Journal of the Virtual Explorer, 2005
Volume 20
Paper 5
http://virtualexplorer.com.au/

A day in the dunes: Quaternary Aeolian landscapes east of Lake Frome, South Australia

Kathryn Fitzsimmons

Department of Earth Sciences and Cooperative Research Centre for Landscape Environments and Mineral Exploration, The Australian National University, Canberra ACT 0200, Australia.

Email: kathryn.fitzsimmons@anu.edu.au

Keywords: Quaternary Aeolian, Lake Frome, South Australia

Abstract: Studies of the landscape provide valuable information about environmental processes and change over time, and are crucial tools for environmental management. The susceptibility of arid landscapes to even minor hydrologic and climatic changes makes them particularly sensitive gauges and records of palaeoenvironmental evolution. A lack of understanding of the development and dynamics of deserts presents us with the increasing challenge of managing environments subject to desertification and general arid conditions. The purpose of this excursion is to give an introduction to the Australian desert dunefields which occupy around one third of the continental land mass.

Table of Contents

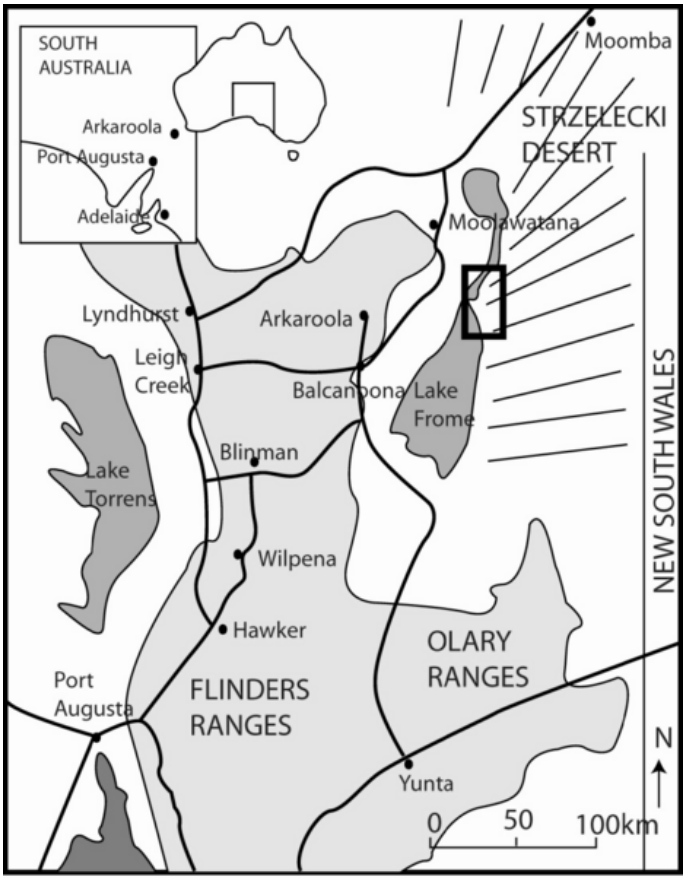
Introduction

Studies of the landscape provide valuable information about environmental processes and change over time, and are crucial tools for environmental management. The susceptibility of arid landscapes to even minor hydrologic and climatic changes makes them particularly sensitive gauges and records of palaeoenvironmental evolution. A lack of understanding of the development and dynamics of deserts presents us with the increasing challenge of managing environments subject to desertification and general arid conditions. The purpose of this excursion is to give an introduction to the Australian desert dunefields which occupy around one third of the continental land mass.

Location and regional context

Lake Frome is a playa (or largely dry salt lake) located east of the northern Flinders Ranges, on the southwestern margin of the Strzelecki Desert in South Australia (Figure 1). It lies within the large, shallow Frome Embayment, which forms a southerly extension of the Eyre Basin (Devogel et al., 2004). The Strzelecki Desert is primarily a longitudinal dunefield, dominated by aeolian ridges oriented parallel to the direction of the sand shifting winds, although transverse dunes (oriented perpendicularly to the prevailing wind direction), small salt lakes and claypans also occur. Longitudinal dune orientation varies across the continent in response to wind direction, with the overall distribution pattern resembling a giant whorl (Jennings, 1968). The longitudinal dunes immediately east of Lake Frome are oriented southwest to northeast.

