

PLATYPUS ROCKSHELTER (KBA:70), S.E. QUEENSLAND: CHRONOLOGICAL CHANGES IN SITE USE.

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INTRODUCTION

Platypus Rockshelter is a multicomponent archaeological site set into a conglomerate cliff on the Brisbane River near Fernvale, S.E. Queensland. Excavation revealed seven stratigraphic units in the smaller of two weathered cavities and these date from some 5300 BP to younger than 540 BP (Figure 1). An abundance of bone, freshwater mussel shell, charcoal and a lesser amount of other organic material (e.g. feathers, hair, plants) was found associated with numerous stone artefacts. This good organic preservation, when linked with an internally consistent C14 dating series, a model of site formation and an initial understanding of site disturbance processes, makes it feasible to investigate variability in prehistoric human use of Platypus Rockshelter. Details concerning the site's complex stratigraphy, dating and site formation are the focus of a separate paper in this issue of QAR (Hall et al 1988). In accordance with the aims of the Moreton Region Archaeological Project - Stage II (Hall and Hiscock 1988), this companion paper presents data on the assemblage content and discard patterns in order to discuss changing site use during the Holocene. In particular we raise the issue of how the changing morphology of the shelter may have influenced the temporal pattern of cultural discard and follow with a discussion of how the nature of assemblages may be employed to tease out some factors relating to temporal changes in site use. We also offer the caveat that changes in the discard rate of cultural material through time do not necessarily reflect shifts in "occupational intensity".

CHANGES IN SHELTER MORPHOLOGY

Information relating to stratigraphy, chronology and geomorphology obtained by careful excavation and analysis revealed a number of changes in the elevation and topography of the shelter floor. Although a reconstruction of site formation has been detailed elsewhere (Hall et al 1988), it is necessary to outline the salient points of this scenario as follows (see also Figure 2).

1. Prior to 5300 BP a cavity had been formed in a conglomerate cliff. Sediment composed of weathered matrix as well as soil from above the cliff built up as a dome-shaped apron in front of the shelter, causing deposition within the cavity (Figure 2a).

2. As this process continued people began to use the shelter and discard cultural material there as, found in Stratigraphic Units 7-2, (Figure 2b). Two "living floors" were recorded (SU3 & SU5) which were characterised by thin, fairly continuous layers of cultural material which exhibited very little breakage and which lay disconformably on harder-packed undifferentiated sediments (see Figure 1).

3. At some time after 2350 BP but prior to 541 BP, the apron slumped due to river bank incision and consequent downslope instability. Also during this time a large block separated from the roof to be deposited on the slope in front of the shelter. The slumping resulting in a vertical truncation of the deposits inside the newly-created dripline of the shelter. The cultural deposits outside the dripline were moved downslope towards the river (Figure 2c).

4. The depositional process continued with sediments (SU1) now being built up outside the dripline at a level some 75cm lower than the top of the older truncated deposits, the fallen block acting as a sediment trap. People continued to camp and discard material at the site, but only in the area outside the dripline (Figure 2d).

The Interrelationship of Shelter Morphology and Cultural Discard

Given this scenario it is clear that the geomorphic events would have altered the size and location of habitable space and thus may have affected the quantity and nature of activities carried out. The idea that cave form is correlated with the size of groups using it has been employed by other archaeologists. Binford (1972:320-323) suggested that the amount of sheltered floor space was an important factor influencing the attractiveness of a site for groups of varying size. He also suggested that, in some circumstances, human occupation alters site form in a way that affects the likelihood of further occupation of a certain kind, thereby producing directionality in the archaeological sequence. In Australia, Smith (1982:115) suggested that fluctuations in floor space would influence fluctuations in the size of groups deciding to inhabit a shelter. There is also empirical evidence for a positive correlation between shelter size and the abundance of artefacts discarded there (Hiscock 1984) which might imply more regular re-occupation of larger caves. Hughes (1977) argued that human occupation altered the morphology of sandstone shelters, thereby increasing their habitability and perhaps leading to directional archaeological sequences (cf. Hughes and Lampert 1982).

If throughout the occupation of Platypus Rockshelter a correlation existed between floor area and human use of the site (in terms of the number of inhabitants or the frequency and duration of their visits or their pattern of discard), temporal changes in the rate at which cultural material was discarded may reflect alterations in shelter form. Thus, we calculated discard rates for the major stratigraphic units with a view to investigating this possibility. Before discussing these results it is necessary to explain how they were derived.

CALCULATING DISCARD RATES

Calculating discard rates involved dividing the quantity of material in a stratigraphic unit by the number of years over which that unit formed. This in turn required accurate estimates of both the quantity of objects and the duration of the strata.

