Kaalpi: The Archaeology of an Outlying Range in the Dunefields of the Western Desert

Peter Veth[1], Mike Smith[2] and Michael Haley[1]

Following a decade of debate about the timing and nature of occupation of desert dunefields (e.g. Smith 1993, 1996; Smith *et al.* 1998; Veth 1993, 1995, 2000b) and the increasing evidence for Pleistocene occupation of sites which lie at the margins of the Western Desert (O'Connor and Veth 1996; O'Connor *et al.* 1998; Smith 1989; Smith *et al.* 1997; Thorley 1998a, 1998b) a systematic program of excavation of sites within core areas of these dunefields is clearly warranted. This paper reports on one such excavation at the site of *Kaalpi* located within the Calvert Ranges of the Little Sandy Desert, south of Lake Disappointment, WA. These ranges contain numerous rockshelters with evidence for occupation and very abundant suites of rock paintings and engravings. The Calvert Ranges are a small isolated outlier of uplands, containing apparently permanent water, in a vast field of red siliceous dunes.

The initial test-pit at *Kaalpi* aimed to address several key research issues. These included the following:

1. Is there evidence for occupation before the mid-Holocene and, if so, does it extend through the period of heightened aridity associated with the last glacial maximum?
2. Are there changes in the inferred function of the site during the late Holocene, as registered from other Western Desert and central Australian sites?
3. Does the discard rate for cultural assemblages increase significantly after approximately 1000 - 1500 BP as registered from other arid zone sites?
4. Does the presence and distribution of ochres in the deposit allow any interpretations to be made about the age and nature of the abundant rock paintings?
5. What is the chronological distribution of grindstones within the deposit? Is there a trend towards formal millstones during the late Holocene?
6. Is there evidence for protein stress, in the form of heavily comminuted bone, as registered from other arid zone sites in marginal environments?
7. Does the abundant rock art display variability in theme, style and spatial patterning which may allow an assessment of information networks?
8. What are the implications of this sequence for the origins and timing of the spread of the Western Desert language?

Although these are ambitious questions for an initial test-pit and recording program, they do help focus recovery and analysis towards a number of critical themes for arid zone archaeology in Australia and specifically help develop a framework for understanding regional patterns of occupation within the Western Desert as a whole.

Regional Context of *Kaalpi*

Kaalpi is the name used by some Martu Aboriginal people for the northern section of the Calvert Ranges comprising a discrete quartz sandstone uplands located some 30 km due south from Lake Disappointment and 30 km southeast from Durba Springs. The location of *Kaalpi* is shown in regional context in Figure 1. The Calvert Ranges are approximately 12 km in length, 3 km in width, and host a number of well developed valley systems. The northernmost of these contain numerous rockshelters, including *Kaalpi*. A sizeable sedge-lined pool occurs in the top valley and is said by Martu to provide reliable and plentiful water. It is possibly spring fed, as is the major pool at Jillikuru (Killagurra Spring, Canning Stock Route Well 17) at Durba Springs. Some Martu who visited *Kaalpi* with Peter Veth and Mike Smith in 1996 had used the Calvert Ranges prior to European contact. They noted that major aggregations of people had occurred in the vicinity from

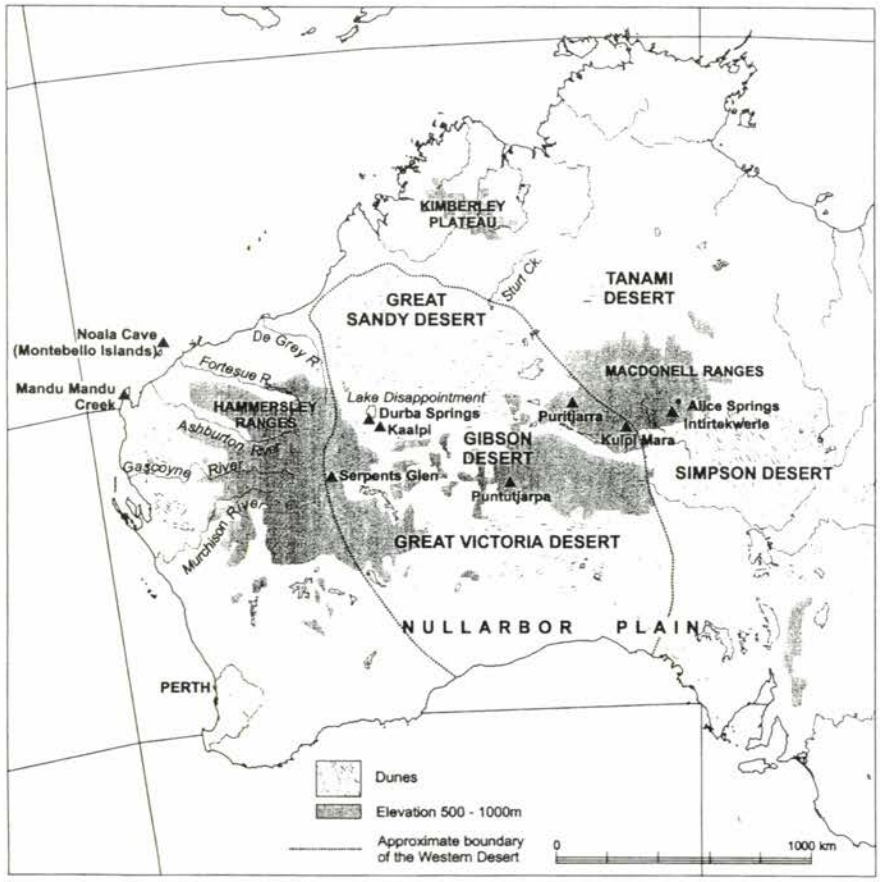

Figure 1 *Kaalpi* and other stratified sites mentioned in the text with the approximate boundaries of the Western Desert indicated.

1 Department of Archaeology, James Cook University, Townsville, Qld 4811, Australia

2 People and Environment Section, National Museum of Australia, GPO Box 1901, Canberra, ACT 2601, Australia

time to time and also provided mythological referants for some of the rock paintings, which link this site to other range uplands with permanent waters such as Durba Springs, Diebel Spring and the Carnarvon Ranges (cf. Veth 2000a). The Calvert Ranges are located in an expanse of well developed dunefields that average 8 to 10 metres in height.

