

# SEG 100 Conference: Celebrating a Century of Discovery

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**B6**

## **Metal Sources in the Central Africa Copperbelt: Assessing the Mafic Contribution**

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Mafic intrusions, primed with base metals including Ni, Cu, and Co, are often an abundant component of sedimentary rift basins, particularly those along craton margins. The Central African Copperbelt represents a Neoproterozoic rift basin along the southern margin of the Congo Craton within present day Zambia and the Democratic Republic of the Congo, and it is one of the richest resources of sediment-hosted Cu, Co, and other base metals. The estimated contained Cu resource continues to increase with new discoveries, yet these resources cannot be fully accounted for solely by models that propose redbeds or basement rocks as the source. Thus, given the elevated inherent base metal content of mafic rocks, they provide an intriguing potential answer to this mass balance problem. Mafic rocks are known to be an important or even major source of metals in some sediment-hosted Cu systems, such as the Yeneena and McArthur Basins, Australia. Although the deposits and their host stratigraphy have been extensively explored and well documented, the volume of mafic bodies within the Copperbelt remains relatively poorly constrained.

The Domes region in the Zambian Copperbelt is one area where mafic intrusions have been recognised and mapped more extensively and, notably, in close proximity to the largest deposit, Kansanshi. Modelling of the well-constrained occurrences at Kansanshi has highlighted the morphology, abundance, and volume of mafic bodies within the area, which have preferentially exploited evaporitic horizons and occur mostly as flattened pods rather than continuous sills. The intrusions occur at multiple lithostratigraphic depths, are of differing sizes from  $<10 \text{ m}^3$  up to  $10^7 \text{ m}^3$ , and have been extensively and variably altered. The intense alteration of mafic rocks highlights the likelihood that significant volumes of metals may have been leached from them and transferred into the circulating, basinal ore-forming fluids.

The association of the mafic rocks with evaporitic strata may be an important factor in their contribution as a metal source. It is well documented that the ore-forming fluids in the Copperbelt were highly saline and likely sourced, at least in part, from evaporites that have subsequently been destroyed by later metamorphism. Alteration of the mafics is characterised by scapolite-rich assemblages, indicating likely interaction with evaporate-derived fluids. Chemically, the mafic rocks show signatures consistent with extensive alkali metasomatism and associated net losses of Cu and Co. We evaluate this data in the context of the basin as a whole and the relative contribution that the mafic rocks have had in sourcing base metals in the Copperbelt. Furthermore, we assess the role that highly aggressive fluids in some parts of the region may have also liberated Ni from mafic sources to form deposits such as Enterprise.