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ARTICLE

Orebody geometry, fluid and metal sources of the Omitiomire Cu deposit in the Ekuja Dome of the Damara Belt in Namibia

Shawn Kitt[1] · **Alexander Kisters**[1] · **Torsten Vennemann**[2] · **Nick Steven**[3]

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Abstract The Omitiomire Cu deposit (resource of 137 Mt at 0.54% Cu) in the Ekuja Dome of the Damara Belt in Namibia is hosted by an anastomosing, low-angle Pan-African (ca. 520 Ma) shear zone system developed around an older (ca. 1100–1060 Ma), late Mesoproterozoic intrusive breccia between a suite of mafic rocks (originally lava flows) and later tonalitic gneisses. High-grade ore shoots preferentially formed along contacts between tectonically interleaved biotite-epidote-quartz-chalcocite schists and felsic gneisses, and are directly related to an increase in the number and cumulative thickness of thin, contact-parallel mineralized shear zones. Alteration and mineralization are associated with elevated concentrations of K_2O, Cr, Rb, S, and Cu and a loss of Na_2O, CaO, and MgO. Oxygen isotope fractionation for quartz-biotite, quartz-feldspar, and quartz-amphibole mineral pairs support equilibrium temperatures of between 500 and 650 °C during the fluid/rock interaction. Mineral separates from amphibole-biotite gneisses and mineralized schists have similar ranges in $\delta^{18}O$ values of about 1.2 to 2 ‰ relative to VSMOW. Coexisting minerals are arranged in an order of increasing $\delta^{18}O$ values from biotite, to epidote, amphibole, and quartz, suggesting that the Omitiomire Shear Zone was a rock-dominated system. Similarly, H-isotope results for mineral separates from biotite-epidote schists and amphibole gneisses do not show any reversals for D/H fractionations, with δD values of between −48 and −82 ‰, typical of metamorphic-magmatic rocks. The homogeneous and low $\delta^{34}S$ values (−6.1 to −4.7 ‰ CDT) are compatible with a local redistribution of sulfur from magmatic rocks and interaction with sulfur derived from metamorphic fluids of metasedimentary origin. The relatively low fluid/rock ratios and elevated Cu values (>1500 ppm) from unaltered amphibolite point to a local redistribution of an earlier (late Mesoproterozoic) Keweenaw-type Cu mineralization into later Pan-African shear zones during the exhumation of the Ekuja Dome. The timing, polyphase evolution, and tectonic setting of the Omitiomire deposit show remarkable similarities with the large Cu deposits of the Domes Region in the adjoining Lufilian Arc of northern Zambia. This suggests the presence of a much larger, regionally significant Cu province extending from central Namibia, through northern Botswana, and into Zambia.

Keywords Damara Belt · Cu · Mesoproterozoic dome · Pan-African · Shear zone · Stable isotopes · Fluid/rock ratio · Lufilian Arc

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✉ Shawn Kitt
shawnkitt@gmail.com

[1] Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland, Stellenbosch 7602, South Africa

[2] Institute of Earth Surface Dynamics, University of Lausanne, Lausanne, Switzerland

[3] Rockwater Consulting, 10 Evergreen Lane, Constantia, Cape Town 7806, South Africa

Introduction

Central Africa is one of the major Cu provinces in the world. Traditionally, the Central African Copperbelt in the southern Democratic Republic of Congo (DRC) and northwestern Zambia has been known for its sediment-hosted, stratiform Cu deposits (e.g., Selley et al. 2005; Sillitoe et al. 2010;