In broader context, the Calvert Ranges are one of a number of small isolated range systems (e.g. Durba Hills, Kintore Range, Cleland Hills), that extend from the major desert uplands, such as the Pilbara and Central Australian ranges, deep into the Western Desert. From the Calvert Ranges, the Durba Hills to the west and the Runton Ranges to the northeast are both visible, and from the Durba Hills the main ranges to the west can just be made out.

The Ranges are located within the Bangemall Basin and are characterised as middle Proterozoic sedimentary rocks (Daniels 1975). Silcretes, quartzites and quartz are locally available. Vegetation comprises grass steppe of spinifex (*Triodia pungens, T. basedoii* and *T. wisena*), areas of mulga scrub (*Acacia aneura*), teatree scrub (*Melaleuca sp.*) and waterwood (*Acacia coriacea*) with eucalypts fringing the valley floors (Beard and Webb 1974). Rainfall is low (120-250 mm p.a.), seasonal and patchy (Walsh 1987).

The valleys of the northern half of the Calvert Ranges contain many rockshelters, caves and chambers. The majority have evidence for occupation in the form of artefacts, organics and faunal remains on the surface of their floors and exceptionally abundant panels of both paintings and engravings both within these sites and on numerous rock panels surrounding them. A number of rockshelters have paintings and engravings which have been partially covered by occupation deposits (Fig. 2). There are many grindstones, mullers and ground bedrock surfaces within the shelters. The density of both occupation deposits and rock art is very high by regional standards, as assessed by the senior authors from comparative work. In particular, the Calvert Ranges have a very large number of rock engravings, possibly one of the highest concentrations recorded in the Western Desert, and comparable to the concentration of engraved motifs at Thomas Reservoir in the Cleland Hills, 800 km due east.

While we will argue that the paintings likely date to the late Holocene, many of the engravings have been substantially weathered, chemically altered and in some cases covered in thick coatings of natural varnish and other crusts. It is quite likely that many of these engraved motifs date to the Pleistocene (Figs. 3 and 4).

Preliminary recording of motifs suggests there are differences in the style, spatial patterning and thematic content of motifs between the engravings and the paintings. The engravings show a graphic vocabulary that includes tracks and geometric designs, common in desert art, together with figurative motifs more characteristic of the Pilbara. The majority of the engraved naturalistic motifs appear to reflect foraging themes with the presence also of large infilled anthropomorphs. In contrast, the paintings display greater thematic diversity and contain a higher proportion of complex designs, although many of the same geometric motifs are also present. The paintings include a wide diversity of motifs and styles, including bichrome or monochrome *wati kutjarra* anthropomorphs and 'snakes', and a range of paintings that appear to have stylistic links with the Wiluna district to the south and the southern Kimberley to the north. Although more detailed study of the Calvert rock art is required our impression is that the history of the Calverts has been particularly dynamic, with several changes in inter-regional connections.

The 1996 excavations

Kaalpi Rockshelter is a north facing overhang 20m wide, 3m high and an average of 5m deep (Fig. 5). The shelter has a small chute at the rear, that appears to allow ingress of sediments, and is located close to the basal level of a nearby creek channel. Probing indicated that the eastern third of the deposit had greatest depth.

Following the establishment of an arbitrary grid a 2 x 1m test pit (W5, W6) was pegged out with excavation proceeding by 2cm spits or by natural layers. This represents approximately 5% of the total site deposits that might be excavated. A nest of 5mm and 2mm sieves were used. All formal artefacts and all features were recorded *in situ*. Solid samples were taken for each spit and volumetric measurements made for both recovered sediments and boulders. Cultural materials were sorted from the large (> 5mm) fraction in the field with 2mm fractions returned to the laboratory for further sorting. The rock art on the shelter wall was systematically photographed at approximately 40% overlap. The deposit of the shelter floor comprised fine siliceous sand, dense

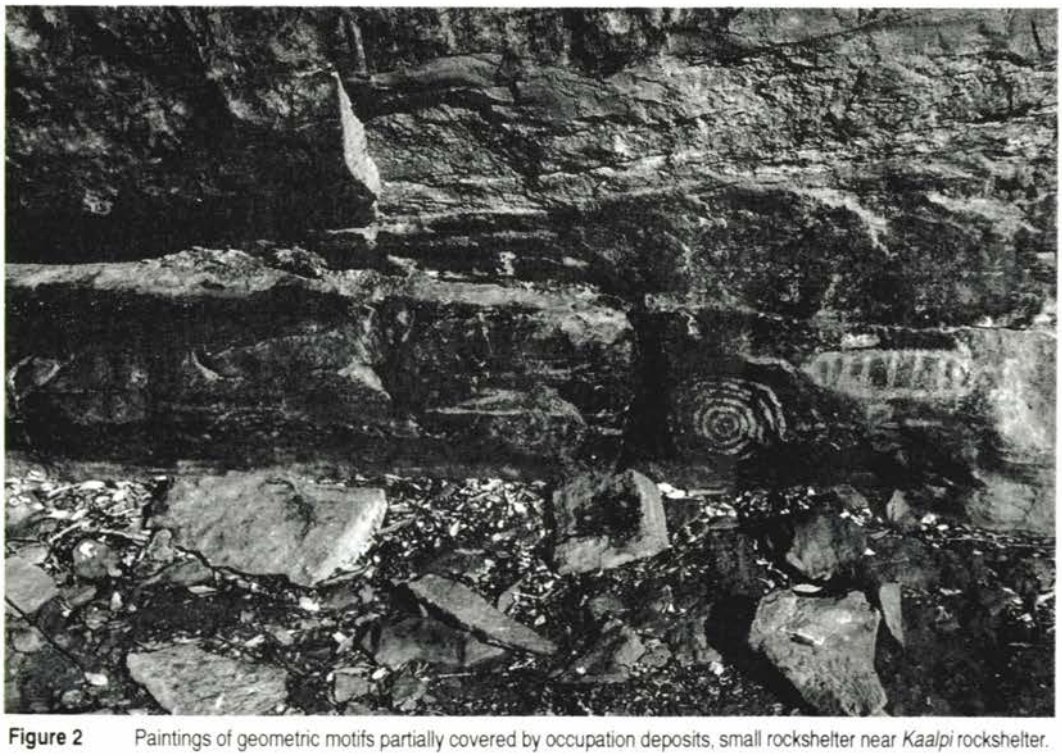

Figure 2 Paintings of geometric motifs partially covered by occupation deposits, small rockshelter near *Kaalpi* rockshelter.

patches of charcoal, grindstone fragments and mullers manufactured from arenaceous sandstone, flakes and debitage of silcrete, quartzite and chalcedony, and a central boulder with ground hollows.

