THE NEED FOR A TAPHONOMIC PERSPECTIVE IN STONE ARTEFACT ANALYSIS

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INTRODUCTION

In Australia a number of taphonomic studies suggest that natural processes may cause stone artefacts to move vertically within a site (Stockton 1973, Hughes and Lampert 1977, Stern 1980), and to move around the landscape (Cane 1982). There seems to be a consensus amongst Australian archaeologists that, while stone artefacts may be moved vertically or horizontally, they are virtually indestructible. Consequently it is believed that interpreting artefact numbers and morphologies requires no taphonomic perspective at all. One recent sentiment reads:

> The resistance of stone artefacts to physical and chemical destruction is why they are often the only evidence of humans to have survived from remote prehistoric periods. The field-worker may therefore expect to find artefacts looking as fresh as the day they were made and dating from the remotest periods of human settlement of Australia (Wright 1983:119).

This paper argues that in order to derive information about the past from the archaeological record it is necessary to have a taphonomic perspective on morphological characteristics of stone artefacts. The framework of taphonomy is discussed and it is claimed that the taphonomic processes which act upon bone can equally modify stone, and that the main objectives of taphonomic studies in palaeontology can be achieved in the study of prehistoric artefacts. Two case studies are presented to demonstrate the mutability of stone artefacts. In the Hunter River Valley artefacts are often fragmented, and site descriptions which do not involve a taphonomic component may overestimate the number of prehistoric artefacts and underestimate their size. In northwest Queensland the study of the effects of physical and chemical attrition on stone artefacts provides information about the prehistoric use of fires, the amount of walking which occurred at various prehistoric periods, the extent of vertical movement within the deposit, and the accuracy of artefact recognition. These case studies demonstrate that only with a taphonomic perspective is it possible to accurately reconstruct the original composition of an assemblage or to elicit information about human and non-human site formation processes.

TAPHONOMY

Taphonomy literally means "the laws of burial". Traditionally it has been defined as "...that area of paleontological research that defines, describes, and systematizes the nature and effects of processes that act on organic remains after death" (Gifford 1981:366). These processes are perceived by some as falling into two realms: the study of what happens to bones between death and final burial, and the study of what happens between final burial and recovery (Gifford 1981:367). Others regard the passage of bones from the animal to the laboratory as involving more than simply processes normally studied as taphonomy. For example, Gifford (1981:387) argues that bones pass through five processes: death, burial, diagenetic change, exposure and sampling, and analysis. Taphonomists studying these processes have had a variety of objectives, most of which fall into two categories:

1. In many palaeontological studies taphonomy "...involves 'working back' from the fossil assemblage to the composition, structure and dynamics of the parent populations..." (Olson 1980). The ultimate objective of this approach is to reconstruct the palaeoecology of certain areas or species.

2. Studying the taphonomic processes themselves provides information about the changing function of the palaeontological site and of changes in the surrounding landscape.

Taphonomy has lately filled similar roles in Australian archaeological research. An understanding of carnivore scavenging, bone fragmentation and/or burning and fluviatile movements has contributed significantly to archaeological interpretation. Such studies have provided a clearer indication of the nature and context of the bone assemblage when it was originally handled by humans, and of the processes which modified the assemblage (eg. Jones 1980; Walters 1984; David 1984). Others have stressed that distinctive patterns of residue formation (and by implication the processes of attrition) might act as "archaeological signatures" of particular human and non-human animal behaviour (Yellen 1977; Gould 1980:113).

It may appear paradoxical to talk of a taphonomy of stone artefacts since they are inorganic and rarely tell us directly about past environments. Taken in a wider sense however, many taphonomic mechanisms do affect stone artefacts. In one sense inferences about artefact function gained through microwear studies are based upon the results of attrition (such as edge fracturing, striation and gloss) which occurs before artefacts are discarded. Numerous researchers into usewear have also been concerned that after artefacts are discarded their edges might also be damaged by attrition within the deposit (eg. Flenniken and Haggarty 1979; Keller 1979; Kamminga 1982). A number of archaeologists have discussed taphonomy as one factor in the formation of archaeological sites (cf. Binford 1977; 1978; 1980; 1981; Gifford 1980; Schiffer 1976; Sullivan 1978). Many of the processes which these archaeologists visualise as forming sites should apply to stone artefacts as well as to organic debris. Schiffer and McGuire (1982:255) put it this way:

> The growing body of literature on formation processes is leading to the view that artifacts be considered merely as peculiar particles in a sedimentary matrix. This perspective

assists the archaeologist in recognizing that a sizable number of formation processes, cultural and noncultural, have observable mechanical effects, such as abrasion, size reduction, size sorting, and vertical and horizontal displacement.

