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New correlations and tectonic setting of the Kalahari Copperbelt in Namibia and Botswana

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The Kalahari Copperbelt, a 1000 km long by up to 250 km wide NE-trending Meso- to Neoproterozoic belt occurs discontinuously from western Namibia (Sinclair Supergroup) to northern Botswana (Kgwebe Formation and Ghanzi Group) along the NW edge of the Palaeoproterozoic Kalahari Craton. Copper-silver deposits are generally stratabound and hosted in Neoproterozoic metasedimentary rocks that have been folded, cleaved and faulted and metamorphosed to greenschist facies during the Pan-African Damara Orogeny.
Whereas the belt in western and central Namibia is relatively well exposed, eastern Namibia and most of Botswana are covered by the Cenozoic Kalahari sands, precluding direct correlations with pre-Cambrian rocks exposed in Namibia. Because of the lack of exposure and also because of paucity in age constraints on the sedimentation, linking host-rocks to the mineralisations across the international Namibia/Botswana state border has been previously hampered.
In this contribution, we present an integrated multidisciplinary study in both countries based on exhaustive compilation of published zircon ages of magmatic and sedimentary rocks and thorough summary of existing lithostratigraphic descriptions that are modified by new field observations of key sedimentological features. The age of sedimentation is also constrained by recently published isotope chemostratigraphic data. The spatial continuity of newly defined lithotectonic domains below cover and across the state border was inferred using processed 50 metre resolution aeromagnetic maps.
In Namibia, the Sinclair Supergroup unconformably overlaps Palaeoproterozoic graniti-gneissic basement and is marked at its base by $\sim$1200 Ma old arc-related magmatic rocks. These rocks are overlain by a $\sim$1100 Ma several km thick package of volcanic-plutonic bimodal continental tholeiites alternating with volcaniclastic marginal marine and/or continental sediments. This lithotectonic domain is virtually identical in age, rock-type and magnetic response with the 2 km-thick Kgwebe Formation in Botswana where it constitutes the first well-dated post-Palaeoproterozoic event on the Kalahari Craton. Above a major regional unconformity, the following stratigraphic sequence is remarkably similar in both countries, albeit thicker in Namibia (10 km vs. 6 km for the Ghanzi Group). Indeed, sedimentological investigations suggest an open shelf marine depositional environment that deepens from basal marginal mesotidal to deeper water and reduced conditions which are capped by near shore sediments in Botswana only. This sequence was deposited in between $\sim$1100 Ma and the Sturtian glaciation event ($\sim$710 Ma), based on a lack of glacial strata. The Cu-Ag deposits are localized within and just below the reduced horizons formed in the deepest environment where rocks in both countries record the $\sim$780-800 Ma global Bitter-Spring negative carbon excursion. This age therefore provides the maximum age of the mineralisation while its upper age is not constrained as in some places the mineralisation is described in literature as post-Damara Orogeny.
The important lithostratigraphic control on the aeromagnetic signature enabled detailed indirect mapping of the Kalahari Copperbelt lithotectonic domains. Together with the new paleogeographic and chronological correlations, the continuity of these lithotectonic domains from Namibia to northern Botswana across the Namibia-Botswana border allow revision of existing tectonic models for the formation of the Meso- to Neoproterozoic belt that hosts the Kalahari Copperbelt.