Preliminary sorting of the cultural assemblages and the dating of charcoal samples was supervised by Mike Smith in Canberra. Chemical and mineralogical analyses of ochre recovered from the *Kaalpi* excavations have been carried out by Smith and Barry Fankhauser. Details are presented elsewhere, together with analyses of ochres from a range of sites in the Western Desert and central Australia (e.g. Smith 1996; Smith *et al.* 1998). Detailed analysis of the flaked stone artefact assemblage, ochre, bone, charcoal and macrofloral remains (total of 5 mm fraction and sample of 2 mm) was carried out by Michael Haley and Peter Veth (Haley 1999), while the ground stone artefacts were analysed by Kym McNamara (McNamara 2000). Their classification is still provisional.

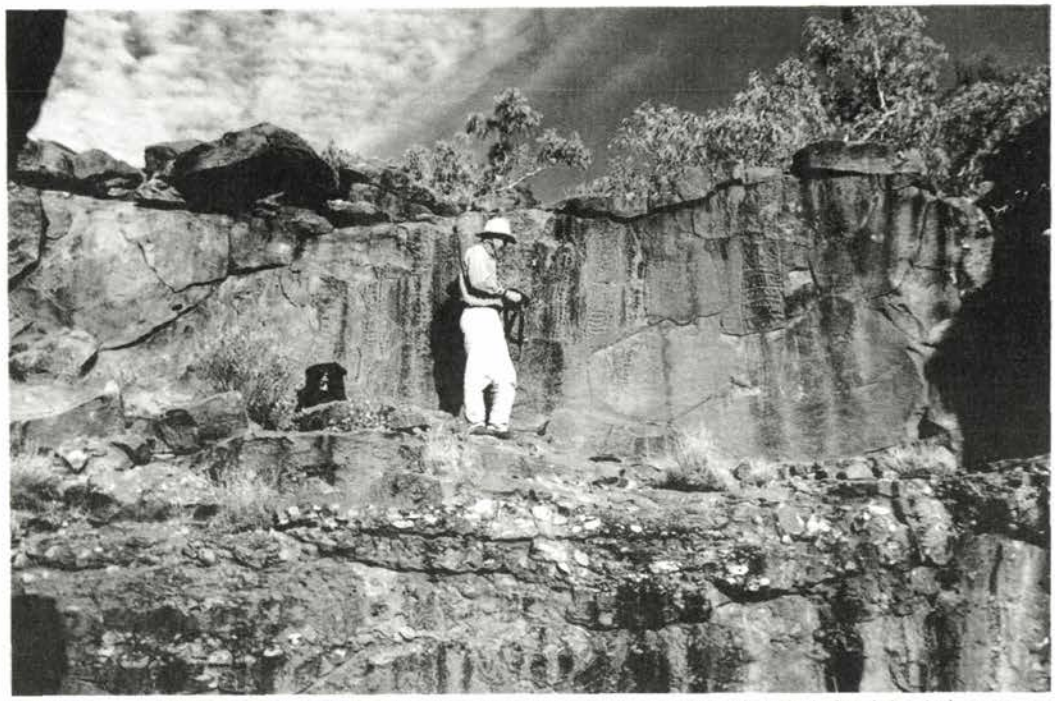

Figure 3 Engravings of large infilled anthropomorphs that have been altered through geological and chemical processes, *Kaalpi*.

Eight different kinds of raw materials used for the flaked and ground stone artefacts were identified by Doug McConnell, geologist from the Environmental Protection Authority, who had direct experience of the surface geology and archaeological sites from the study area. Indices of fragmentation were calculated for the small bone assemblage, in both burnt and unburnt classes, and a range of macrofloral classes identifed, some with the assistance of Betsy Jackes, Professor of Botany at James Cook University.

Stratigraphy and depositional history

The cultural deposits of *Kaalpi* can be divided into eight stratigraphic layers which, while sometimes only varying moderately in texture and colour, can be grouped into four units for the purpose of describing changes in artefact assemblages (Fig 6). Unit 1 comprises fine red aeolian sand with abundant charcoal fragments in the upper layer and extends to approximately 14 cm bsl (below surface level). Unit 2 is characterised by very fine aeolian sand, gravels from *in situ* weathering and small ironstone pisoliths, extending to a maximum of 34 cm bsl. Unit 3 contains both loosely and strongly indurated sediments containing pisoliths and lies on bedrock. The lowermost unit is a fine grey sand containing fragments of bedrock forming a fill in a deep joint in the bedrock. This unit is culturally sterile. The sediments of all units are strongly acidic (pH 3.5).

There is some lateral variability in the shelter stratigraphy. Deposits near the dripline are less consolidated, have more fine organics and less colour

Figure 4 Close-up of engraving of climbing figure showing weathering of rock face and dark varnish within the engraved (pecked) surface. The figure is approximately 25 cm high.