Consequently, an understanding of degradational processes which affect stone artefacts should aid in the **reconstruction of original assemblages** and in the identification of **archaeological signatures** imprinted by particular forms of degradation.

Stone analysts in Australia have not perceived that many of the processes of attrition studied in taphonomy, and so widely accepted as affecting bone debris, might also drastically alter the **state** of archaeological stone artefacts. In an attempt to demonstrate this, three mechanisms are described in this paper: trampling of artefacts lying on the ground surface, cooking of artefacts lying just below the ground surface, and _in situ_ weathering and decay of artefacts in a deposit. During the course of stone artefact analysis at sites in the Hunter River Valley and in northwest Queensland, these mechanisms were found to dramatically alter assemblages.

CASE STUDY 1 - HUNTER RIVER VALLEY

Redbank Creek 5 (RBC5) is a site in the Hunter River Valley near Singleton which was partially salvaged in the course of consulting work by Koettig and Hughes (1983). It was chosen from among hundreds of other sites affected by development for its ability to reveal the stratigraphic context of the artefacts. Of secondary interest was its high density of stone pieces, most of which were thought to be artefactual (Koettig and Hughes 1983:26-27, 32). After surface collection and excavation the consultants analysed one portion of the site, four square metres in area, by counting the number of fragments of stone. Since the 1790 pieces of stone they recovered did not occur naturally at the site it was argued that all these fragments were artefacts, thus giving this part of the site an average density of 450 artefacts per square metre.

A subsequent technological analysis by Hiscock (1985) found that although all the stone material had indeed been transported to the site, the number of fragments was a very poor indicator of the number of prehistoric artefacts discarded at the site. Within one square metre there were 138 fragments of stone shattered by heat; but there were no artefacts at all. Almost all fragments were of silcrete. Furthermore, many flakes were broken and counts of the resulting fragments drastically over-estimate the number of knapping events. As an indication of the amount of breakage, the number of fragments which represent each prehistoric flake removal was calculated for all the artefacts rejoined in a conjoin analysis. The results can be expressed separately for the two types of raw material: 41 silcrete flakes were broken into 82 fragments, giving an average of 2 fragments per flake; whereas 16 mudstone flakes were broken into 23 fragments, giving an average of 1.4 fragments per flake. With these figures it is possible to estimate the original number of complete flakes. Of the 1790 stone fragments 1430 are silcrete. Of these 1430 silcrete fragments only 1300 are artefactual. The 1300 silcrete artefact fragments derive from 650 flakes. Of the 360 fragments of indurated mudstone about 350 are artefactual and these come from about 250 flakes. This calculation gives an estimate of about 900 original flakes, half the number of stone fragments recovered.

The dramatic differences between the original assemblage and the recovered fragments reveals an immense scope for misinterpreting similar open sites. It is possible that archaeologists might identify sites with a higher degree of fragmentation as those with higher artefact densities, and more consequently assess them as significant during consultancies. A related problem is that the fragments are smaller than the original flake, and so apparent variations in artefact size between sites or through time might result from differing degrees of fragmentation. If some raw materials break up more frequently than others then the degree of attrition on an assemblage might also determine the proportion of each raw material in that assemblage. Detailed field recording procedures would be required to overcome these potential pitfalls.

A further implication of the effects of taphonomic processes on an assemblage is seen when we examine chronological change in stratified sites. Table 1 lists the number of complete flakes and the number of broken flakes made of indurated mudstone for each level in one square of Sandy Hollow 1 (SH1), a cave deposit near the Hunter River excavated by David Moore in 1965 (Moore 1970). The percentage of mudstone artefacts which are broken flakes varied from 15% to 42%, and the ratio of broken: complete flakes varied from 0.2:1-0.9:1. These values demonstrate that even at one site and on one stone material the proportion of broken flakes can vary considerably over time. A specific example from SH1 shows how changes in the amount of broken artefacts could affect interpretation. The number of complete flakes in levels 4 and 5/6 are approximately equal, and much lower than in spit 3 (see Table 1). High amounts of breakage in spit 4 and the very infrequent breakage in spit 3, however, result in the total number of artefactual fragments in spit 4 being close to the number in spit 3 and distinctly higher than the number of fragments in spit 5/6 (see Table 1). There is no need to belabour the point that densities and accumulation rates of stone fragments might vary greatly due to the differing effects of a number of attritional mechanisms. These possibilities will be of interest in view of the increasing number of studies attempting to calculate indices of occupational intensity.

