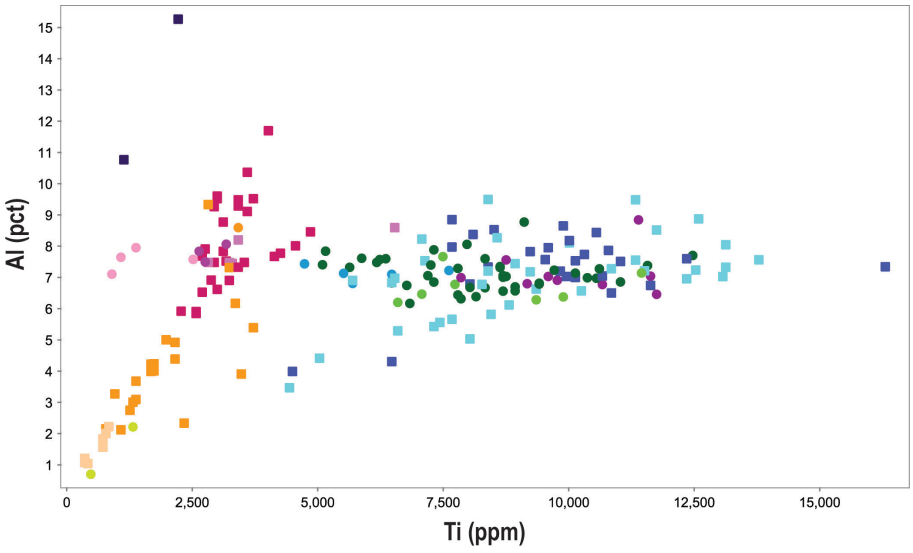

Figure 1. Geochemical plot (Suplejack area) of titanium versus aluminium distinguishing mafic igneous and sedimentary rocks (blue-green colours) from felsic sedimentary rocks (orange-red colours).

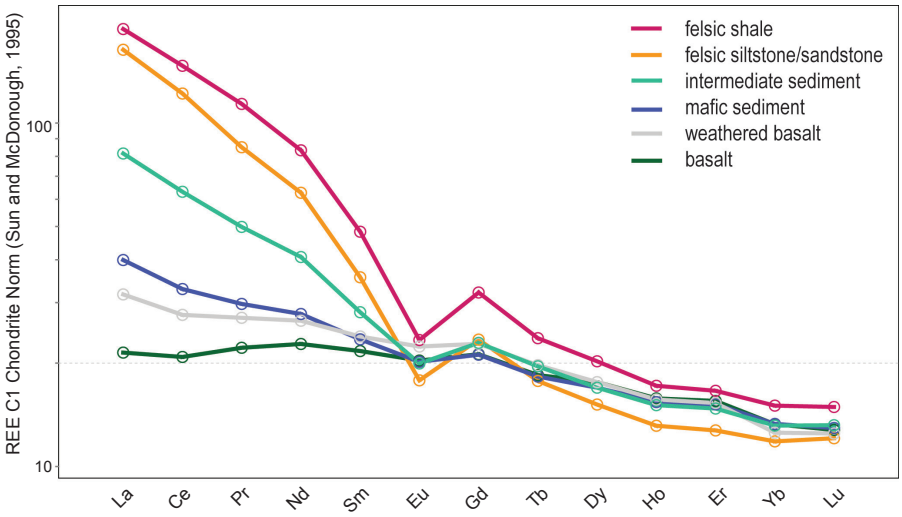

Figure 2. Plot of REE C1 chondrite normalised showing increasing ratio between LREE and HREE from mafic to felsic rocks (colour scheme the same as in **Figure 1**).

rocks are part of the Tanami Group. Geochemically 'fingerprinting' the sequence allows stratigraphic correlation to be made across areas of poorly outcropping terrane, something that has not been possible before due to the historic reliance on visual discrimination. Geochemical classification from the study has resulted in improved understandings of the structure and lithological controls on mineralisation. This knowledge has allowed ABM Resources to target the prospective interflow sediments in the latest round of RC drilling at Seuss and Hyperion South. The results from the RC drilling (ABM Resources 2017b: 13 m @ 7.3 g/t gold including 7 m @ 12.7 g/t gold: in SSRC100047) demonstrate the success of these tools. ABM's geologists have grown the strike length of known mineralisation at Hyperion to over 2.4 km. The tools and vectors developed can be applied across the Tanami Region. These will confirm, simplify and correlate target lithology for gold mineralisation that may have previously been misidentified or not fully understood based on their geochemical signature. The lithogeochemical data is also being integrated with geophysical datasets to develop attributed basement geology maps.

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