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Geochronology and Assessment of the Age(s) of Khoemacau Cu-Ag Mineralization Event(s) in the Ghanzi-Chobe Belt Portion of the Kalahari Copper Belt

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The Khoemacau Cu-Ag deposits are located in the Ghanzi-Chobe Belt (GCB) of northwestern Botswana and are found within the metasedimentary sequence of the Ghanzi Group. The origin of this Cu-Ag mineralization is still debated because of the lack of precise and reliable ages. Therefore, there is no agreement on the genetic model for ore formation. To better understand the timing of mineralization and to elaborate on the genesis of Cu-Ag deposits in the region, we used sericite $^{40}\text{Ar}/^{39}\text{Ar}$ and in-situ biotite LA-ICP-MS Rb-Sr geochronology in samples from two mineralized zones (i.e., the Banana Zone North East Fold and Zone 5). We found that sericite intergrown with chalcocite-bornite returns ages of 669.8 ± 0.1 Ma and 588.3 ± 0.2 Ma for Zone 5 and North East Fold, respectively. Biotite intergrown with chalcocite-bornite ore from the North East Fold yields an isochron age of 565.6 ± 6.5 Ma. This data links the timing of Cu-Ag mineralization in the GCB to compressional tectonics during the Damaran Orogenesis and highlights mineralization events that were previously unknown. The ca. 670 Ma event coincides with the final break-up of the Rodinian supercontinent. The ca. 588 Ma and 566 Ma fluid pulse events correspond to syn-orogenic and syn-metamorphic Cu-Ag mineralization episodes that overlap with the window time frame of basin inversion and metamorphism in the GCB. The identification of numerous pulses of mineralization is an important factor in the formation of giant-to-supergiant sediment-hosted Cu-Ag deposits. Therefore, the possibility of such deposits occurring in the GCB cannot be dismissed. Our data confirms that mineralization took place in several stages and provides fresh insights into Cu-Ag ore genesis in the GCB. The genesis of this Cu-Ag ore can be explained by the episodic release of hydrothermal fluids from the sedimentary basin at different times.