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Cenozoic evolution of West Africa scenery from cryptomelane ^{40}Ar-^{39}Ar dating

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^{40}Ar/^{39}Ar dating of successive generations of cryptomelane [$K_{1-2}Mn_8O_{16}$, nH_2O] identified in outcropping Mn-crusts and core loggings of the supergene manganese ore deposit of Tambao in northern Burkina Faso allows discussion of both palaeoclimatic history and long-term morphogenesis of West African scenery. As many supergene manganese ore deposits, the genesis of Tambao deposit is related to the lateritic weathering of carbonate and silicate Mn-protores underneath palaeolandsurfaces. This Mn-ore deposit is effectively located in a critical area where bauxitic and ferruginous palaeosurfaces could have been topographically close [1].

Detailed petrological and geochemical investigations characterize an upper cryptomelane-rich layer, and a lower K-depleted layer where pyrolusite (β-MnO_2) is the dominant Mn-oxide. The oldest ages are obtained on surface outcrops while the youngest ones characterize deep Mn oxidation fronts. Paleocene-Eocene (60 to 45 Ma) ages bracket the greenhouse effect period that was propitious to thick bauxitic weatherings all over the World [1]. A weathering event is also depicted at the end of Oligocene (23-29 Ma) in the upper layer, while various age clusters from ca 18 Ma to ca 3 Ma are recorded in the lower layer. The spatio-temporal distribution of Ar-Ar ages of distinct cryptomelane generations allows characterization of successive weathering and erosion episodes and long-term morphogenesis and paleoclimates. Vertical distribution of Ar-Ar ages allows estimation of oxidation front sinking rate.

Apparent correlations with global deep-sea oxygen record (δ^{18}O curve) [2] and sea level variation curve [3] suggest different-stages of the ore deposit evolution. ^{40}Ar/^{39}Ar age clusters document various weathering and erosion periods that would

correspond to Cenozoic climatic and geomorphic changes that have shaped the West African Shield. The lack of significant measured ages from middle Eocene (ca 45 Ma) to middle Oligocene (ca 29 Ma) could correspond to an erosion period, during which detrital sediments including lateritic materials accumulated in continental and offshore basins. The preservation of old cryptomelane (ca 60 Ma to 45 Ma) in the upper part of the ore deposit indicates however a denudation limited to the erosion of previous bauxites and, partly of ferricretes.

References

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