by erosion tend to be yellow internally (pers. obs. after fracturing). It seemed possible that the red colouring of the fractured surface material might have resulted from heating yellow cobbles, following their exposure on the ground surface by erosion or excavation of overburden. Heating may have occurred accidentally during bushfires, or been carried out deliberately by Aborigines either to break up large cobbles (see Florek 1989 for discussion of this possibility in the Lake Eyre Basin), or to improve flakability.

**Aims and hypotheses tested**

To determine the colour of in situ source material, and to investigate whether red artefacts may have originated from yellow source material that was subject to post-extraction heating, two hypotheses were tested:  

*Hypothesis 1.* Silcrete previously unexposed to bushfires or intentional heating will not be red (test 1).

*Hypothesis 2.* Yellow silcrete and mudstone will turn red when heated (tests 2 and 3).

**Methods**

**Test 1.** Eleven silcrete cobbles, each with a bleached cortex, were excavated from an in situ below-surface layer at Dunheved, west of Sydney. Cobbles were then flaked to expose the inner matrix.

**Test 2.** Sixteen pieces of yellow silcrete and mudstone from various locations (Fig. 1) were broken roughly in half. One half of each piece was heated to 400°C in a laboratory furnace for four hours; the other half was kept for comparison.

**Test 3.** A number of small pieces of yellow silcrete, flaked from a large cobble, were subjected to a short simulated bushfire on the ground surface (temperature not recorded).

**Results**

**Test 1.** All 11 cobbles were found to be yellow internally, though one was red at one end (from a burning tree root?) and a few others had minor 'rusty' discolouration along fault lines.

**Test 2.** All 16 pieces turned red. In addition, when two pieces were re-broken, the newly exposed surfaces were lustrous.

**Test 3.** Some pieces turned fully or partly red, some stayed yellow. Most were fire-blackened.

**Conclusions**

The test results indicate that:

1. in situ, unexposed silcrete is likely to be yellow, and
2. red silcrete and mudstone artefacts need not originate from red source material — they may derive from yellow rock that has been heated subsequent to exposure, either intentionally or accidentally.

In addition, the tests and literature search indicate that lustrous yellow goethite-bearing rock cannot have been 'heat-treated' to improve flakability, as the temperature required to produce lustre is higher than that at which yellow rock turns red. Consequently, it is inappropriate to use lustre as an indicator of heat treatment in yellow goethite-bearing silcrete or mudstone.

**Acknowledgements**

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**The age of two human occupation sites in the Eastern MacDonnell Ranges, Central Australia**

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This paper reports on the radiocarbon chronology of two occupation sites discovered during a geomorphic investigation of the Todd River catchment in central Australia (Fig. 1). While it is widely accepted that the arid zone has been occupied since the late Pleistocene (Smith 1987, 1996), there are no dates available for the eastern MacDonnell Ranges. Data provided here on late Holocene archaeological sites will contribute to the larger spatial and temporal framework of human occupation of the central Australian arid zone.
Short Reports

MacDonnell Ranges

Area of sand dunes
Ranges
Small channels
B
Jessie Gap quarry
Floodout
B Mosquito Bore

Simpson Desert

Figure 1 Location of Sites A and B in the Todd River catchment.

Site A

This site is a small hearth located on the flank of a source bordering/climbing dune east of Jessie Gap (23°45', 134°02') (Fig. 1). It was accidentally discovered, exposed in a recently graded track in the dune which is currently being quarried for sand.

Geomorphological setting

The dune was formed by the deposition of wind-blown sediment, sourced from the active channel and floodplain of Jessie Creek on the southern side of a bedrock ridge in the eastern MacDonnell Ranges. The upper section of the dune is beige in colour indicating slight pedogenesis and dune stability. This broad band, 1-3 m deep, is underlain by white sands 30 m deep (R. Morley, pers. comm.). Sedimentary structures are well preserved, and contain remnants of rapidly buried vegetation in growth position. This late Holocene dune is underlain by an older, indurated, red dune which is laterally truncated by fluvial and colluvial units sourced from an adjacent small steep catchment. The textural properties of the underlying aeolian unit are similar to a dated dune sequence in the Western Simpson Desert (Nanson et al. 1995) and are therefore believed to be Pleistocene in age. The construction of the late Holocene dune is related to a period of increased fluvial activity rather than a period of increasing aridity and windiness. Fresh sediment deposited on the channel and floodplain of Jessie Creek by large floods was winnowed and deposited in the dune. This interpretation is supported by the preservation of plant remnants in the dune which indicate that there was sufficient moisture for plant colonisation. This vegetation would have stabilised the dune and enhanced its aggradation rate by trapping sediment.

