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Facies variations in the Kalahari-Karoo Basin of Botswana using borehole core and 2D seismic data

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The Central Kalahari Sub-basin is located in the Kalahari-Karoo Basin of Botswana. This sub-basin houses sedimentary and volcanic rocks of the Karoo Supergroup which overlie a Precambrian basement or rocks of the Palapye Group. The basement rocks are intruded by the Xade Complex. The Karoo Supergroup is covered by the 35 m - 105 m thick Cenozoic Kalahari Group sands. Previous work done in this area was largely based on borehole data. This study focuses on the southeastern portion of the Central Kalahari Sub-basin and draws upon data from nine borehole cores drilled through the Karoo Supergroup and underlying Precambrian basement in addition to 2D reflection seismics from within and surrounding the study area. This study seeks to reconstruct depositional environments and determine the basin geometry of the Central Kalahari Sub-basin. Fifteen lithofacies and five lithofacies associations were discriminated for from sedimentological studies of the boreholes. The facies associations (FA) comprise those from the Dwyka and Ecca Groups. The Dwyka Group comprises FA 1 which is deposited in a glaciolacustrine environment. The Ecca Group comprises FA 2 (channel deposits), FA 3 (levee deposits), FA 4 (interdistributary deposits) and FA 5 (floodplain deposits). These facies associations are interpreted to represent a delta plain environment. Based on tectonic provenance fields, the sandstones of the Central Kalahari Sub-basin suggest a recycled-orogen source. Detrital-zircon geochronology, palaeocurrent directions and petrography suggest metamorphic and sedimentary sources, namely, the Ghanzi-Chobe Belt, Damara Orogenic Belt and Limpopo Belt. Basin geometry was determined by

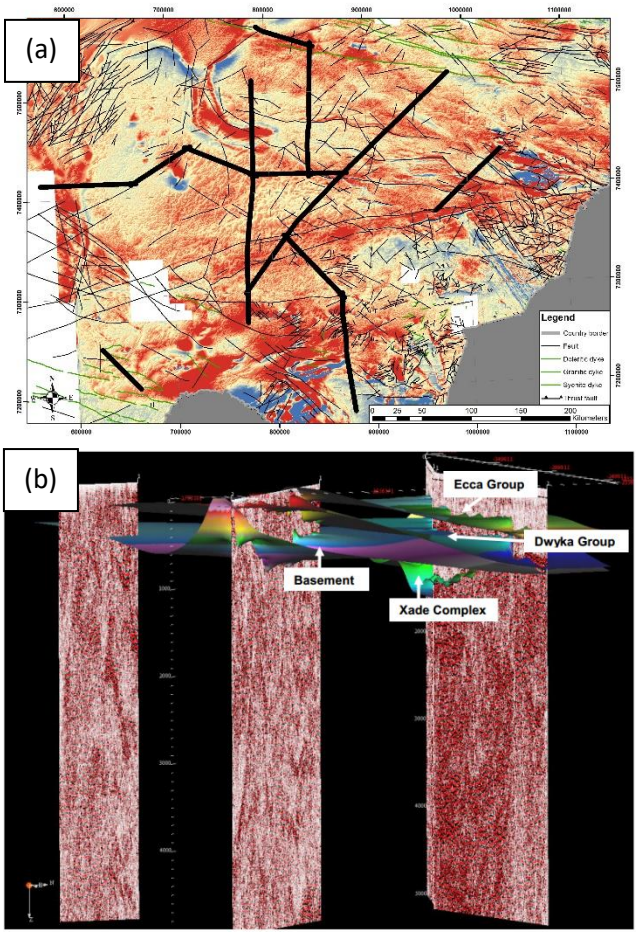

Figure 1: (a) Aeromagnetic map of the Central Kalahari Sub-basin overlapped with seismic lines (Adapted from Council for Geoscience). (b) An exaggerated 3D model of the Central Kalahari Sub-basin showing the basin geometry. This was constructed by integrating borehole data with 2D reflection seismic data. The model shows seismic lines overlain with surfaces corresponding to the Precambrian basement, Xade Complex, Dwyka Group and Ecca Group.

integrating borehole data with 2D reflection seismic data acquired by Anglo American in 1970s (Fig. 1a). The seismic data are characterized by strong and continuous seismic markers that correspond to the top of the Dwyka and Ecca Groups of the Karoo Supergroup. The data have also delineated numerous NE- and NW-trending normal faults with throws ranging from 25 m to 500 m. This suggests the Karoo sedimentation is controlled by major and minor faults. The integration of the borehole data and 2D seismic data suggest that the Kalahari-Karoo Basin formed predominantly as an intracratonic sag basin which was later influenced by rifting.