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Stratigraphy and palaeoenvironments of Permian-Jurassic strata in the Lebombo-Tshipise Basin, northeast South Africa

CLAYTON, K.¹, Jinnah, Z.², and Tucker, R.³

¹University of the Witwatersrand, Evolutionary Studies Institute, West Campus 2050 1106796@students.wits.ac.za

² University of the Witwatersrand, School of Geosciences

³Stellenbosch University, Department of Earth Sciences

The Lebombo-Tshipise Basin (LTB) in northeastern South Africa has generated research primarily aimed at elucidating its tectonic origins related to stresses from the southern convergent and northern divergent margins of Gondwana [1]. However, little detailed quantitative work has focused on the palaeoenvironment and sequence analysis of this basin. The goal of this project is to evaluate the stratigraphic correlation of the LTB deposits with the Main Karoo Basin (MKB) and to reconstruct the environmental conditions that prevailed in this area during Karoo times. We present preliminary results on approximately 150 m of strata underlying the Elliot Formation in the LTB. This sequence includes diamictite and interbedded sandstones, shales, and coals which likely represent the Carboniferous-Permian Tshidizi, Madzaringwe, and Mikambeni Formations and the Triassic Fripp, Solitude, and Klopperfontein Formations [1]. Additionally, we compare these results with data on the general warming trend from cold, semi-arid glacial environments during the Late Carboniferous and Early Permian to hot climates and varying precipitation in the Triassic and Jurassic recorded in the MKB [2].

In the LTB, the Elliot Formation consists of numerous paleosols, nodular mudstone and ripple-laminated fine-grained sandstone facies. Elliot Formation outcrop also reveals some coarse-grained facies with intraformational quartz gravel scours, and lacks the characteristic red hue of described mudstones and siltstones of the informal lower Elliot of the LTB [3] and the fine-grained upper Elliot Formation in the MKB [4]. Sauropodomorph dinosaur fossils have been found in this outcrop [5]. The Clarens Formation consists of coarse-grained fluvial/ephemeral river facies overlain by large, tangentially bedded fine-grained sandstones. Pervasively bioturbated beds and convoluted bedding occur just below the large dune facies in our field area. The former Red Rocks Member of the Clarens Formation (now considered Elliot Formation [6]) consists of dune and some stacked channel facies, and contains a heavily weathered basal pedogenic bed and sparse pedogenic nodules. These preliminary data indicate differences in Triassic and Jurassic deposits across the MKB and LTB which we posit are driven by differences in palaeoenvironment. We will present geochemical analyses (e.g., X-ray diffraction, X-ray fluorescence, chemical indices of alteration, Scanning Electron Microscope) which will help us isolate these differences as tectonic or climatic in nature.

References:

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