



Palaeoclimate and human occupation in southeastern arid Australia



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ABSTRACT

This review focuses on the relationships between palaeoenvironmental change and prehistoric occupation in the driest part of the Australian arid zone. Palaeoclimatic evidence from the last ~60 ka identified fluctuating periods of wet and dry conditions during the late Pleistocene and Holocene. For most of this period conditions were arid, including during the Holocene, and maximum aridity occurred at the LGM which peaked at ~21 ka. Maximum wetness occurred before ~45 ka, at ~33–31 ka and episodically during the deglaciation between ~18 and 11 ka. The pre-LGM archaeological record is extremely sparse but records from the LGM through to the mid Holocene show people occupied the dunefields and stony plains during prolonged wet periods in the deglaciation and largely abandoned them during drier phases, retreating to better-watered refuges. Human occupation in dunefields from the LGM through to the mid Holocene can be used as a proxy for past climates. From the late Holocene changes in settlement patterns were made possible by the social, economic and technological adaptations which allowed people to occupy what became an increasingly harsh environment. These reconstructions were facilitated by discoveries in the Roxby dunefield of buried stratified layers of stone artefacts in dune sands, dated by single-grain luminescence analyses. These discoveries indicate the possibility that hitherto unreported cultural sequences, potentially dating back to >50 ka, may be present in many Australian dunefields.

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1. Study context

The purpose of this review is to examine the relationships between palaeoenvironmental change and prehistoric occupation of the driest part of the arid zone, encompassing the Flinders Ranges, the arc of playa lakes and sand deserts to its north and east, and the mosaic of stony and sand-covered plains to the west (Fig. 1). This region has been a focus of detailed palaeoenvironmental research covering the last 100 ka or more and has archaeological records from various areas, most recently the Roxby dunefield in the west (Fig. 1).

It is widely acknowledged that archaeological site locations and landscapes are closely linked, especially in arid regions, and that lack of surface water was a fundamental constraint to long-term or permanent occupation of the arid zone. As discussed below, throughout this region water availability was highly variable and this has determined the pattern of human occupation over time. People entered the Australian continent before 50 ka and most

evidence for early occupation comes from its north and north-western fringes (Allen and O'Connell, 2014; Clarkson et al., 2015; Hiscock, 2008; Roberts et al., 1994), with a cluster of sites in the Lake Mungo area in the southeast of the continent (Bowler et al., 2003). One of the few sites in the Sydney Basin dated to earlier than the LGM indicates that people may have reached the eastern seaboard by ~50 ka (Hughes et al., 2014a).

In the western part of the desert, from the southern Kimberly in the north, through Lake Gregory to the Pilbara in the centre several archaeological sites dating to 40 ka or older have been excavated (Balme, 2000; Law et al., 2010; Morse et al., 2014; O'Connor, 1995; Slack et al., 2009; Veth et al., 2009). Numerous other sites dating to 30–40 ka have been found (Morse, 2009). In the arid interior of Australia comparatively few sites older than 30 ka have been reported.

Almost all of these early sites occur in rockshelters in extensive ranges country where people would have had access to permanent or semi-permanent water-holding gorges and bedrock waterholes. At these sites the earliest occupational debris is typically found at depth within the deposit, often more than half to one metre below the surface of the site. In some sites these deposits are localised catchments collecting locally generated sediments, but in other