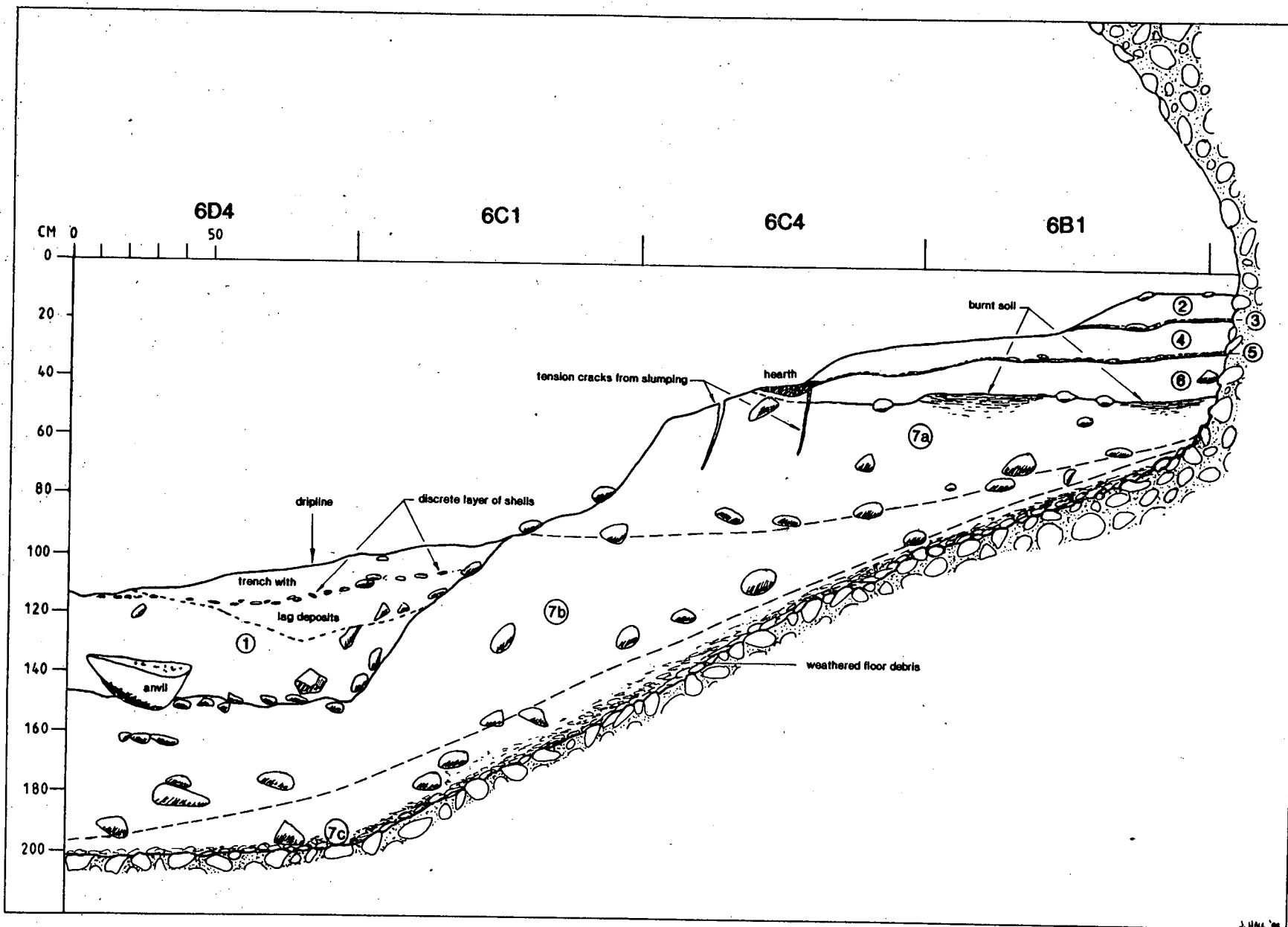


Figure 1. Composite stratigraphy (NW-SE) in small chamber, Platypus Rockshelter (from Hall et al 1988).

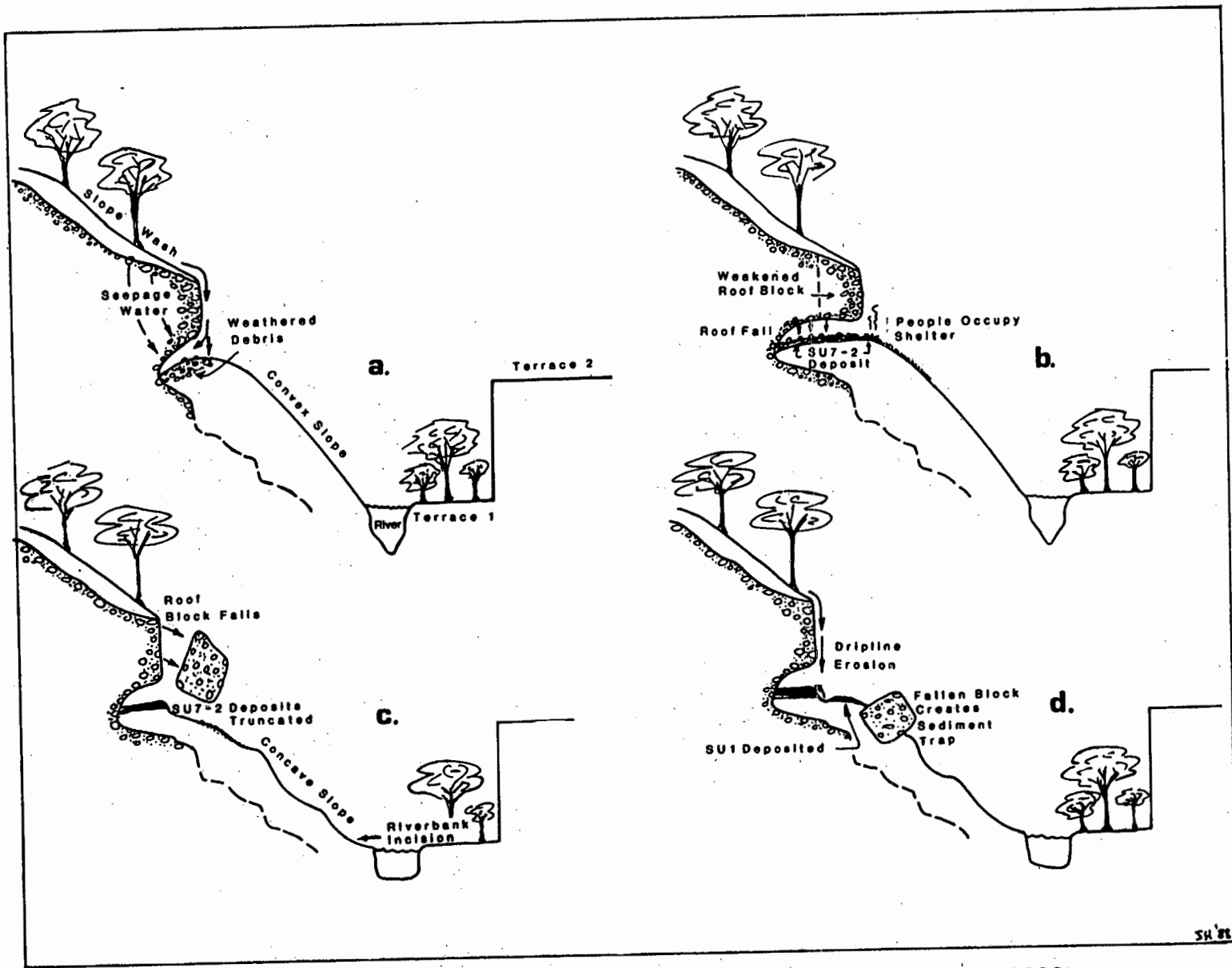


Figure 2. Model of site formation at Platypus Rockshelter (from Hall *et al* 1988).

Quantity of material

Obtaining worthwhile estimates of the quantity of material involved the selection of squares with the most reliable stratigraphic and dating sequences. We excluded some squares because there were doubts about either their stratigraphic integrity or the precision with which stratigraphic changes had been identified during excavation. It was also necessary to choose squares which provided representation for all of the strata. As explained in an accompanying paper (Hall *et al* 1988) many of the strata were spatially restricted within the site. Five 1m x 1m squares were chosen for analysis: 6D4 and 6C1 were selected to provide samples for SU1, and squares 7B2, 6B1 and 6B2 for SU2-7 (Figure 3).

Weight was chosen as the measure of abundance in this analysis for a particular reason - comparability of results. Weight can be applied to all three classes of material under discussion here - bone, shell and stone artefacts. The number of bone, shell and stone pieces varies with the degree of fragmentation (which is likely to differ between the three classes), and indices such as minimum numbers or meat weight are not readily calculable for stone artefacts. Thus, for our purposes calculations for the amount of material transported to the shelter and discarded there is expressed in terms of weight.