Figure 1. Location map.



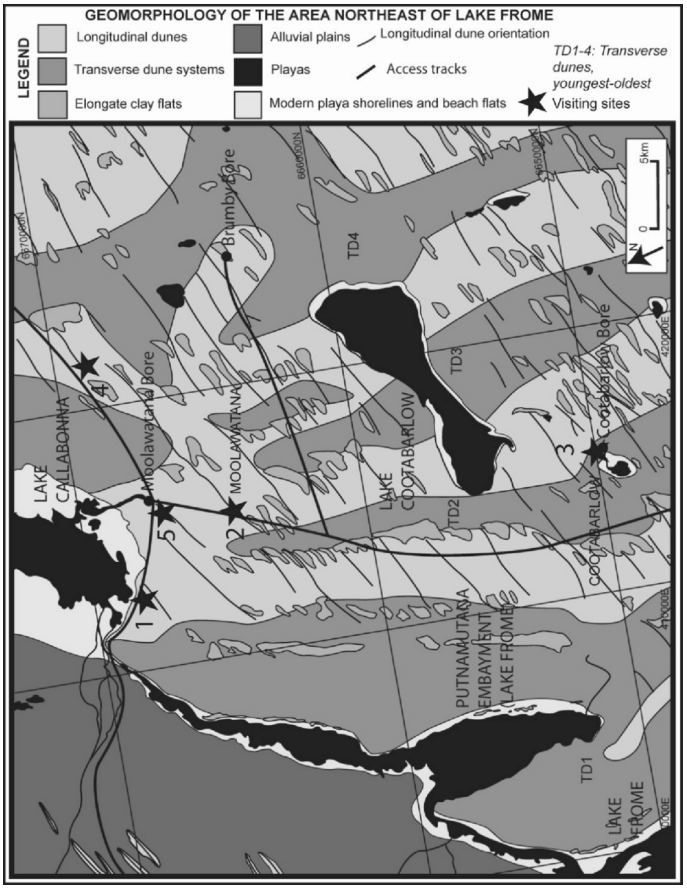
Location map.

Map displaying the location of the study area within the Strzelecki Desert, relative to the Flinders Ranges in South Australia.

Aims of excursion

This excursion aims to give an introduction to Quaternary aeolian landscapes on a visit to the dunefields just northeast of Lake Frome (Figure 2). It will involve a brief stop to examine typical playa sediments at the southern edge of Lake Callabonna. An introduction to the identification of aeolian landforms will follow upon entering the southern Strzelecki Desert dunefield, including visits to transverse, parabolic and both active and stable longitudinal dunes. The Quaternary landscape history will be discussed, and current landscape processes observed, including badlands erosion.

Figure 2. Dune map.



Dune map.

Map of the area northeast of Lake Frome, including the four transverse dunes and their close relationship with the longitudinal dunes. Sites to be visited are marked by a star.

Stops

Stop 1 - Lake Callabonna and the northern end of Transverse Dune 1

The first stop will be to observe typical playa sediments on the surface of southern Lake Callabonna, including evaporative salts and clays. Small gullies nearby the lake comprise laminated gypsum crystals, which reflect the palaeohydrology of the area.

The stop also lies just north of the end of the lunette closest to the current shoreline of Lake Frome. From here we will be able to identify the scale and general morphology of one of the dominant landform types in the area. Four large, complex transverse dunes have been identified from satellite imagery within the area, and are oriented parallel to the current lake shoreline. The transverse ridges in the east contain quartz sands with minor clay aggregates, typical of lunette sediments. Lunettes are transverse dunes which form immediately downwind of playas, and contain sediments derived from the deflation of the dry lake floors. The morphological and sedimentological evidence suggests that the transverse dunes represent ancient shorelines of an ancestral Lake Frome which has retreated over time.