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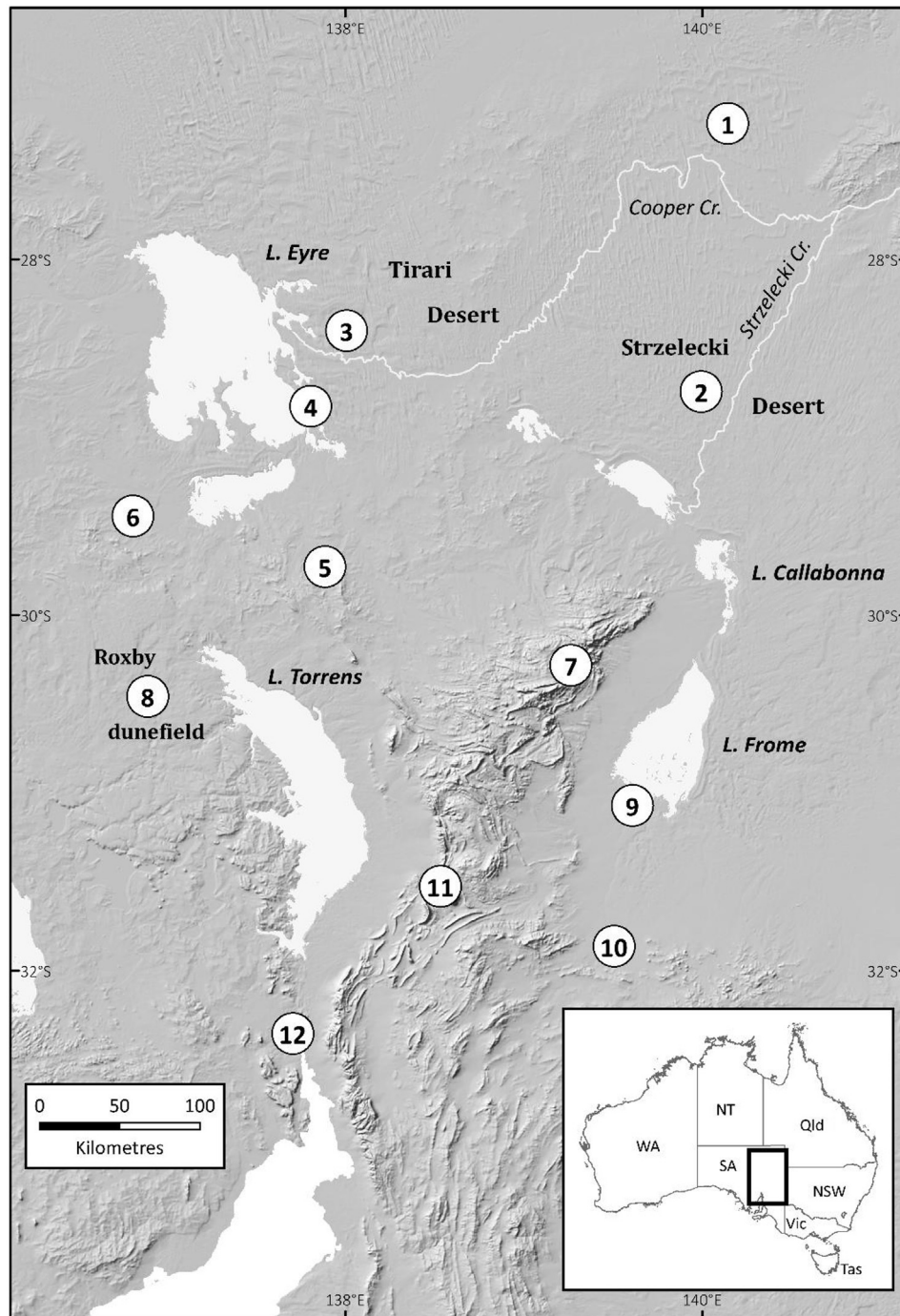


Fig. 1. The study area, showing the locations of archaeological sites described in Table 1. 1: Middle Cooper lake systems; 2: Strzelecki Desert; 3: Lower Cooper Creek; 4: Lake Eyre; 5 & 6: Mound springs; 7: Northern Flinders Ranges; 8: Roxby dunefield; 9: Lake Frome; 10: Olary upland; 11: Southern Flinders Ranges; 12: Port Augusta. Drawing by Tom Sapienza

sites the deposits reflect sediment accumulation within the broader landscape. The depth at which the earliest artefacts are buried, at sites such as Puritjarra (Smith, 2013), indicates that many older land surfaces and sites in those areas are buried and have not been discovered by archaeologists. Burial of sites as well as widespread destruction of sites severely limits the available evidence, and is a theme in archaeological interpretations of early occupation below.

Fortunately the insubstantiality of the archaeological records is supplemented by a rich palaeoenvironmental record. When people entered Australia more than 50,000 years ago there was no arid

centre. Palaeoenvironmental evidence indicates the interior was being supplied by moisture from both the westerlies and the tropical trade winds, with the Indo-Australian monsoon at its maximum effectiveness (Cohen et al., 2012a; Johnson et al., 1999). Surface water would have been widely available and for a few millennia people would have been able to move relatively freely across and to occupy much the continent on a permanent basis. It has been hypothesised that these conditions facilitated human settlement of the interior and that foragers gradually adjusted to subsequent desertification (Hiscock and Wallis, 2005). The onset of

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