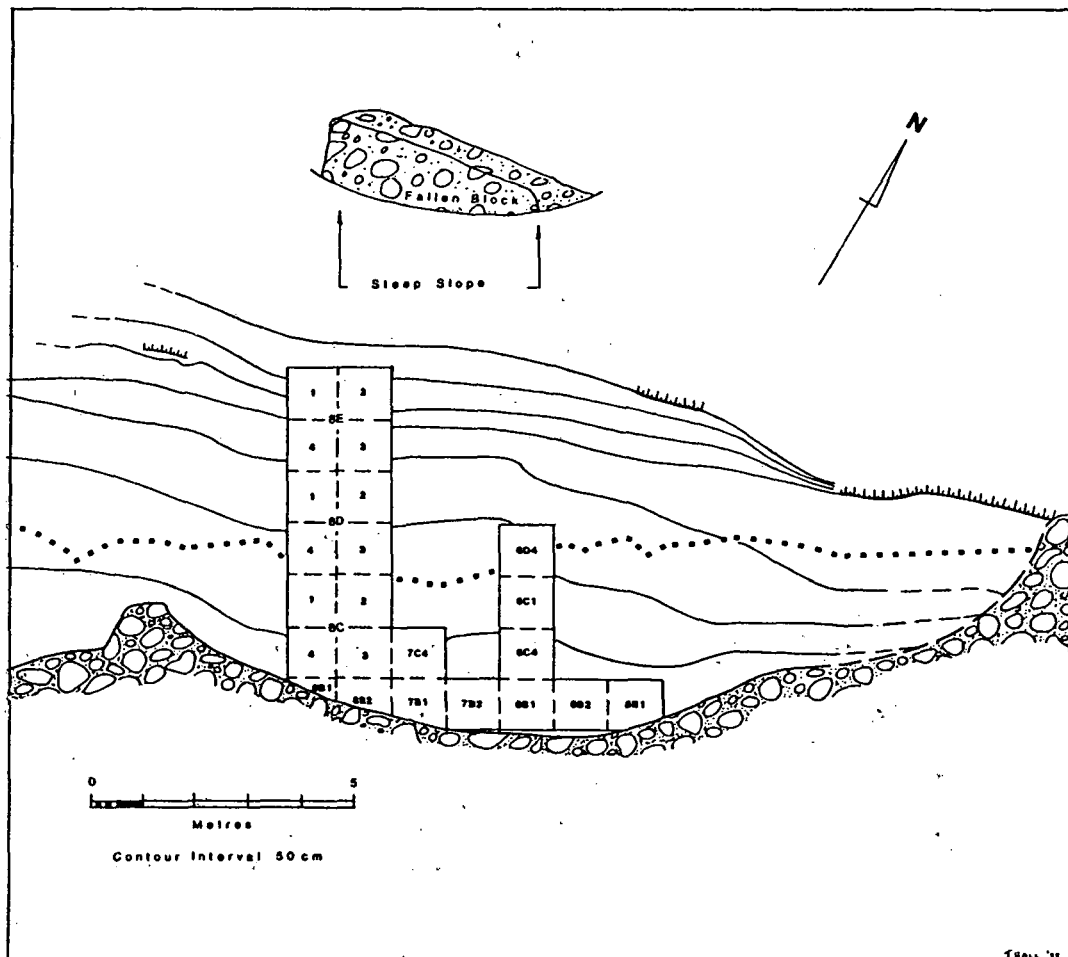


Figure 3. Platypus Rockshelter site plan showing excavated squares in the smaller chamber.

Samples were standardized by dividing the total weight of material for each stratigraphic unit by the number of grid squares used as the sample, and expressing abundance as weight per square metre. When samples were of mixed stratigraphic provenance they were not split equally between the relevant strata but were omitted from the analysis. In such cases the average was calculated for only those squares for which bone was represented by unmixed samples. Stratigraphic Units 3, 4, and 5 were combined for all calculations, in order to increase sample sizes and to reduce dating difficulties (see below).

Determining the duration of Stratigraphic Units

The second requirement for the calculation of discard rates is an estimate of the duration of each of the strata. Australian archaeologists have commonly obtained such estimates by reference to an age/depth curve (eg. Flood *et al* 1987; Hiscock 1986; Hughes and Djohadze 1980, Smith 1982; Walters *et al* 1987), and in sites which exhibit constant and relatively uniform sediment accumulation this procedure has proved quite useful. Unfortunately, this approach is not applicable to Platypus Rockshelter as its stratigraphic sequence is broken by marked erosional events and is nowhere represented in a single column. Instead, we have been able to establish age estimates for the stratigraphic units by direct reference to radiocarbon dates. Two of the strata (SU3 and SU5) appear to be living floors, probably representing short-term events, and are dated by radiocarbon analyses. A number of other strata (SU4, SU6, SU7) are bracketed by C14 determinations, and can therefore be assigned maximum durations with a reasonable degree of accuracy. It proved more difficult to deal with SU1 and SU2 in this way. The radiocarbon date obtained from the underlying living floor (SU3) provides a maximum age for the initial accumulation of SU2. As there is no true stratigraphic break at the junction of SU1 and SU2, there is no possibility of assessing precisely when SU2 ceased to accumulate or SU1 began to form.

Estimates for the time-span of each stratigraphic unit were calculated in this way. Table 1 gives calibrated ages for the five C14 samples received for the 7 strata. We have utilized recent strides in C14 calibration in order to give calendar year dates to archaeological units (see Hall and Hiscock 1988). Although the CALIB calibration program (Stuiver and Reimer 1986) provides the statistically most likely date for the C14 ages (or, in the case of Beta - 3075, a choice of three), it was considered prudent to include the possible range of each (to two sigmas) in our calculations. This was done to ensure that any temporal trends resulting from the analysis were real rather than a result of over-confidence in the accuracy of the calibrated date.

The resulting estimates of the duration for each stratum are presented in Table 2, reference to which will demonstrate that estimates were derived in two ways. In the first, unit duration - called the "likely duration" - was indicated by calibrated dates. For example, SU7 is bracketed by two C14 samples, SUA-1502 and Beta-3074 which give calibrated ages of 4237 BP and 5305 BP respectively. By simply calculating the difference, 1068 years, we arrive at the likely duration for the stratum sandwiched between them. The second way of estimating duration was indicated by the maximum age range given by the two sigma value (called the "possible duration"). This produced minimum and maximum estimates for the duration of stratigraphic units. For example, in SU7 the minimum duration is estimated by taking the oldest possible

age of the upper C14 sample, 4819 BP, from the youngest possible age of the lower C14 sample, 4873 BP, which gives a time-span of only 54 years. The maximum duration for SU7 is established by taking the youngest possible age of the upper C14 sample, 3726 BP, from the oldest possible age of the lower sample, 5446 BP, which gives a span of 1720 years. This was done for each stratigraphic unit (Table 2).

Table 1. Radiocarbon ages and calibrated dates for Platypus Rockshelter.

Strat. Unit	Radiocarbon age (yrs. b.p.)	Laboratory Number	Calibrated Age	
			Estimated age (yrs. BP)	Estimated range (two sigmas)
SU1	560 \pm 60	Beta 3076	541	500-660
SU2	---	---	---	---
SU3**	2420 \pm 90	I 11094	2356	2200-2749
SU4	---	---	---	---
SU5**	2480 \pm 70	Beta 3075	2479/2658/2701*	2339-2749
SU6	---	---	---	---
SU7 ^t	3850 \pm 170	SUA 1502	4237	3726-4819
SU7 ^b	4540 \pm 80	Beta 3074	5305	4873-5446

** Living floors

* Calibration yields three equally valid dates for this sample.

t Top 2.0cm of this stratum

b Date for lowest cultural material

Table 2. Estimated duration of Stratigraphic Units at Platypus Rockshelter.