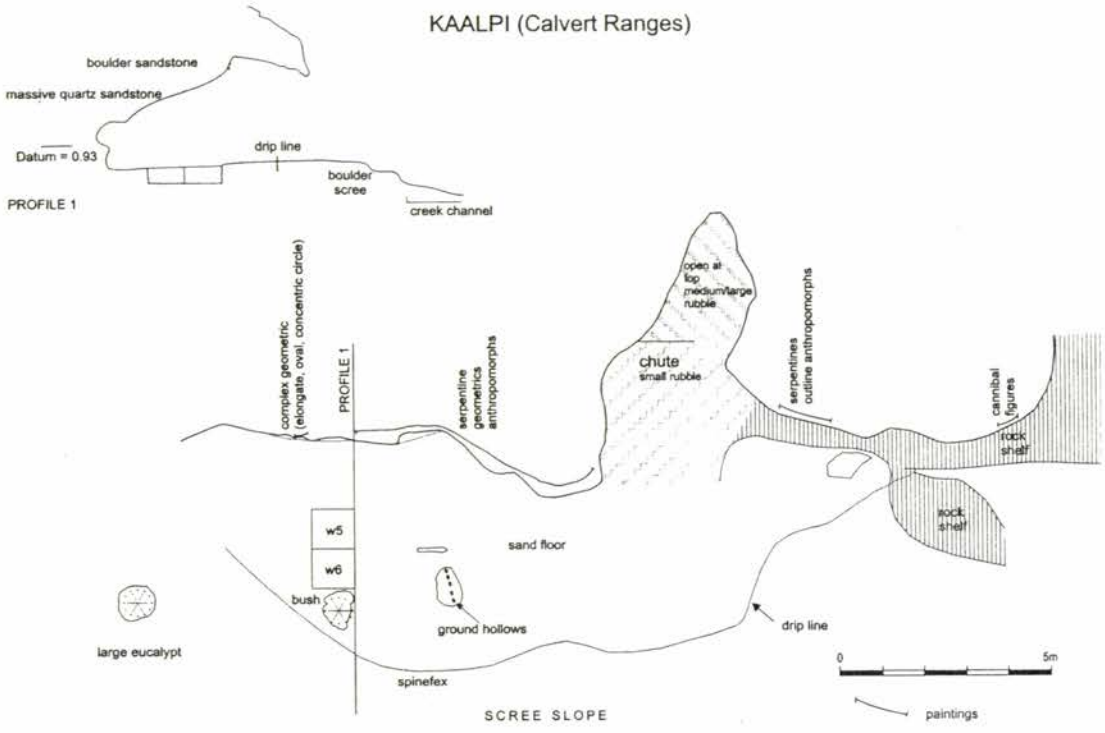

Figure 5 Profile and plan of *Kaalpi* rockshelter and excavation squares.

differentiation of layers. Despite this, it is evident from textural differences and from the orientation of roof fall that the major stratigraphic units extend more-or-less horizontally across the shelter.

Five charcoal samples were submitted for radiocarbon and AMS determinations (the latter is Wk-5646). Larger charcoal fragments were collected *in situ* and individually leveled. Charcoal was also taken from the hearth feature in Square W5 (Fig 6). Refer to Table 1.

Given there are no reversals in this sequence of dates nor apparent ambiguities in the consecutive strata the deposit is thought to have good stratigraphic integrity. This interpretation is reinforced through conjoining of two silcrete flakes from Spit 13, Square W6. The two oldest dates overlap at one standard deviation and indicate that the rate of sediment accumulation may have been rapid at this time. A slower and steadier rate of accumulation is suggested by the distribution of remaining dates, when controlled for volume (Haley 1999). It is quite likely that a major flooding event(s) occurred at approximately 2200 BP with the possibility that earlier occupation deposits have been scoured and removed. We believe this may have been an important factor in removing critical Early Holocene and Pleistocene deposits where these could conceivably have formed in this and similar Western Desert upland catchments.

The depositional history of the rock shelter reflects several processes. The shelter's position low on the side of the gorge leaves it exposed to heavy run-off, flooding and accumulation of slack water deposits. It is likely that deposits have been removed periodically from the shelter by scouring but we cannot tell how many cycles of deposition and erosion may have taken place prior to the accumulation of the current parcel of sediments. The earliest surviving deposits are culturally sterile and consist of sub-angular sandstone fragments and dark sand in a deep joint line towards the front of the shelter (layer 8). These are overlain by a dense layer of pisoliths (2-5 mm) in tough ferruginous cement, dating to about 2200 BP. Although pisoliths occur in the local sandstone, the concentration of pisoliths in layer 7 may reflect the stripping of soils on the plateau above the shelter. Layer 7 is rich in stone artefacts and other cultural remains. As none of these are rounded or abraded we interpret them as material deriving from use of the shelter either during or shortly after deposition of the pisolith layer. The induration of layer 7 may have occurred relatively quickly: iron is relatively mobile in moist acidic conditions. Deposition of pisoliths tapered off during the build up of layers 4 and 6. These layers contain an interleaved series of small lenses of rounded quartz pebbles (up to 50 mm) and aeolian

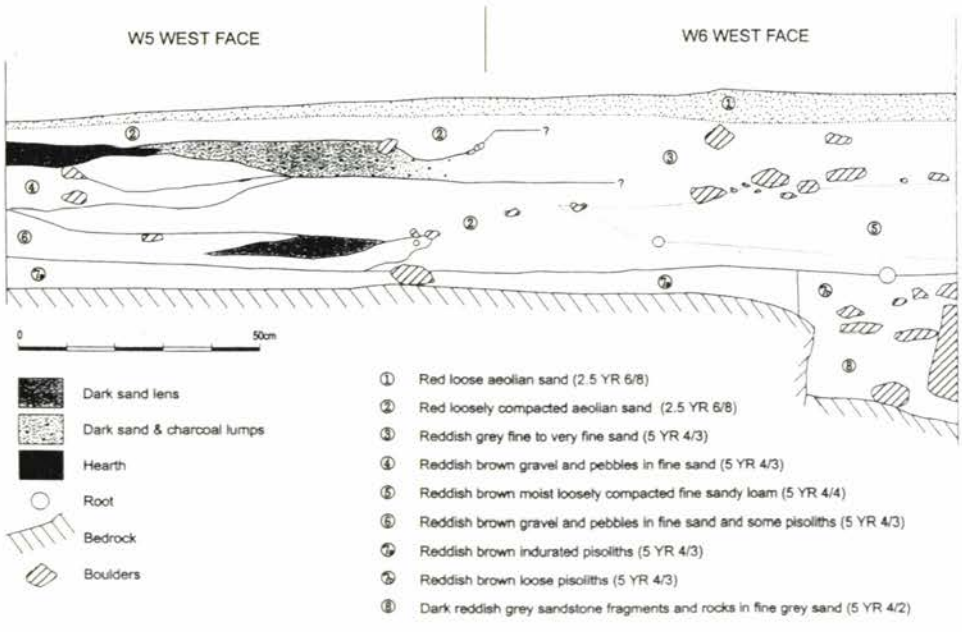

Figure 6 Sections for Squares W5 and W6, *Kaalpi*.

sand. The gravel is derived from the local pebbly sandstone, which apparently weathers in patches, dumping discrete parcels of gravel on the shelter floor.

The shelter appears to have been stabilised shortly after 970 BP. Layers 1-3 reflect deposition of fine aeolian sand derived from the extensive dune field lying outside the gorge system, together with substantial quantities of ash and charcoal from hearths and human use of the shelter. There are several small water-cut channels in layers 2-6.

