

Kalahari borehole stratigraphy from the Tsodilo Hills area, NW Botswana: clues to understanding uplift and climate history of the Kalahari Plateau

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ABSTRACT

We report analysed stratigraphic records across the central Kalahari highlands, including facies analysis and logging of a number of boreholes near the Tsodilo Hills of NW Botswana, which track the geological changes associated with the formation of the Kalahari Plateau. The study of these condensed sedimentary sequences from the interior of this plateau reveal that the evolution of its palaeo-environments are linked to both regional and local tectonic and climate changes, e.g. those related to the plateau's episodic vertical movements, the opening of new oceans and continental margins flanking the plateau, and associated magmatism. Dating these geological events derived from the preserved stratigraphy is one of the main objectives of our ongoing drilling program. Reconstructions of the sedimentary architectures on profiles between boreholes, and correlations at more regional scales, are based on bio- and litho-stratigraphy. The total succession (100 to 200m thick) comprises relics of Karoo sequences that include diamictites, turbidites and deltaic deposits overlying high grade gneisses. This lower succession records significant tectonic, climate and topography changes from the carboniferous Dwyka period (350-300 Ma) to the Jurassic Stormberg magmatism (180 Ma). These successions are variably altered and intruded by Late Cretaceous (100-70 Ma) kimberlite deposits. Overlying sediments comprise a thick Kalahari sequence of carbonates and sands, usually interpreted as calcretes and aeolian deposits, respectively. In sub-surface, the carbonates are extensive and vary in thickness from 30 to 60m. These appear to be related to lacustrine processes as recorded in various biomarkers (no fossils are visible), and pedogenesis. Carbon and oxygen isotopes of the sediments provide distinct trends that will be completed by the study of a stalagmite from caves across southern Africa to test for high resolution signatures of climate changes. The uppermost unconsolidated sand-silt successions are difficult to sample by conventional drilling. New techniques will be tested later this year. Our first tests reveal sequences include muddy and carbonated intervals with sufficient plant remains to date wet-dry episodes to reconstruct relatively recent climatic variations.

Key words: Kalahari Plateau, Botswana, sediments, drilling, Tsodilo Hills