(U-Th)/He Thermochronometry of Supergene Base Metal Ores and Implications for Namibian Paleoclimate

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Weathering processes can generate economically important supergene Cu-Zn-Pb ores from hypogene base metal sulfide deposits. The mineralogy and size of supergene deposits, and their location relative to the precursor sulfide bodies reflect the primary sulfide and host-rock assemblage, as well as the hydrologic and climatic regime through time. We have applied (U-Th)/He methods to the supergene minerals tarbuttite ($Zn_2(PO_4)OH$) and descloizite ($PbZn(VO_4OH)$ in order to constrain the formation age of two nonsulfide deposits in Namibia (Skorpion and Wolkenhauben).

Tarbuttite is a relatively minor constituent of the economically important Skorpion Zn deposit (Gariep Belt) . It was precipitated in the vadose zone during the weathering of Neoproterozoic hypogene sulfide mineralization. Tarbuttite ages have a bimodal distribution with peaks at around 50 and 85 Ma, perhaps indicating Zn-phosphate precipitation during several episodic intervals of humid climate in southern Africa (Cretaceous and Eocene).

Descloizite (U-Th)/He ages from the small Wolkenhauben (Otavi Mountain Land) Pb-Zn vanadium prospect range from 40-60 Ma (n=10) with a weighted mean of 51.1 ± 1.7 Ma. This age also points to an Early Tertiary period of descloizite formation, when climatic conditions must have been humid and warm to allow deep chemical weathering and lateritization.

The similarity of the tarbuttite and descloizite ages may suggest a relationship between Cretaceous-Eocene climatic conditions in Namibia and the formation of supergene deposits. For example, the supergene enrichment of some Mn deposits in South Africa has been related to the post-Gondwana formation of the “African erosion surface”. These encouraging results point to the need for further studies of similar secondary minerals in order to further explore the links between mineralization, weathering and climatic history. The results may also improve our understanding of the genesis of supergene mineralization in other areas and aid in the development of exploration models.