Wk No.	Square	Spit	Years BP	Unit	Depth bsl
Wk-5643	W5	4	210±50	1	8-9 cm
Wk-5644	W6	8	970±60	2	23-25 cm
Wk-5645	W6	10	1310±60	2	28-30 cm
Wk-5646	W5	14	2,175±78	3	34-39 cm
Wk-4966	W6	14	2,270±80	3	42-46 cm

Table 1 Radiocarbon age determinations (uncalibrated) from *Kaalpi* excavation.

Stone artefacts, ochres and faunal remains

751 flaked and ground stone artefacts were recovered from the 5 mm fraction and 90 pieces of microdebitage from the 2 mm fraction. Full assemblage and attribute data for these artefacts are available on CD-ROM in Haley (1999). In summary, eight classes of lithic materials were identified, including quartzite, silcrete, quartz, chert, chalcedony, sandstone, arenaceous sandstone and other. Modified artefacts included tula adzes and slugs (tulas were recovered from W5/7 and W6/12 – all post-dating 2200 BP), retouched and/or utilised flakes and a wide range of grindstone types including millstones, mullers, mortars, pestles and amorphous grindstones (definite mullers were found in W5/1 and W6/5, and a fragment of a well-worn millstone with part of the ground groove in W6/7 – all post-dating 970 BP).

The flaked stone artefacts from both squares show great homogeneity through time in their technology of manufacture, raw materials used and the range of retouched/utilised implements. The majority of stone material used is quartzite which is abundant throughout the Calvert Ranges. There are changes registered, however, in the approximated discard rates for the stone artefacts and which are relevant to changes noted in the pattern of other cultural materials. Assuming a modern date for the surface of the site and after making adjustments for volume the number of artefacts discarded per 100 years can be estimated (Table 2).

The discard rate almost halves during the last 1000 years. There are substantial changes in both the number of grindstones and the raw materials utilised in their manufacture in comparing the lower and upper units (after Haley 1999). 47 grindstones (provisional tally) were recovered from both squares. Almost 80% (n = 37) come from the upper two units dating post- 1310 BP. Approximately 84% (n = 31) of these have been manufactured from arenaceous sandstone. Only three of the 10 grindstones in the lower units have been manufactured from this sandstone with the remainder made on quartzite and coarser grained sandstones. Haley (1999: 60) notes that this shift most likely reflects increasing focus on wet milling techniques.

Although analysis of the grindstones is ongoing, at this stage we draw attention to the noticeable increase in the quantity of grinding material above Spit 10 (approximately 1300 BP) and the shift towards the use of arenaceous sandstone as opposed to locally available sandstone. All of the formal millstones have been manufactured from arenaceous sandstone and were recovered from strata dating from after 1300 BP.

The distribution of ochre also shows a major change by Spit 10 (W6) dated to approximately 1310 BP. No ochre fragments were recovered in W6 beneath Spit 10, whereas ground fragments of red, yellow or white ochres were recovered from throughout the upper two units. The distribution for W5 is almost as abrupt with a strong peak noted in number and weight within Unit 2. Two very small fragments of red ochre were recovered from Spit 14 (Haley 1999: Figures 6.2 and 6.3).

Most of the ochres are sandy yellow pigments and some high-grade red ochre is present and we thought there was a possibility that this material might derive from Wilgie Mia in the Murchison region WA. However, an analysis of major and minor oxides showed that all of the *Kaalpi* ochres are derived from laterites presumably from a source from the broad expanse of tertiary-age laterites exposed some 250 kilometres to the east of the Calvert Ranges. They do not match ochre from the local quarry to the north known as *Tirnu* (Smith and Fankhauser *in prep*).

Bone fragments were negligible (a total of 5.32g was collected) and were recovered only from the upper four spits in both squares. The bone is highly comminuted and approximately 2.0g of this has been burnt. A value for Index of Fragmentation of 0.104 is lower than that recorded at Puntutjarpa (O'Connor et al. 1998) although of the same order as that recorded from Serpent's Glen (Veth 2000a). While this evidence for bone reduction may reflect protein-stress, and can be considered in the context of the abundant vegetable and/or food processing grindstones and anvils recovered from the site, the acidic pH must be acknowledged as one major and known taphonomic factor.

While charcoal was present in most spits, both scattered and in features, macrofloral remains were only present from the upper units. These included quandong seeds (*Santalum acuminatum*), fungi, macropod faeces, small twigs and the seed of a fossilised lichen (B. Jackes pers. comm.). Although charcoal weights vary between spits, preservation is apparently good, with values for charcoal weights in Unit 3 (W6) as high as those registered in the upper two units.

Rock art of *Kaalpi* – summary of variability, themes, inferred age and regional context

Kaalpi shares, with Serpent's Glen and Durba Springs, some of the largest rock rock art galleries, comprising both

Age Range	Number of artefacts	Artefacts per 100 yrs
970 - Modern	234	24
1310 – 970 BP	154	45
2270 – 1310 BP	363	38

Table 2 Estimate of artefacts discarded per 100 years, adjusted for volume, W5 and W6 (after Haley 1999).

