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Can drilling fluids be a useful sample media for mineral exploration?

Reid, N.[1], Gray, D.[1] and Gazley, M.[1]

[1]CSIRO Mineral Resources, PO Box 1130, Bentley, Western Australia 6102. Nathan.Reid@csiro.au

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The northern Yilgarn hydrogeochemical mapping project (Western Australia) showed evidence of large-scale (4-8 km spacing) signatures in groundwater chemistry related to lithology, as well as Au and U mineralisation. The aim of this research was to change the field sampling paradigm by testing whether information about the changes in lithology or fluid composition could be identified in drilling fluids.

Groundwater geochemistry can show broader signatures than other sample media (e.g. drill core), as the chemistry is influenced by immediate contact with rocks as well as other materials which have previously interacted with the groundwater. Drilling fluids are a combination medium, comprised of: the fluids used to aid the drilling (usually mains or bore water) with various additives; they can also incorporate any aquifers that are intersected in the drilling; and, the material that is being drilled through.

As such, the deconvolution of these signatures is important to understanding whether this sample medium can provide useful information about the host rock or the groundwater chemistry. One of the major challenges that has been identified, is the contamination from the drilling additives and from the wearing down of the drill bit. This can introduce large concentrations of elements such as W, Ag, Cu, Zn, Mo, S and N into the fluid, and under the right conditions these elements remain in solution. For example, regional groundwaters in the northern Yilgarn Craton, Western Australia, display W anomalism around Au ore bodies, and the magnitude of this anomalism is in the 10's of ppb, in drilling fluids the background concentrations of W can be in the 100's of ppb and up to ppm levels when hard rock is drilled or when a new bit is broken in. This W is in solution as can be seen from Na_2O_4W crystals which form in the solution after filtration through a 0.45 μm filter paper (Figure 1). Knowledge of this contamination means that contaminated elements can be avoided and only those which are not affected can be used for geological information.

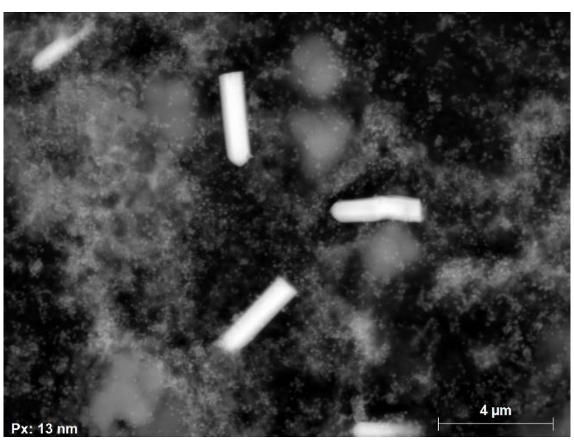

Figure 1. Scanning Electron Microscope, backscattered electron image of Na-tungstate crystals formed after filtration of drilling fluids

This research can lead to faster decision making during a drilling campaign by providing fast feedback on fluid parameters. This could ultimately reduce the cost of drilling and increase the speed of detection of deposit footprints under cover.

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