Lithogeochemistry of Pegmatites in the Broken Hill District, New South Wales: Vectors to Mineralisation?

"At Broken Hill pegmatites are generally considered to be a pain in the arse. They have insidiously eaten away at the stratigraphy, disrupting and consuming the nicely ordered layer-cake sequences. They surreptitiously conform with local layering and then they enjoy the benefits of folding and deformation that the Olarian Orogeny really reserved for ordinary rocks. Their greatest sin however lies in the fact that they are scurrilous ore dilutors.

The folks at Silver City Minerals however took a less condescending view than some on these problematic and much maligned rocks. This presentation outlines a bit of good old fashion science, observation and innovation for explorers"

SUMMARY

Silver City Minerals Limited has completed a lithogeochemical sampling program within its exploration tenure at Broken Hill, New South Wales. The work was specifically undertaken to assess pegmatite geochemistry with the view to using the data to vector towards economic mineralisation. The work was conceptual and experimental. The results were shared with the Geological Survey of NSW as part of a data sharing initiative.

The work has shown that pegmatites hosted in high grade metamorphic rocks (granulite and upper amphibolite facies) are either leucogranites, quartz-feldspar-mica pegmatites or feldspar-rich pegmatites. In contrast those that occur within lower grade metamorphic rocks (lower amphibolite to greenschist facies) are feldspar poor and quartz-muscovite rich (locally mapped as quartz veins), locally highly sheared, with tourmaline on their margins and as replacements of surrounding host sediments.

Element classification diagrams suggest a geochemical continuum from poorly evolved pegmatites hosted in the highest grade metamorphic rocks to highly evolved pegmatites in the lowest grade metamorphic rocks. Spatially, this trend is broadly from the south and southwest toward the north and northeast and from west to east.

Economic element content is similarly divided into two broad groups;

- Pegmatites within higher grade metamorphic rocks host elevated lead-zinc-silver-manganese.
- Pegmatites within lower grade metamorphic rocks contain elevated tin, tungsten, lithium, niobium and tantalum. They are LCT-type pegmatites with other associated incompatible elements (gallium, rubidium, caesium and thallium). The presence of

abundant tourmaline in association with these indicates highly elevated boron. Locally these are elevated in zinc, silver and chrome.

The elevated base metals and silver in the granulite and amphibolite facies rock is attributed to the elevated nature of these elements in the metasedimentary protolith being largely the Broken Hill Group. Our interpretation suggests these are probably not allochthonous but are nearly *in-situ* bodies resulting from partial melting of the Broken Hill Group. Their chemistry largely reflects that of the surrounding rock.

In contrast the concentration of tin, tungsten, lithium and other incompatible elements in pegmatites which are allochthonous and clearly intrude rocks of lower metamorphic grade, suggests these elements have accumulated as fractionation has taken place.

Analysis of the spatial distribution of pegmatites with elevated lead-zinc-silver-manganese indicates many of these are located close to known base metal and/or silver occurrences of the Broken Hill or Thackaringa types.

This study has highlighted three areas of elevated base metal-silver within pegmatites where no known mineralisation is documented either as an occurrence or in historic exploration data. These warrant additional work to test their prospectivity for Pb-Ag-Zn mineralisation.

With respect to exploration, systematic pegmatite sampling at Broken Hill has the potential to enable vectoring toward buried Pb-Zn Ag ores of the Broken Hill type.

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