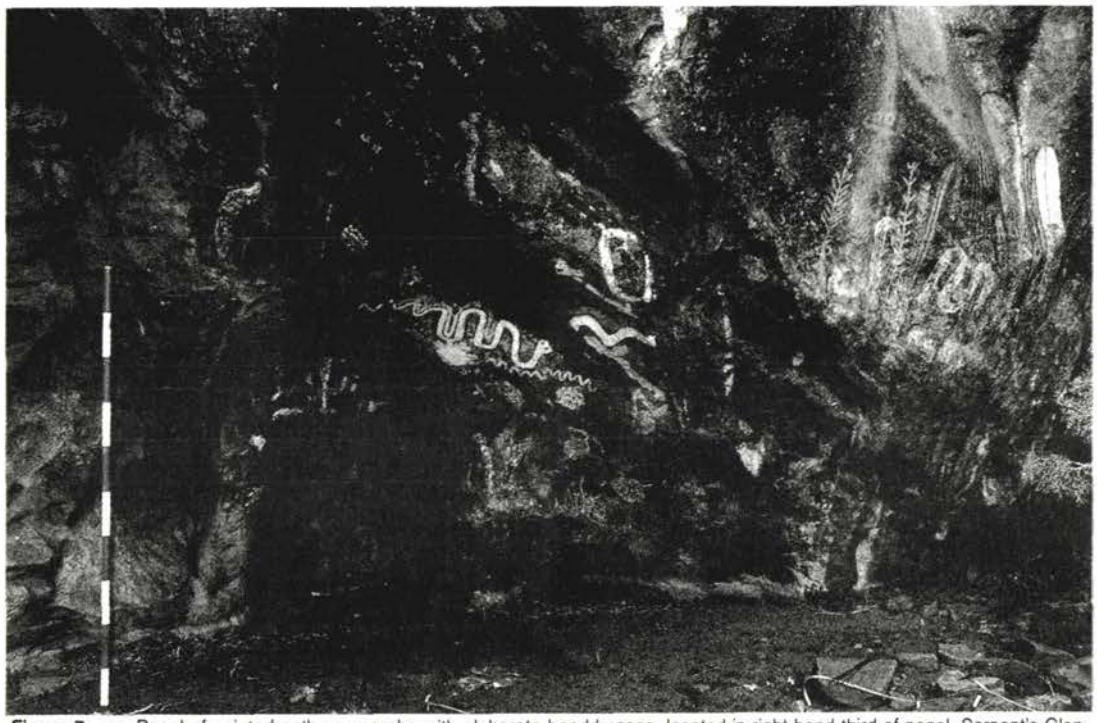

Figure 7 Panel of painted anthropomorphs with elaborate headdresses, located in right hand third of panel, Serpent's Glen, Carnarvon Ranges.

petroglyphs and pictographs, within the central Western Desert. Although dating the rock art is only in the early stages, the majority of paintings are thought to date to the late Holocene, given that the ochre specimens from *Kaalpi* date from 1300 BP and are essentially absent from before this time (Haley 1999: 61). Recent dates have been obtained from a shelter with paintings and ochres at Durba Springs and these also support a late Holocene age for the paintings (Veth in prep.).

In contrast, a large number of the engravings that occur on the quartz sandstone panels of *Kaalpi* have been significantly weathered, chemically altered and in some cases covered in thick coatings of natural varnish and other crusts. It is quite likely that many of these engraved motifs date to the Pleistocene.

Preliminary recording of motifs at *Kaalpi*, Serpent's Glen and Durba Springs suggests there are differences in the style, spatial patterning and frequency of different classes of motifs between the engravings and the paintings. These may reflect a change in the sites' function from a configuration in which high residential mobility prevailed in the Pleistocene towards their role as 'closed-system' aggregation sites in the Late Holocene (Veth 2000a). While they have likely been used for periodic seasonal gatherings or as fallback waters it is assumed that shifts in residential mobility and territorial boundaries have occurred between the Pleistocene and late Holocene.

The engravings include a range of animal tracks, circles, concentric circles and arcs in addition to a range of naturalistic motifs, including macropods, marsupials, snakes and birds. Noticeable are some very large anthropomorphs which have extensive infilling and the so-called archaic faces; disembodied faces that have a distribution through the arid zone from the coastal Pilbara to the Cleland Hills of central Australia, where Puritjarra is located (Dix 1977; Veth in prep). The geometric motifs, archaic faces, naturalistic fauna and large anthropomorphs can be found in differing proportions at *Kaalpi*, Serpent's Glen and Durba Springs. The majority of the motifs, with the exception of the large anthropomorphs, appear to refer to foraging themes and/or prey with the geometric motifs typical of those that have been doc-umented as acting as mnemonic devices for mapping both water hole and ancestral routes at the regional level (Gould 1980).

In contrast, the paintings display greater assemblage diversity and contain a higher proportion of complex designs, although many of the fundamental geometric motifs are also present. Several Martu with whom Peter Veth has previously worked had participated in ceremonies and gatherings at *Kaalpi* and Durba Springs before contact with Europeans (1963) and were able to provide some mythological referants for the figurative paintings. Anthropomorphs are depicted here with exaggerated headdresses, these being recorded only from the three sites of *Kaalpi*, Durba Springs and Serpent's Glen (Carnarvon Ranges) in the Western Desert (Figure 7). As such, they may be signifiers of corporate identity, or the extent of particular cults or religious movements. A range of simple outline anthropomorphs are also present. Some of these are referred to as *mamu* by Martu and represent malevolent beings; other motifs seen depict the dangerous cannibal beings associated with Lake Disappointment (cf. Tonkinson 1991). The paintings are predominantly located under overhangs and on sheltered vertical surfaces and while this must certainly reflect their state of preservation, it is clear that the majority of engravings, in contrast, are in highly visible places such as on prominent boulders and rock pavements.

During excavation of *Kaalpi*, a rock slab with the remains of a pecked design was recovered from the base of layer 7b amongst rubble wedged in the joint line in this part of the shelter. The date of 2270 BP provides a *terminus ante quem* for this engraving, which must have broken off a larger panel and have been brought into the shelter prior to becoming buried. As the slab preserves only the end of two pecked lines (10-15mm wide), the original motif cannot be determined.

Patterning in art has been used by researchers to indicate aggregation and dispersion patterns resting largely on interpretations of inside/outside (exclusive/inclusive) access to information networks (e.g. Conkey 1980; Galt-Smith 1997; Gould 1980). The rock art here indicates that the Calvert Ranges have possibly been the focus of activity and periodic aggregations of people at a number of different time periods. It is postulated that during the late Pleistocene, the engravings provide evidence for some form of population aggregation in this area. During the late Holocene, it is suggested that the

paintings reflect renewed use of the ranges as an aggregation site. However, the patterning in the art suggests that the nature of the aggregation changed over time from an inclusive open system to a more closed system. The engraved motifs, with perhaps the exception of the infilled anthropomorphs, are assumed to reflect an outside or inclusive symbolic configuration. In contrast, the paintings may be seen to include both inside and outside symbols, which is consistent with an argument for the increasing role of these sites for aggregation (both for mundane and sacred purposes), rather than for dispersion (cf. Galt-Smith 1997). The first stage of a long-term and detailed recording program of the art, whereby some of these propositions may be examined, was started in June and July 2000 by Jo McDonald and Peter Veth.

Kaalpi and its relevance to key research issues

Is there evidence for occupation before the mid-Holocene and, if so, does it extend through the period of heightened aridity associated with the last glacial maximum?

The small excavation at *Kaalpi* has revealed evidence for occupation during the late Holocene. It is suggested that earlier occupational evidence has been removed due to water scouring. While the majority of the paintings likely date to this period it is possible that at least some engraving panels date from an earlier phase of occupation. Given the antiquity of other regional sites it is reasonable to propose that this occupation could pre-date the last glacial maximum and be in the order of 25,000 to 30,000 years BP.