Strat. Unit (SU)	Likely range (calculation based on calibrated ages)	Likely Duration (years B.P.)	Possible range (calculated on two sigma value)		Possible Duration (years B.P.)	
			Min.	Max.	Min.	Max.
1-2	0 - 2356	2356	0-2200	0-2749	2200	2749
3-5	2356 - 2479/2701*	123/345*	2749-2339 [@]	2200-2749	100 [@]	549
6	2479 - 4237	1758	2749-3726	2339-4819	977	2480
7	4237 - 5305	1068	4819-4873	3726-5446	54	1720

* These values represent the ranges of the multiple options available for Beta 3075

@ As CALIB shows the possibility that this deposition could be instantaneous, it has been given a value of 100 years for this calculation.

It proved impossible to apply this procedure to stratigraphic units 3-5 without making minor modifications. One problem arose because of the three equally valid calibrated dates for Beta-3075 (SU5). This was dealt with by providing two estimates of likely duration, one based on the youngest calibrated age, the other on the oldest calibrated age (Table 2). Another difficulty was created by the large overlap in calibrated

age ranges between I-11094 and Beta-3075 which indicates the possibility that the accumulation of SU3-5 was instantaneous. One implication of this possibility is that the radiocarbon analysis cannot be relied on to differentiate between these three strata, and we have consequently combined them for all calculations of discard rates. Furthermore, it is necessary to fix some minimum figure for the time difference between the initiation of SU5 accumulation and the cessation of SU3 accumulation, so that the possible range of discard rates can be calculated for these strata. On geomorphic grounds we doubt that these strata actually formed instantaneously and so have employed the value of 100 years for the purposes of this analysis. It is acknowledged that this figure, while being reasonable, is somewhat arbitrary.

The outcome of these methodological contortions is a number of estimates for the discard rate of debris in each stratigraphic unit, expressed as weight of material per square metre per 100 years of deposition. We argue that the "likely discard rate" (derived from the likely duration) is the best approximation of the rapidity at which prehistoric material accumulated, although we cannot exclude any value given by the "possible discard rate" (derived from the 'possible duration' estimate).

TEMPORAL PATTERNS IN CULTURAL DISCARD

Bone Discard

Bone weights, density and discard rates are given in Table 3. The two upper strata (SU1-2) show much lower rates of bone discard than is found in lower levels of the deposit. Even the maximum possible discard rate for SU1-2 is only slightly above the minimum possible discard rate in SU3-7. This decrease can not be shown to have resulted from more intensive weathering of bone in those strata (we will later show that the ratio of bone to both shell and stone artefacts remains little changed in the top of the deposit). Nor can it be explained as an intensification of any other form of attritional mechanism (e.g. carnivore scavenging) because a similar decrease in discard rate is visible in the other classes of cultural material. We conclude that the reduced bone discard in SU1-2 represents a genuine reduction of the discard of bone within the rockshelter.

Table 3. Estimated discard rates of bone in Platypus Rockshelter strata.

SU	Total weight (gms)	Wt/m ² (gms)	Years Represented		Bone Discard Rate (gms/m ² /100yrs)	
			Likely	Range	Likely [#]	Possible ^{##}
1-2	98.5	49.2	2356	2200-2749	2.1	1.8 - 2.2
3-5	165.1	82.6	123/345*	100-549	23.9/67.2	15.1 - 82.6
6	587.5	195.8	1758	977-2840	11.1	7.9 - 20.0
7	288.0	96.0	1068	54-1720	9.0	5.6 - 177.0

Based on calculations using the 'likely duration' of strata.

Based on calculations using the 'possible duration' of strata.

* These values represent the ranges of the multiple options available for Beta 3075

Shell Discard

Table 4 presents data on the weight of shell, its density and its rate of discard in each stratigraphic unit. All methods of calculating discard rate show an increase from SU7 to SU6, and to SU3-5. Thus, there is a trend towards increasing shell discard throughout the period 5300-2400 BP. This trend is broken in the upper levels where rates decrease. One way of illustrating this pattern is by recalculating likely discard rates, combining SU1 with SU2 and SU3-5 with SU6 to give two roughly equal time periods. The resulting decline from at 23.3 - 26.0gms/100 years for SU3-6 to 18.2gms/100 years for SU1-2, argues for a decrease in shell discard in the last 2400 years compared to the preceding period.

This decreasing trend in shell discard rates in the upper levels can not have resulted from more intensive weathering of shell in those strata (as we show later the ratio of bone:shell remains little changed in the top of the deposit). Shell in SU1 and SU2 appears little weathered, as does shell in underlying strata. We conclude that in the early period of site occupation shell was discarded in the shelter at increasing rates, while in SU1-2 there are indications of a reduction in the rate of shell discard during recent millennia.

Table 4. Estimated discard rates of shell in Platypus Rockshelter.

SU	Total weight (gms)	Wt/m ² (gms)	Years Represented		Shell Discard Rate (gms/m ² /100yrs)	
			Likely	Range	Likely [#]	Possible ^{##}
1-2	858.9	429.5	2356	2200-2749	18.2	15.6 - 19.5
3-5	904.0	296.5	123/345*	100-549	85.9/241.1	54.0 - 296.5
6	579.9	193.3	1758	977-2480	11.0	7.8 - 21.1
7	14.3	4.8	1068	54-1720	0.4	0.3 - 8.9

Based on calculations using the 'likely duration' of strata.

Based on calculations using the 'possible duration' of strata.

* Represents ranges of the multiple options available for Beta 3075

Stone Artefact Discard

Chronological trends in artefact discard rates are less certain than those described for bone and shell. Stone artefact weights, density and discard rates for each stratum are given in Table 5. The likely discard rates show a pronounced increase from SU7 to SU3-5, but there is an overlap in the possible rates of SU6 and SU3-5. Consequently, while we suspect that there was a trend towards increasing artefact discard rates throughout the period 2400-5300 BP, we cannot be certain. It is possible that the rate may have peaked in SU6 and declined slightly in SU3-5.

Despite the wide possible range of estimates for SU3-5, the calculated discard rate declines in SU1-2. It is also clear that while average discard rates over the last 2400 years were lower than previously, the change is not remarkable (12.1 gms /100 years in SU1-2 versus 15.7 to 17.6 gms/100 years in SU3-6). We therefore infer that the early period of site occupation, SU7 to SU3-5, probably witnessed

consistent increases in the rate at which artefacts were discarded within the shelter. This trend was not continued in SU1-2 where discard rates were probably fairly stable or decreased slightly.

Table 5. Estimated discard rates of stone artefacts (>0.5cm) in Platypus Rockshelter.

SU	Total weight (gms)	Wt/m ² (gms)	Years Represented		Artefact Discard Rate (gms/m ² /100yrs)	
			Likely	Range	Likely [#]	Possible ^{##}
1-2	598.8	285.9	2356	2200-2749	12.1	10.4 - 13.0
3-5	233.7	77.8	123/345*	100-549	22.5/63.3	14.2 - 77.8
6	757.5	252.5	1758	977-2480	14.4	10.2 - 25.8
7	6.3	2.1	1068	54-1720	0.2	0.1 - 3.9

Based on calculations using the 'likely duration' of strata.

Based on calculations using the 'possible duration' of strata.

