Provenance of the Katangan Basin in Zambia and the Implications for Basin Evolution and Exploration Search Space

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Sedimentary provenance is a crucial element of understanding the stratigraphy, sediment routing, compartmentalization, and tectonics of basins. The regional provenance history of the Neoproterozoic Katangan basin, host to world-class Cu-Co-(Ni) deposits, is poorly understood. A study utilising Kernel Density Estimating and Multidimensional Scaling (MDS) of over 3,000 detrital U-Pb zircon data from regionally spread samples and regional geology provides insights into the provenance of the Katangan Supergroup, basin trends, sediment routing, and major tectonic discontinuities. This information has potential to influence mineral exploration ideas. MDS plots revealed three distinct clusters. MDS1 is characterised by frequent neo-Archean ages in the northwest part of the basin (Mwinilunga) and ends abruptly on the northern margin of the Kabompo Dome. These peaks are interpreted as being sourced from NW in the Archean Congo craton of the Kasai area of the Democratic Republic of the Congo (DRC). This abrupt termination is a strong indication of a major tectonic boundary and Mwinilunga basin being isolated from an eastern sediment source. MDS2 is characterised by dominantly Paleoproterozoic ages of the Bangweulu craton and spatially covers the Domes Region and extends to the eastern margin of the Bangweulu basin. This is interpreted to indicate a local provenance predominantly from underlying Bangweulu aged granites in the basement dome inliers. MDS3 spatially covers central Zambia and is characterised by both strong Paleoproterozoic and Mesoproterozoic frequencies. The two high frequencies result from sediments derived from the Bangweulu, Irumide terranes to the northeast and the Munali Hills type granitoid basement in the south. Distribution of orebodies in the defined basin compartment margins is coincident with MDS2 cluster. Although many local controls are responsible for mineralisation, the extension of MDS2 in central and southern Zambia may imply continuation of prospective sequences at depth, and further investigations might open up new exploration search space.