Are there changes in the inferred function of the site during the late Holocene, as registered from other Western Desert and central Australian sites?

There are two noticeable changes in the assemblages from this site which are dated to approximately 1300 BP. These include the introduction of significant quantities of ochre and a marked increase in the quantity of grinding material with a concomitant shift in raw material preference. A preliminary discussion of the art posits that the site may have shifted its function from an 'open-system' aggregation site, possibly during the Pleistocene, to one marked by more 'closed-system' aggregations during the late Holocene.

Does the discard rate for cultural assemblages increase significantly after approximately 1500 BP as registered from some other arid zone sites?

The estimated discard rate for flaked stone artefacts at *Kaalpi* almost halves after 1000 BP. This is the opposite trend to that recorded from other Western Desert sites of a comparable antiquity (Smith 1988; Veth 1989; but see Thorley 1998a) and may be related to a shift in the function of the site towards more intensive food processing activities such as seed grinding or may simply be a local effect.

Does the presence and distribution of ochres in the deposit allow any interpretations to be made about the age and nature of the abundant rock paintings?

Although we acknowledge the limitations of small sample size, it is interesting to note the near total absence of ochres in the units dating to before 1300 BP and their ubiquity after this date. The red, yellow and white ochres are all represented in proximal paintings, some of which have mythological associations to *Martu* who have occupied this site.

What is the distribution of grindstones within the deposit? Is there a trend towards 'formal' millstones during the late Holocene?

As noted above, there is a noticeable increase in the quantity of grinding material above Spit 10 (approximately 1300 BP) with a shift towards the use of arenaceous sandstone as opposed to locally available sandstone. Provisional classification of the grinding material (McNamara 2000) indicates that all of the formal millstones, whole and fragmented, have been manufactured from arenaceous sandstone and that they occur from after 1300 BP.

Is there evidence for protein stress, in the form of heavily comminuted bone, as registered from other arid zone sites in marginal environments?

The very small quantity of bone recovered from the excavation does not allow a meaningful assessment of this question. The high acidity of the deposit and other, presently unexplored, taphonomic processes may have contributed significantly to the apparently high degree of comminution.

Does the abundant rock art display variability in theme, style and spatial patterning which may allow an assessment of information networks?

Although systematic recording of the rock art has only begun some preliminary suggestions are made about variability in style, theme and spatial patterning between the engravings and paintings. It is argued that the engravings represent an open or inclusive symbolic schema, consistent with the aggregation role of this site within a very high residential mobility system. This stands in contrast to the open/closed or inclusive/exclusive schema of the paintings, which is seen to be more consistent with an aggregation site whereby signifiers of corporate identity and religious connection may be active elements in the negotiation of territory.

What are the implications of this sequence for the origins and timing of the spread of the Western Desert language?

On the basis of linguistic modeling McConvell (1996) has suggested that the homeland for the Western Desert language is in the vicinity of Lake Disappointment and that the remarkable spread of speakers and language dates from approximately 1500 BP (see also Smith *et al.* 1998; Veth 2000b). The donors of this language are argued to have moved from the Southeast Pilbara-Gascoyne area in the millennia preceding this. Veth (2000b) has argued that on the basis of shared material cultural assemblages, mythological frameworks and art traditions, the Pilbara uplands are the most likely donor area, specifically with reference to the central western portion of the Western Desert.

Changes in assemblages and the inferred function/placement of sites of this age from the Western Desert have been noted from a range of studies (Smith 1988; Thorley 1998a; Veth 1993) and are usually attributed to their new focus as ceremonial centres and aggregation sites, in some cases being located near densely clustered resources, such as seed stands, although not necessarily adjacent the most permanent waters. The sand plains surrounding the Durba Springs and Calvert Ranges have abundant stands of edible seed species and it is noted that the density of grindstones recovered from within the *Kaalpi* deposits and also recorded from the surrounding plains of the Serpent's Glen site are very

high by regional standards (cf. Veth 2000a; Walsh 1987). It is clearly worth considering changes in the function of this site by 1300 BP as possibly reflecting its new role as one of a number of centres of production for the new social and linguistic configurations of the Western Desert unity.

Conclusion

The preliminary excavation of a rockshelter in the Calvert Ranges, at the general locality known by Martu as *Kaalpi*, has been carried out as part of a longer-term program which aims to characterise the nature of Aboriginal occupation of the Western Desert through time. Previous excavations in the western portion of the Western Desert have been carried out in the vicinity of Rudall River (Veth 1987, 1993), the eastern Goldfields (O'Connor and Veth 1996), the Carnarvon Ranges (O'Connor *et al.* 1998) and the Durba Springs (Veth in prep.).

The excavation of *Kaalpi* rockshelter has provided a late Holocene sequence dating from approximately 2300 BP, containing abundant grinding materials, flaked stone artefacts, ochres and minor organic components. While the site demonstrates good stratigraphic integrity, there are reasons to believe that earlier deposits may have been removed, most likely due to water scouring during flash flooding. *Kaalpi* has one of the densest concentrations of paintings and engravings recorded from the region. While the paintings are thought to date to the Holocene at least some of the engravings, which are geologically and chemically altered, are thought to date to the Pleistocene.

Given that dates in excess of 23,500 BP have now been returned from the nearby site of Serpent's Glen, and dates in excess of 30,000 BP from the eastern margins of the Western Desert (Smith *et al.* 1997; Thorley 1998b), a Pleistocene antiquity for some of the engravings is a reasonable proposition.

Changes in the cultural assemblages occur by approximately 1300 BP, including the appearance of formal millstones and mullers, and their production from a non-local sandstone, and the introduction of yellow, red and white ochres. The timing of these changes is of interest, given the posited spread of the Western Desert language some 1500 years ago with the homeland argued to be in the vicinity of *Kaalpi*. We have suggested that changes in this site by 1300 BP may reflect the new social and linguistic configurations of the Western Desert unity.

Kaalpi's role as an aggregation site finds support through increases in the quantity of grinding material and their greater degree of reduction, the increased use of non-local lithic materials, the introduction of ochres from sources which likely lie several hundred kilometres to the east and the style and thematic content of the paintings, which are seen to represent some degree of corporate identity and boundedness. The site had also been used by senior Martu custodians in this fashion since before leaving the desert in the 1960's.