* These values represent the ranges of the multiple options available for Beta 3075

A Comparison and Discussion of Temporal Trends in Discard

Having presented these data on the temporal patterns of estimated discard rates of stone artefacts, bone and mussel shell, it is instructive to compare these results. From the comparative illustration in Figure 4 it is apparent that the same chronological trend obtained for each form of debris, albeit to differing degrees. There is a consistent increase from SU7 to SU3-5, followed by a decline in SU1-2. We have suggested that the last 2400 years (SU1-2) experienced lower discard rates than the period 2400-4200 BP. This last trend is pronounced for bone, less so for shell, and least pronounced for stone artefacts. There is also variation in the trend observed within the lower strata. Increases between SU7 and SU3-5 are much smaller for bone than for shell or stone artefacts.

The changes in shell and stone artefact discard are very similar. In most stratigraphic units shell was discarded at a higher rate than were stone artefacts, but otherwise the trends are roughly the same. If bone preservation in SU3-6 was poorer than that in SU7 then the increases in bone discard have probably been understated by our estimates, and the trends in prehistoric bone discard may originally have been closer to those identified in shell and stone (see below). In short, slight discrepancies between the temporal trends in bone, shell and stone discard rates may simply represent the differential effects of taphonomic mechanisms; all three materials can be said to reveal the same major trends. It is therefore useful to focus on the similarities that the data on bone discard shares with that of shell and stone artefacts, and to conclude that bone displays a trend similar to that produced for stone or shell except that the proportional changes from one stratigraphic unit to another are less pronounced in the lower part of the deposit. This finding that the same general trend occurs with respect to three different kinds of archaeological debris suggests to us that the change may involve basic patterns of site use.

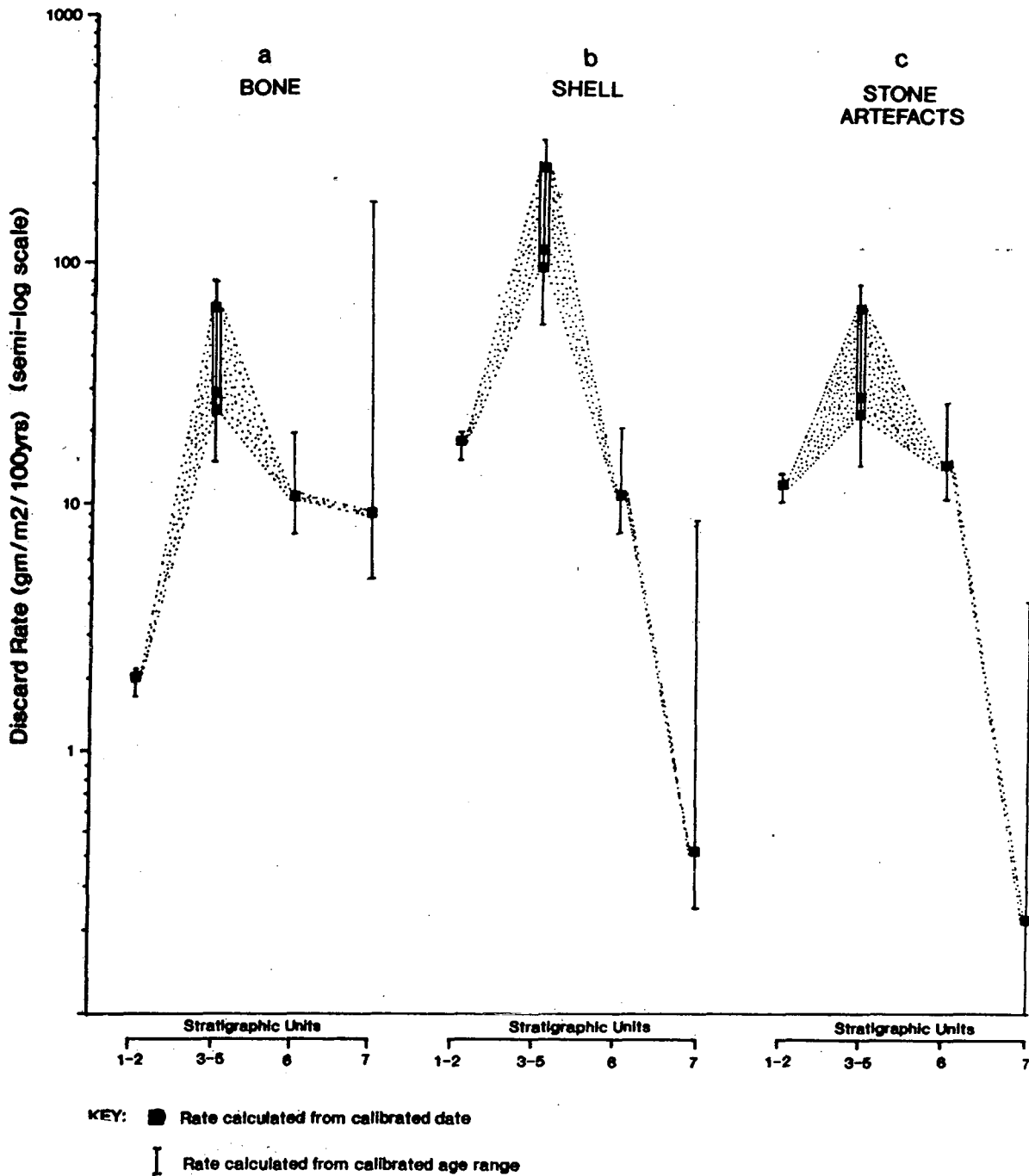


Figure 4. Comparison of temporal changes in discard rates of bone (a), shell (b), and stone artefacts (c) in Platypus Rockshelter.

The past few years of Australian archaeological research has witnessed a number of attempts to employ the concept, "intensity of site use". In fact, it has become almost commonplace for archaeologists to interpret such temporal variations in the abundance of debris in terms of the intensity of site use or the number of occupants. However, as Hiscock (1981:30) points out, the concept has not always been defined (cf. Attenbrow 1982; Blackwell 1982) and when it has been defined its use has been generally marked by ambiguity. For example, it has been used in reference to the duration of human presence at sites within a particular span of time (e.g. Schrire 1972:664) as well as a reflection

of variability in group size and sedentism (Lourandos 1980:297). However, the main threads running through most definitions and uses of the concept have included group size, duration of stay and the nature of human activity at sites. A recent statement is given by Jones and Johnson who define intensity of site use as the "quanta of human actions per unit time" (1985:58).

As reasonable as some of these attempts may seem, the measurement of site use, and especially that of the intensity of site use, is fraught with difficulty. If we were to apply this "intensity" interpretation to Platypus Rockshelter we would have to posit that between 5300 BP and 2400 BP site usage intensified but then the trend reversed in the last 2400 years. We hesitate to make such claims for this site as the relative abundance of cultural material within the shelter might have varied according to one or more of a multitude of factors. The problem, like that of measuring prehistoric population, is that numerous variables must be controlled before we may even begin to measure human actions per unit time. One of the most fundamental issues to be resolved before such work is undertaken is that of site formation. As Schiffer (1976) points out in discussion of archaeological explanation, the first level of explanation should concern site formation. Only when the archaeological record is understood in this light may we feel confident in our search to explain site use by humans. Consequently, for Platypus Rockshelter, it is to this issue we now turn our attention. In a similar situation to that of Platypus Rockshelter, Smith (1982) argued that chronological changes in discard rates at Devon Downs Rockshelter in South Australia were potentially explicable in three ways: changes in shelter morphology, changes in the intensity of site use, and changes in the size of prehistoric populations. All three of these processes might be invoked to explain the major trend in discard rates at Platypus Rockshelter, but we argue below that the geoarchaeological data strongly suggests that changes to shelter morphology provides the best explanation for the long term variations in the rate at which bone, shell and stone artefacts were discarded within the site.

