



# **LANDSCAPE EVOLUTION OF THE UMBUM CREEK CATCHMENT, WESTERN LAKE EYRE, CENTRAL AUSTRALIA.**

**VICTOR G. WACLAWIK**

**BSc. (HONS) (FLINDERS)**

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Discipline of Geology and Geophysics  
School of Earth and Environmental Science  
University of Adelaide  
Australia

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### ABSTRACT

Landscape evolution is important for mineral and petroleum exploration concepts, especially in dryland continental settings. This study seeks to understand the main issues and controls on landscape evolution that have produced the regolith and young sediments around the western side of Lake Eyre, in the arid heart of Australia.

Several methods were employed including satellite image analysis, geomorphometry, geological mapping, regolith mapping and surveying.

Outcomes indicate that the underlying structural fabric of the basement has controlled the development of the surface morphology of the Umbum Creek Catchment. The arrangement of basement faults is reflected in the distribution of surface landforms and in the topography of the land surface. Significant deformation of the Etadunna and Eyre formations indicate tectonic activity occurred at the end of the Miocene and was probably related to movement in the Lake Eyre Fault Zone. Pleistocene faulting is expressed as minor blind faulting associated with pre-existing basement faults. These faults remain active and current seismic activity is driven by changes in hydrostatic pressure (hydroseismicity). The scale of Pleistocene faulting and modern seismic activity demonstrates that since the Pliocene tectonic activity has been subdued.

Climate change caused landforms developed under wet conditions during the Palaeogene and Neogene to be preserved by the development of aridity in the Pleistocene. High erosion rates associated with tectonism and the onset of aridity in the Pleistocene led to topographic inversion of many features. Palaeo-Proterozoic inliers formed inselbergs, silcrete outcrops formed capstones, gypsum hardpans protected underlying sediment from erosion creating plateaux of gypsum patterned ground and palaeo-channels on the Neales Fan were eroded to make heavily armoured mounds and associated sand dunes and sand sheets.

The dominant factor influencing the evolution of the landscape in the Umbum Creek Catchment was the deposition of sedimentary sulphides within the Bulldog Shale. The excess sulphur that this sediment supplied to the landscape over time created the necessary conditions for the formation of a range of landscape features that would not otherwise exist. Weathering, oxidation and leaching of the sedimentary sulphides led to the development of silcrete. Subsequent weathering and tectonic activity led to the breakdown of the silcrete and the distribution of silcrete pebbles widely across the landscape forming gibber plains. Sulphur from the Bulldog Shale continued to contribute to the landscape forming intra-formational gypsum and precipitating as gypsum hardpans.

This study has implications for petroleum exploration in dryland continental settings as potential reservoirs may be affected by secondary diagenetic processes, such as the formation of gypsum or silcretes, that could act as baffles or result in reduced porosity within the reservoir.

The broad-scale architecture of fluvial systems, like the Neales Fan, may not conform to traditional fan-shaped models being, instead, comprised of structurally rearranged channels.

In terms of earthquake risk assessment, the identification of hydroseismicity active within the Lake Eyre Basin allows for a new level of predictability of earthquake behaviour within Central Australia.

**DECLARATION**

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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