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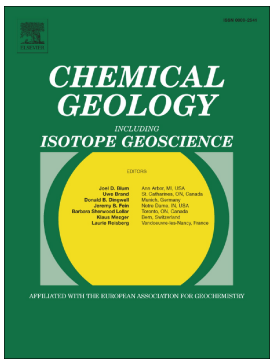

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Provenance and depositional environments of Quaternary sediments in the southern Kalahari Basin

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Abstract

The vast Kalahari Basin is characterized by uplifted margins, terrestrial sedimentation within semi endorheic sub-basins, subdued morphology and tectonic quiescence. This intracratonic basin has been subjected to a prolonged period of subsidence affecting its sedimentary fill by plate motion and climatic cycles. Provenance studies of Kalahari Group sediments mainly focused on the surficial deposits that represent only the last phase of sedimentation, leaving unresolved questions related to the rest of the strata.

The southern Kalahari Group succession exposed along the walls of the Mamatwan Mine, Northern Cape, South Africa, reveals three main depositional environments: a bottom low-energy water-body, a middle fluvial, high-energy environment and an upper aeolian sandy unit. The entire section, which was deposited during the early to middle Quaternary, records significant environmental and depositional changes suggesting a highly dynamic landscape.

The fully exposed section (55 m) of the Kalahari Group at Mamatwan Mine was analysed for its mineralogy, elemental composition, Sr, Nd and Pb isotopic ratios and iron species. Isotopic fingerprints were used to determine the source rocks of the sediments. The basal part of the section was derived from the distant Angolan highlands supporting previous suggestions for the existence of a paleo, trans-Kalahari drainage system. Weathering sensitive indices show that these sediments underwent considerable chemical weathering typical to humid areas. Mineralogical assemblage and iron phases imply that a brackish and alkaline shallow water-body existed during the early-middle Pleistocene contemporaneous with relative dense hominin occupation of the area.

During the Early-Middle Pleistocene transition, the lacustrine environment was rapidly filled with volcano-sedimentary Archean clasts that were derived mainly from the surrounding hills and experienced limited degree of source rock chemical weathering, but underwent subsequent groundwater alteration by iron, silica, and calcium-rich solutions and precipitation of calcrete and silcrete duricrusts. These changes in provenance and depositional environments may be related to tectonic adjustments along the southern margins of the Kalahari basin. Ultimately, a shift into an aeolian-transport dominated landscape occurred in the region. This was accompanied by reduced