SHELTER MORPHOLOGY AND ITS AFFECTS ON DISCARD RATES

The discard trends shown in Figure 4 appear to fit well with the changes in shelter form depicted by the site formation model (Figure 2). Humans apparently did not occupy the shelter until the rough bedrock floor was mantled with a mixture of roof fall debris and slopewash sediment (represented by the culturally sterile basal portion of SU7). They discarded material at an increasing rate as a broad, flat floor was built up by continued sedimentation (represented by SU7, SU6, & SU3-5). At, or immediately after the apron of sediment slumped downslope towards the river there was a marked decline in the rate at which people discarded material in the shelter (represented by SU2). As sediment trapped by the fallen roof block accumulated outside the dripline and built up a platform below the level of the old shelter floor the rates of discard may have again increased (in SU1), although not returning to the rates witnessed previously.

This relationship is unlikely to be fortuitous and we argue that geomorphic events influenced changes in cultural discard behaviour by altering the space of the shelter. There are two mechanisms by which the alterations in shelter dimensions might have affected discard rates. Firstly, changes in the amount of readily accessible floor space might

have influenced the amount of activity taking place in the site. Secondly, changes in floor topography may have influenced a shift in the nature of activities carried out there and, as a consequence, a shift in the location of activity and discard areas. The first mechanism implies that discard rates may reflect the intensity of occupation, whereas the second mechanism need not carry that implication. Since each of these mechanisms have very different consequences for the interpretation of human occupation of the shelter they require more detailed examination.

If it were supposed that throughout the occupation of Platypus Rockshelter a correlation existed between floor area and the number of inhabitants or the frequency and duration of their visits, the chronological changes in discard rates may indicate fluctuations in the frequency of site occupation. From this perspective the increasing discard in the lower portion of the sequence (SU7 - SU3-5) may well represent increased use of the site, related to its gradual development of a larger and flatter area of sediment within the shelter. If so, then the decreased discard in the last 2400 years may represent a reduction in the frequency of site use as a direct consequence of the slumping event, roof block fall and consequent reshaping of the shelter floor. After the slump and block fall there would only have been a small flat area inside the new dripline created by the block fall. This was separated in elevation from the newly created surface outside the dripline. Archaeological evidence suggests that occupation of the site was thereafter concentrated outside the new dripline, in which case the diminished and probably sloping surface area there may have been less attractive and habitable for even small groups. In short, the area available for carrying out the same kinds of activities as previously would have been disrupted and at least diminished to a significant degree, thus resulting in this area being less frequently used.

Alternatively, discard rates may not reflect frequency of occupation but simply changes in the nature of activity and in the location of activity and discard areas in accordance with changes in floor topography and floor area under the shelter roof. Jones (1980: 165-7) hypothesised the activity and discard areas would be moved laterally over time as sedimentation gradually altered space within Rocky Cape South Cave. Although the slumping event at Platypus Rockshelter would have produced a sudden change in the size and shape of the shelter interior, it is still possible that the location of activities and discard might have been affected. If this were the case, the observed changes in discard rates may indicate alterations in the nature of site use, related to the truncation and reshaping of the shelter floor. From this perspective the decreased discard in the last 2400 years represents a shift in the siting of activities from the rear of the shelter to the front of the shelter and/or a change from discarding material within the shelter to discarding it outside. Activities and discarded debris need not have been restricted to the excavated portion of the small flat area immediately outside the dripline, but may well have extended laterally and downslope. For this reason it is difficult to argue that the rate at which material accumulated in SU1-2 accurately represents the total rate of discard by the occupants of the site. In SU3-7, when the shelter floor probably sloped towards slightly the rear wall and sediment mounded at the shelter entrance, it is likely that objects used either within the shelter or at the front would also have been discarded in the shelter, perhaps against the rear wall. No such assumption can be made for the patterns of discard during the last 2400 years (SU1-2). At this time the occupied areas outside the dripline were separated from what had become

a ledge within the shelter by a steep bank, and discard of debris downslope towards the river rather than upslope into the shelter may have been the rule. In this case the spatial difference in the use of the site makes it impossible to employ estimated discard rates as a measure of the intensity of occupation throughout the sequence at Platypus Rockshelter.

Generally speaking, we feel that the data yielded by calculating discard rates at Platypus Rockshelter might be used to support interpretations of change in either the nature or frequency of site use. Nevertheless, whichever interpretation proves to be best supported we hold that the temporal discard trends, rather than truly reflecting human site use in the entire subcoastal zone, more appropriately reflect the habitability of the Platypus site. That habitability was directly influenced by geomorphic processes and the truncation event at this site would have greatly affected the available human space and habitability at different times. The inferred drop in discard rates after about 2400 BP is thus best explained in terms relating to geomorphic changes rather than directly cultural ones.

TEMPORAL CHANGES IN ASSEMBLAGES: A HINT AT CHANGING SITE USE?

Following the above, it may now be possible to make some statements about the nature of site use. The trends in discard rates might hint at changes in the nature of activities carried out in the site - although much more supporting evidence is required from the excavated assemblages before one can reliably demonstrate such shifts. While detailed analyses of the archaeological material recovered from the site are still in progress, it is possible to make some broad statements about the three major classes of debris - bones, shells and stone artefacts - which have a bearing on this issue.

Preliminary results indicate that people occupying Platypus Rockshelter exploited a wide variety of terrestrial and riverine animal species for their subsistence. Apart from the Platypus (*Ornithorhynchidae*) remains for which the site was named, the faunal investigation has so far identified seven taxa of Macropods, three Perameloids, six Dasyurids, five Phalangeroids, eight Myomorphids, two Pteropodids, five Reptilia, two Amphibia, five Aves, and at least seven fish taxa. The most prevalent bones found were the skutes of the freshwater tortoise. Freshwater mussel shells were plentiful in most stratigraphic units, reinforcing the impression gained from the bone material that the economic focus of the occupants was on the near-by riverine resources. Over 6kg of shell was recovered which attests to three freshwater mussel species which are still found near the site today. In sum, a diversity of faunal species were found throughout the deposit and we suggest that, although there were changes in types and proportions of animals processed at the site, the breadth of the human procurement strategies and their economic focus on the Brisbane River varied little throughout the site's history.

More than 4500 stone artefacts were also recovered, 1728 of which are larger than 0.5cm (for details see Hiscock and Hall 1988). Most of the artefacts are made on locally available chert, quartzite or basalt. The closest source of this material was probably cobble beds in the nearby Brisbane River, and it is likely that this artefactual assemblage also documents the riparian focus of the inhabitants of the site.