A field trip to *Kaalpi* was conducted by Peter Veth and Jo McDonald in June/July 2000 with the express aims of firstly, excavating another shelter less likely to have been affected by water action and, therefore, more likely to yield older occupation deposits and, secondly, the systematic recording of engravings and paintings located within the adjacent valley system towards an assessment of symbolic schema and information networks and ultimately, a more detailed understanding of the changing functions of this site through time.

Acknowledgements

We would like to acknowledge the support of the Western Desert Puntukurnuparna Aboriginal Corporation and of Martu people from Newman, Jigalong, Well 33, Cotton Creek and Punmu for the fieldwork. During the excavation of *Kaalpi*, Peter Veth and Mike Smith were assisted by Mack Kiriwirri Gardener and Ewan McPhee. Peter Veth carried out the research while on a Special Studies Program from James Cook University. Radiocarbon dating of Kaalpi was funded by AIATSIS through grant G96/5222 to Mike Smith. For assistance with sorting the assemblage Mike Smith would like to thank Kate Jess. Peter Veth wishes to give special thanks to Doug McConnell, geologist within the Environmental Protection Agency (Queensland), who described artefact lithologies and provided unique insights into regional structures based on extensive mapping he carried out in the Western Desert during the 1960's and 1970's.

References

Beard, J.S. and Webb, J. 1974 *Vegetation Survey of Western Australia: Great Sandy Desert*. Perth: University of Western Australia Press.

Canberra: Australian Institute of Aboriginal Studies. *Prehistory and Material Culture Series* 13, London: Duckworth.

Conkey, M.W. 1980 The identification of hunter-gatherer aggregation sites: The case of Altamira. *Current Anthropology* 21:609-30.

Daniels, J.L. 1975 Bangemall Basin. In *Geology of Western Australia*, pp. 147-158. Perth: University of Western Australia Press. *Western Australian Geological Survey Memoir* 2.

Dix, W. 1977 Facial representations in Pilbara rock engravings. In P. J. Ucko (ed.) *Form in Indigenous Art*, pp. 277-285. *Prehistory and Material Culture Series* 13. Australian Institute of Aboriginal Studies. London:Duckworth.

Galt-Smith, B. 1997 Motives for Motifs: Identifying Aggregation and Dispersion Settlement Patterns in the Rock Art Assemblages of Central Australia. Unpublished Honours Thesis, Department of Archaeology and Palaeo-anthropology, University of New England, Armidale.

Gould, R. A. 1980 *Living Archaeology*. Cambridge: Cambridge University Press.

Haley, M. 1999 Kaalpi: Investigation of Archaeological Assemblages from the Calvert Ranges Western Desert, Western Australia. Unpublished Honours Thesis, Department of Archaeology, James Cook University, Townsville.

McConvell, P. 1996 Backtracking to Babel: The chronology of the Pama-Nyungan expansion in Australia. *Archaeology in Oceania* 31(3):125-44.

McNamara, K. 2000 The Daily Grind: Gender in Archaeology and the Western Desert Phenomena. Unpublished B.A. (Hons) thesis, James Cook University, Townsville.

O'Connor, S. and Veth, P. 1996 A preliminary report on recent archaeological research in the semi-arid/arid belt of Western Australia. *Australian Aboriginal Studies* 2:42-50.

O'Connor, S., Veth, P. and Campbell, C. 1998 Serpent's Glen Rockshelter: Report of the first Pleistocene-aged occupation sequence from the Western Desert. *Australian Archaeology* 46:12-21.

Smith, M. A. 1988 The Pattern and Timing of Prehistoric Settlement in Central Australia. Unpublished PhD Thesis, University of New England, Armidale.

Smith, M. A. 1989 The case for a resident human population in the Central Australian Ranges during full glacial aridity. *Archaeology in Oceania* 24:93-105.

Smith, M. A. 1993 Biogeography, human ecology and prehistory in the sandridge deserts. *Australian Archaeology* 37:35-50.

Smith, M. A. 1996 Prehistory and human ecology in central Australia: an archaeological perspective. In S. R. Morton and D. J. Mulvaney (eds) *Exploring Central Australia: Society, Environment and the 1894 Horn Expedition*, pp. 61-73. Chipping Norton: Surry Beatty and Sons.

Smith, M. A., Prescott, J.R. and Head, M. J. 1997 Comparison of ^{14}C and luminescence chronologies at Puritjarra rock shelter, Central Australia. *Quaternary Geochronology (Quaternary Science Reviews)* 16: 1-22.

Smith, M.A., Fankhauser, B. and Jercher, M. 1998 The changing provenance of red ochre at Puritjarra rockshelter, central Australia: Late Pleistocene to present. *Proceedings of the Prehistoric Society* 64: 275-292.

Thorley, P. B. 1998a Shifting Location, Shifting Scale: A Regional Landscape Approach to the Prehistoric Archaeology of the Palmer River Catchment, Central Australia. Unpublished PhD Thesis, Anthropology, School of Southeast Asian and Australian Studies, Northern Territory University, Darwin.

Thorley, P. B. 1998b Pleistocene settlement in the Australian arid zone: Occupation of an inland riverine landscape in the central Australian ranges. *Antiquity* 72:34-45.

Tonkinson, R. 1991. *The Mardu Aborigines: Living the Dream in Australia's Desert.* Fort Worth: Holt, Rinehart and Winston.

Veth, P. 1987 Martujarra prehistory: variation in arid zone adaptations. *Australian Archaeology* 25:102-111.

Veth, P. 1993 Islands in the Interior: The Dynamics of Prehistoric Adaptations within the Arid Zone of Australia. *International Monographs in Prehistory 3.* Ann Arbor, Michigan.

Veth, P. 1995 Aridity and settlement in North West Australia. *Antiquity* 69:733-46.

Veth, P. 2000a Cycles of aridity and human mobility: Risk-minimization amongst late Pleistocene foragers of the Western Desert, Australia. Paper presented to the Annual Meeting of the Society for American Anthropologists, Philadelphia.

Veth, P. 2000b Origins of the Western Desert Language: Convergence in linguistic and archaeological space and time models. *Archaeology in Oceania* 35(1):1-19.

Veth, P. in prep. The archaeology of an oasis: Durba Springs and the Western Desert Unity.

Walsh, F.J. 1987 The influence of the spatial and temporal distribution of plant food resources on traditional Martu subsistence strategies. *Australian Archaeology* 25:88-101.