The hearth

Stratigraphically, the hearth lies in the upper pedogenic layer at 75-88 cm below the surface. The age of the hearth, as determined by radiocarbon analysis on charcoal fragments, is 2930±155 cal BP. This is in stratigraphic agreement with a charcoal sample taken from sedimentary layers 200 m east of the hearth, at the crest of the dune which was determined to be 1380±500 cal BP (Table 1).

As no artefacts were found, this feature was identified as a hearth primarily on the basis of morphology. It is a bowl-shaped feature 13 cm deep with a flat top and a core of charcoal fragments underlain by a zone of ashed soil organics. It is not believed to be the remains of a burnt tree for the following reasons. Firstly, the bowl-shaped, flat-topped morphology conforms with hearth morphologies reported by others (e.g. Smith et al. 1991). Secondly, there are no burnt tree roots extending from the core. Thirdly, the remains of other plants found in their growth position in the dune formed narrow, vertical, dark, organic-rich features. Their morphology and texture contrasts markedly with that of the hearth. The lack of artefacts and the small scale of the hearth indicates that this was a transient site perhaps used only once.

Site B

The second hearth is located close to Mosquito Bore, 75 km southeast of Site A (23°58', 134°43') (Fig. 1).
Table 1  Radiocarbon ages of hearths and associated sediments in the Todd River catchment. The two-sigma calibrated ages are determined by the probability distribution method (Stuiver and Reimer 1993).

<table>
<thead>
<tr>
<th>Location</th>
<th>ANU Code</th>
<th>Age BP</th>
<th>Age (cal BP)</th>
<th>Geomorphic Environment</th>
<th>Material</th>
<th>Sample Depth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jessie Gap sand quarry</td>
<td>8835</td>
<td>1430±270</td>
<td>1380±500</td>
<td>Source Bordering Dune (top)</td>
<td>Charcoal</td>
<td>86</td>
</tr>
<tr>
<td>Jessie Gap sand quarry</td>
<td>8836</td>
<td>2830±70</td>
<td>2930±155</td>
<td>Source Bordering Dune (flank)</td>
<td>Charcoal in Hearth</td>
<td>75-88</td>
</tr>
<tr>
<td>Mosquito Bore Coolibah Channel</td>
<td>10064</td>
<td>390±60</td>
<td>410±100</td>
<td>Floodplain</td>
<td>Charcoal</td>
<td>290</td>
</tr>
<tr>
<td>Mosquito Bore</td>
<td></td>
<td>400±60</td>
<td></td>
<td></td>
<td>Charcoal in Hearth</td>
<td></td>
</tr>
<tr>
<td>Coolibah Channel</td>
<td>10065</td>
<td>210±140</td>
<td>340±0</td>
<td>Floodplain</td>
<td>Charcoal</td>
<td>320</td>
</tr>
</tbody>
</table>

Geomorphological setting

The site is located to the east of the main channel of the Todd River. It is positioned on the southern eroded bank of a distributary flood channel which extends eastwards from the main channel out onto the surrounding plains. Stratigraphic and chronological data suggest that this floodplain formed rapidly by a close succession of high magnitude floods.

The hearth

The hearth is buried 320 cm below the surface in a sequence of horizontally bedded floodplain sediments. This alluvial sequence consists of alternating layers of sands and silts and the hearth lies towards the base of this aggrading flood deposit 40 cm above the bedrock. Charcoal in the hearth provided a radiocarbon age of 400±60 cal BP while charcoal from an overlying fluvial unit returned a second age of 410±100 cal BP (Table 1). The age of the overlying sample and the fact that the error bars of the uncalibrated ages overlap (390±60 and 210±140) indicates that the date of the hearth is unlikely to be younger. The hearth contained fragments of burnt egg shell suggesting human activity. There is other evidence of human occupation in the immediate locality, i.e. a small rockshelter close to an overlying weathered dolomite ridge adjacent to the main Todd River channel. This rockshelter contains burnt faunal skeletal remnants in an undated hearth. Larger rockshelters located lower on the ridge are subjected to frequent inundation and sedimentation by the river and no artefacts were found during the geomorphic excavations.

Conclusion

These two sites are the only dated occupation sites in the eastern MacDonnell Ranges. The hearths are situated in relatively young geomorphic features where rapid aggradation of the landform has enhanced the likelihood of preservation. This aspect of site preservation and the effect of palaeofloods on human occupation in the Todd River catchment are explored further in Bourke (in prep.).

Acknowledgements

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