Interpreting these remains other than in a site-specific way is not possible at present. The material discarded in this rockshelter probably represents only one component of the prehistoric subsistence pattern in the region and by itself can not be taken as representative of the entire economy. Nevertheless, these remains can inform us of the changing use of this site. Chronological changes in the density and proportions of these three forms of debris are illustrated in Figure 5. Bone occurs in greater amounts at the base of the deposit than in Stratigraphic Units 1 to 5. In contrast, shell densities remain relatively constant throughout the deposit until SU1, in which they treble. Densities of stone artefacts are high at both the top and towards the bottom of the deposit, and much lower in SU2-5.

Different trends in the three classes of debris suggest that the archaeological pattern can not simply be explained in terms of variations in the intensity of occupation; rather there may have been changes in the nature of site use. This possibility is strengthened by temporal changes observable in the relative abundance of the three forms of debris. Changes in the composition of the cultural assemblage may be illustrated by calculating the ratios of these elements (Figure 5d-f). Although the ratio of one element to another does fluctuate it is possible to perceive several major trends. Firstly, bone is more common in the lower portions of the deposit in relative as well as absolute terms. By weight, shell far exceeds bone in SU1-5, and in that upper portion of the deposit there are only minor fluctuations in the ratio of bone:shell (Figure 5d). In contrast there are equal quantities of bone and shell in SU6 and much greater quantities of bone than shell in SU7. This pattern cannot be explained as shell decaying more rapidly than bone because a similar pattern occurs in the bone:stone artefact ratio (Figure 5e). Artefacts recovered from the base of the deposit show no signs of weathering and there is no evidence that at this site stone was decaying faster than bone. Consequently, it may be that in SU7, and to a lesser degree in SU6, bone comprised a greater proportion of the discarded material than at later levels. Alternatively, the changes in the abundance of bone relative to other archaeological materials might have resulted from the preferential destruction of bone, presumably through mechanical attrition by animals. A specific study of bone taphonomy, concentrating on burning indices, teeth marks, bone fragmentation and species composition is currently under way to assess the extent to which this trend is biased by differential use of the shelter by non-human carnivores and scavengers. It should be pointed out, however, that the drastic reduction of the bone:shell ratio between SU7 and SU6 is dated to about 4000 years ago, the same time as dingoes are thought to have been introduced into Australia (Gollan 1984:924). The decline in bone relative to shell may therefore signify increased attrition of the bone assemblage in levels post-dating the appearance of the dingo in southeast Queensland (see Walters 1984).

Secondly, the proportion (by weight) of shell relative to stone artefacts was highest in SU2-5 (Figure 5f). In these levels shell exceeded both stone artefacts and bone by a factor of 2.7-7.1. Although this may indicate a general shift in economic focus towards riverine, and particularly molluscan, resources, it certainly reflects a change in the activities carried out in the shelter and/or the discard pattern. The two-fold increase in the bone:stone artefact ratio in SU4 compared with SU5 and SU1-3, but the stable bone:shell ratio in SU2-5 perhaps suggests that at least one component of these activity changes might have involved alterations to stoneworking activities. For example, if in SU2-5 times tool production created less debris and/or use-life was

relatively great, then a smaller quantity of stone might have been brought to and discarded in the shelter. As a result the ratio of shell:artefacts and bone:artefacts would have increased while the bone:shell ratio would remain unchanged, which is the pattern found. Although artefacts with extensive gloss, possibly indicating long use-life, are least common in SU3-5, there are other indications that a distinctive stoneworking technology exists in SU2-5 and may have involved the importation and reduction of smaller amounts of stone (cf. Hiscock and Hall 1988). There was, in SU2-5, a greater emphasis on later stages of reduction, accompanied by the knapping of retouched flakes rather than cores and a shift in raw material procurement towards the use of chert and basalt. Thus, chronological changes in the relative abundance of these classes of debris may reflect alterations to site use which involved changes in the nature of technology and economy as much as variations in the resource zones which were exploited.

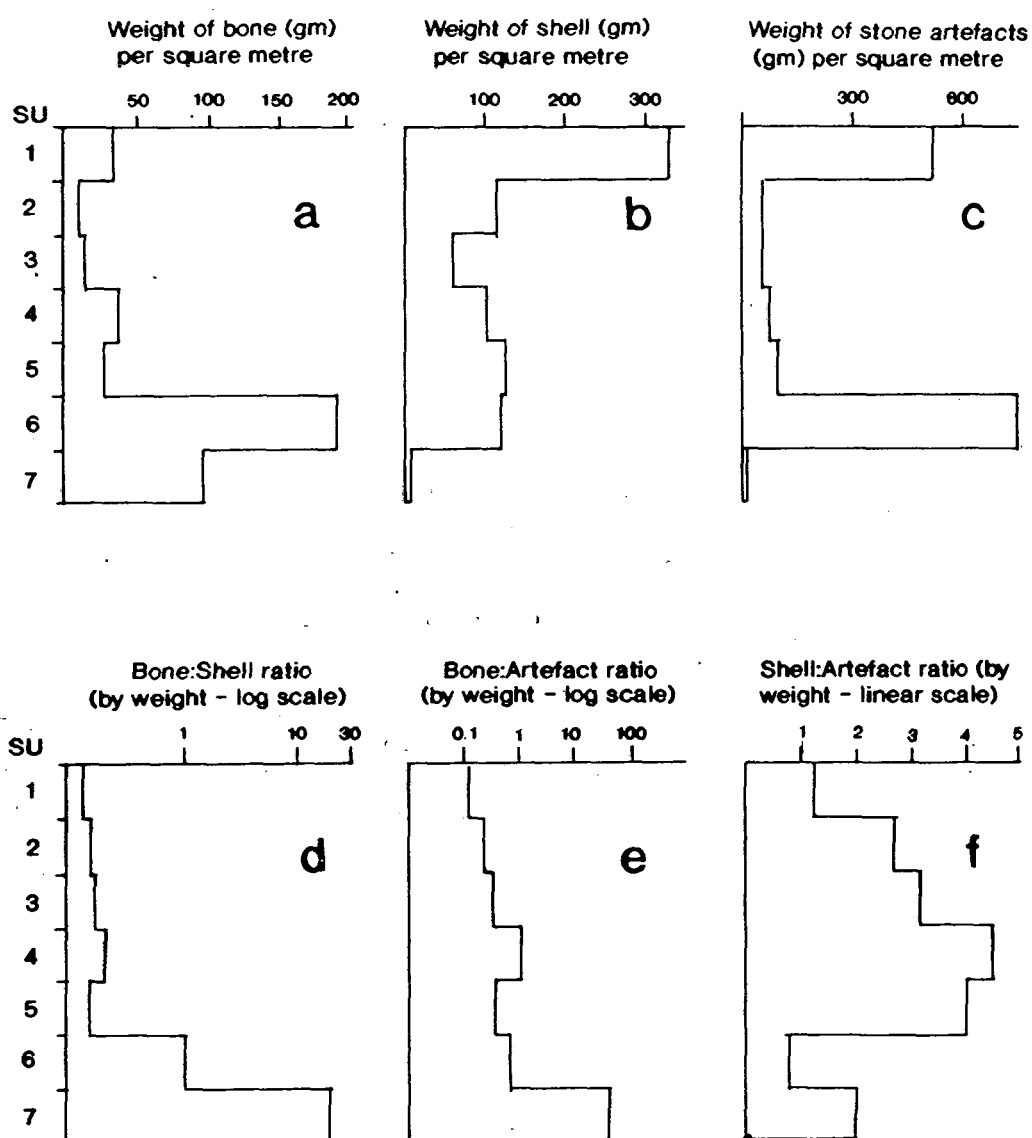


Figure 5. Chronological changes in the density and composition of archaeological material recovered from Platypus Rockshelter.