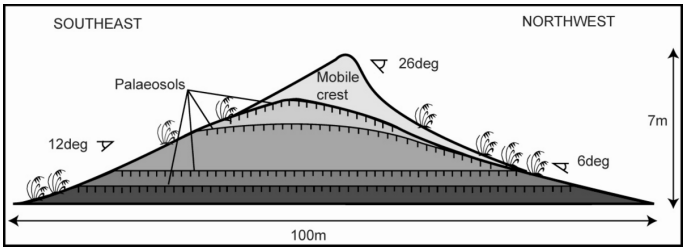
Longitudinal dunes extend downwind from these transverse ridges, and will be observed at the next stop. Just past Stop 1, we will pass through an area of irregular parabolic aeolian ridges and hummocks downwind of the transverse dune. These forms are significant in illustrating the genetic nature of the relationship between transverse and longitudinal dunes. These landforms quite often have a hybrid morphology and orientation.

Stop 2 - Dingoville longitudinal dune and landscape chronology

Longitudinal dunes are elongated individual ridges of aeolian sediment, forming parallel to the resultant vector of the sand shifting winds (King, 1960). The longitudinal dunes are spaced approximately 300m apart and length varies from a few hundred metres to over twenty kilometres.

The longitudinal dunes northeast of Lake Frome are largely stable (Sprigg, 1982). Most dunes in the area have at least a small amount of mobile quartz rich sediment forming the crests. Desert dunes in the area (including transverse dunes) retain an internal structure consisting of multiple palaeosols overlying undisturbed, laminated aeolian sediments (Figure 3). The development and preservation of palaeosols is possible due to a clay component, which has important hydrologic implications requiring relatively high water tables to assist in clay deflation (Bowler, 1973). Furthermore, the multiple strata suggests that net aeolian accumulation was an episodic process, alternating with relatively more humid conditions conducive to soil development.

Figure 3. Cross section of a longitudinal dune



Cross section of a longitudinal dune.

Cross section of a typical longitudinal dune for the Lake Frome region, illustrating asymmetry of slope, including crestal slipface, and internal stratigraphy.

Stop 3 - Cootabarlow transverse dune and bore

This is the southernmost point of interest on this excursion. The uncapped artesian bore which gives this site its name has, over decades of flow, produced significant amounts of erosion into the clay-bearing sediments. This enables us to observe a good example of active erosion, and almost the entire stratigraphic column, as we walk through the gully.

Stop 4 - Active dune past Moolawatana bore

Intense levels of grazing around the artesian bore have assisted in the removal of vegetation on the dunes and subsequent reactivation of sediment.

Stop 5 - Moolawatana bore

An example of an artesian bore in the area, one of the few places where water occurs at the surface in the desert, and therefore one of the most densely populated.

References

Bowler, J., 1973. Clay dunes: their occurrence, formation and environmental significance. Earth Science Reviews, 9 pp. 315-338.

Devogel, S., Magee, J., Manley, W., and Miller, G., 2004. A GIS-based reconstruction of late quaternary palaeohydrology - Lake Eyre, arid Central Australia. Palaeogeography, Palaeoclimatology, Palaeoecology, 204 pp. 1-13.

Jennings, J., 1968. A revised map of the desert dunes of australia. Australian Geographer, 10 pp. 408-409.

King, D., 1960. The sand ridge deserts of South Australia and related aeolian landforms of the Quaternary arid cycles. Transactions of the Royal Society of South Australia, 83 pp. 99-108.

Sprigg, R. C., 1982. Alternating wind cycles of the Quaternary era and their influences on aeolian sedimentation in and around the dune deserts of South Australia. In Wasson, R., editor, Quaternary dust mantles of China, New Zealand and Australia - Proceedings of a workshop. Australian National University.

Error: no bibliography entry: d0e147 found in http://docbook.sourceforge.net/release/bibliography/bibliography.xml