Edge-damage and Heat-Shattering as Indicators of Trampling and Hearths

More specific aspects of site use may be assessed by investigating temporal changes in particular classes of data within assemblages. In this section we look to stone artefacts as a source of information concerning possible relationships between temporal trends in discard rates and occupation intensity at Platypus Rockshelter. Although stone artefacts are usually more resistant to degradational processes than bone and shell, they still exhibit morphological features which may reflect particular types of activities. The frequency of such features within assemblages has sometimes been employed as indication of the frequency of those activities (eg. Flenniken and Haggerty 1979; Hall and Love 1985; Hiscock 1985). Because this measurement involves the composition of the assemblage it can be considered to be largely independent of the rate of artefact discard. The traits examined here are flake edge-damage and artefact heat-shattering, and they are used as indicators of trampling and fires/hearths respectively. Data for these characteristics are presented separately for both chert and quartzite in an attempt to reduce the biasing effects of rock fracture properties.

It is hypothesised that those strata in Platypus Rockshelter which represent times of greatest site use should exhibit higher proportions of edge-damaged flakes. Results given in Table 6 indicate a trend which is broadly similar to that found in discard rates. The frequency of edge-damage rises from SU7 to SU3-5, then decreases in SU2 before increasing again in SU1. The pattern departs from that seen in discard rates because the average frequency of edge-damage is noticeably higher in SU1-2 than in SU3-6. Interpretation of this pattern is made difficult by the possibility that the extensive edge-damage of flakes in SU1 may result from reworking by dripline action. The data on edge-damage is therefore equivocal on the subject of the intensity of prehistoric treadage, but clearly does not support the notion of decreased occupation after SU3 times.

Table 6. Chronological changes in the frequency of edge damage in KB:A70.

SU	Percentage of edge-damaged chert flakes	Percentage of edge-damaged quartzite flakes	Percentage of all edge-damaged flakes
1	60.5 (N=38)	25.7 (N=35)	35.9 (N=86)
2	19.4 (N=31)	10.5 (N=19)	15.5 (N=71)
3-5	32.1 (N=53)	22.2 (N=36)	26.0 (N=146)
6	24.7 (N=158)	6.5 (N=108)	16.6 (N=385)
7	25.0 (N=36)	5.4 (N=37)	11.5 (N=104)

1-2	42.0 (N=69)	20.4 (N=54)	23.2 (N=157)
3-6	26.5 (N=211)	10.4 (N=144)	19.2 (N=531)

A second activity that might be expected to increase when the shelter was being more heavily used is the lighting and use of campfires, which should be archaeologically recognizable as an increase the proportion of heat-shattered artefacts. Observations made on the chert and quartzite artefacts provide the results given in Table 7. Heat-shattering increased in frequency from SU7 to SU2 and then decreased in SU1. Because sedimentation rates were probably relatively high in SU1 artefacts in that unit were probably less prone to heat-shattering than in older strata. Nevertheless, the frequency of heat-shattered artefacts is higher in SU1 than in SU3-5. Unlike estimated discard rates, the frequency of heat-shattered artefacts is noticeably higher in SU2 than in other strata. When stratigraphic units are combined as in the analyses above, SU1 with SU2 and SU3-5 with SU6, the average frequency of heat-shattering is twice as high in the last 2400 years as in the period 2400-4200 BP. We suggest that this increase in heat-shattering, and by implication the use of fires, can be interpreted in one of two ways. Firstly, it implies a general increase in site use in SU1-2 over SU3-6. Secondly, the pattern could represent a change in site usage, in which some activities become more common while others become less common. Both of these interpretations prohibit the claim that discard rates at this site are a useful indicator of the intensity with which the site was occupied. If the intensity of some activities did increase in SU1-2 then discard rates are a false indication of intensity of those aspects of usage, and if the site function changed then it cannot be assumed that the archaeological assemblages are comparable in terms of their expression of intensity. Although it is impossible to confidently differentiate between these alternatives at the moment, the parallel trends in both edge-damage and heat-shattering make it plausible that the intensity of occupation continued to increase throughout the sequence and did not decline in the last 2400 years. Thus, we cautiously conclude that the intensity of at least some activities may have increased, but that if it did so this was not reflected in the rates at which material was discarded.

Table 7. Chronological change in heat-shattering of artefacts in KB:A70

SU	Chert artefacts	Quartzite artefacts	All artefacts
1	27.8 (N=79)	10.9 (N=64)	16.9 (N=225)
2	31.6 (N=57)	17.9 (N=39)	21.1 (N=133)
3-5	25.4 (N=134)	5.2 (N=58)	14.2 (N=302)
6	10.9 (N=255)	4.6 (N=195)	6.9 (N=662)
7	12.7 (N=55)	3.1 (N=64)	5.9 (N=171)
1-2	29.4 (N=136)	13.6 (N=103)	18.4 (N=358)
3-6	15.9 (N=389)	4.7 (N=253)	9.2 (N=964)

Stone artefact analysis also demonstrated a shift in raw materials used for their manufacture in SU1-2 times. More importantly, in SU1 and SU2 there are proportionately more retouched flakes, a greater diversity of retouched flake forms, and an increased frequency of artefacts with heavy use-polish, compared with the preceding strata. These features would all be consistent with an extension of tool use-life, which might have the effect of reducing artefact discard rates. There are other explanations for this patterning, and the hypothesis of increased use-life in upper levels would need to be tested by further analysis. Nevertheless the archaeological data on stone artefacts does not unequivocally lend itself to an interpretation of discard rates as reliable measures of occupation intensity.

CONCLUSION

In dealing with this site we have reversed the usual interpretative principles. It was suggested that the amount of at least some prehistoric activity within the site might be revealed in the nature of the archaeological assemblage, whereas the changes in site function might be revealed in the amount of material that had been discarded. We have pointed out that different aspects of the archaeological record display different temporal patterns; in recent levels a downward trend in discard rates but an upward trend in damage to artefacts. While these differences might be reconciled in more sophisticated interpretations they might also demonstrate that not all aspects of behaviour will necessarily vary in intensity together, and that attempts to depict chronological changes at a site like this in terms of a comprehensive concept such as "the intensity of site usage" may be doomed to miss the mark (cf. Hiscock 1981).

The results of this analysis of three cultural components of Platypus Rockshelter are suggestive of interesting temporal trends concerning human site use during the Holocene. The faunal assemblage displays an interesting change dating to approximately 4000 BP which is consistent with the beginnings of dingo predation. In general, human use of the site and their patterns of discard were closely tied to shelter form and geomorphic processes. We also suggest that there was a change in occupation about 2400 years ago, although it is uncertain whether the change was in the intensity or nature of site use, and it was argued that the shearing of the sediment apron and roof block in front of the shelter may have been a major conditioning factor for either or both. Data from continuing investigations, particularly those concerning taphonomy and the faunal assemblage, may alter the scenario offered herein and lead to a refinement of these propositions about human use of Platypus Rockshelter.

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