The effects of these attritional mechanisms vary with the nature of the artefacts. It was already pointed out that at RBC5 silcrete flakes tended to break into more fragments than mudstone flakes. Table 2 gives the average number of broken flakes for each complete flake at a number of sites at Mount Arthur North and Mount Arthur South, two areas near the Hunter River midway between Redbank Creek and Sandy Hollow 1. These data suggest that higher breakage rates on silcrete flakes than on indurated mudstone flakes is a general pattern found throughout the Hunter Valley. The cause of such patterns are probably regularities in the characteristics of flakes made on each raw material type which would determine the likelihood of particular flakes being broken; characteristics such as the thickness, cross-section, and thermal alteration of each stone type.

Data presented in Tables 1 and 2 also demonstrate the variation in flake breakage which can occur between sites in different landscapes within a single region. The vast majority of open sites at Redbank Creek, Mount Arthur North and Mount Arthur South contain assemblages of mudstone flakes which are more fragmented than those from the Sandy Hollow rockshelter. Such a pattern might be expected to result from European activities such as ploughing and livestock grazing, which would not effect caves. None of these open sites show stratigraphic disturbance of the sort which would accompany ploughing, however, and at some of the open sites subsurface artefacts were more highly broken than those currently lying on the ground surface. These data suggest that neither ploughing or trampling by stock may totally explain the pattern. Perhaps the relatively low degree of flake breakage at Sandy Hollow 1 merely reflects the much greater sedimentation rate there and consequently protected artefacts from further damage.

While the potential for such processes to blur our understanding of the past should be acknowledged, it is equally important to perceive that an understanding of them could clarify our vision of the past. The RBC5 example has demonstrated that estimates of the composition of the original assemblage are more easily and accurately made after the identification and study of any taphonomic processes that might have acted upon the material. The ability to identify heat shattering might lead to the accurate description of hearths or heat-treating pits at open sites. Recognition of heated artefacts might also allow the widespread application of dating techniques such as thermoluminescence or ESR at some open sites.

Table 1. Indurated Mudstone Artefacts from Square AA at Sandy Hollow 1.

Spit No.	Number of Mudstone Artefacts	Number of Complete Artefacts	No. of Broken Flakes	Ratio of Broken: Complete Flakes	Percentage of Broken Flakes in Assemblage
1	126	63	49	0.8:1	39
2	88	53	27	0.5:1	31
3	376	287	57	0.2:1	15
4	358	171	153	0.9:1	42
5	274	168	88	0.5:1	32

Table 2. Number of Broken Flakes per Complete Flake in Sites at Mount Arthur North and South, Hunter Valley (Ratio calculated only when sample size exceeded 50 complete flakes).

Site	Zone	Mudstone	Silcrete
Surface assemblages			
MAN9	1	1.9	6.3
MAN9	2	1.4	15.0
MAN10	1	0.6	-
MAN10	2	-	8.5
MAN20	2	-	4.3
MAN24	-	-	2.3
MAN27	1	-	4.0
MAN31	1	2.3	-
MAS24	-	-	2.5
MAS46	-	2.3	-
Subsurface assemblages			
MAN9	1	0.9	3.0
MAN10	1	0.9	-
MAN27	1	-	3.2

Flakes break in a number of ways and for a number of reasons. If it is possible to equate certain types of breakage with certain mechanisms, it will be possible to more accurately define the formation of assemblages. For example, it appears that for flakes of the same raw material, size, and shape, those split along the percussion axis are more likely to have been broken during manufacture whereas transverse snaps are more likely to be broken during ploughing or by being trampled by humans or stock when lying on the ground surface. Hiscock and Walters (in prep) present experimental evidence of these patterns.

An understanding of the processes of attrition raise even more possibilities in the study of stratified sites. For example, if the effects of trampling induced breakage or campfire induced shatter can be accurately identified it would be possible to directly measure aspects of prehistoric behaviour which are otherwise difficult to define: the number/size of fires at any level or the amount of walking which occurs in any period. These possibilities are explored in the second case study of the paper.

CASE STUDY 2 - COLLESS CREEK CAVE, NORTH-WEST QUEENSLAND

Colless Creek Cave is located in the gulf fall zone of the Barkly Tablelands, approximately 7km from where the tableland abruptly gives way to the Carpentarian Plain. The cave faces east into a small tributary valley on the southern side of Colless Creek gorge. The site is 15m above the level of the creek, at the top of a steep scree slope, and at the base of a 15m high vertical cliff. The cave itself is 7m wide, 2m high and extends 12m into the cliff face. The cave floor is veneered with a lag of gravel and artefacts and there are several large blocks of roof-fall protruding from the deposit. A plan of the site showing the location of square P46 is given in Figure 1. In all parts of the cave which were excavated the same stratigraphic sequence was found; but only in the rear of the cave, in square P46, was there an unbroken stratigraphic sequence back to 17,000 BP which could be dated and for which an age/depth curve could be constructed. Using the age/depth curve it was possible to assign dates to the top and bottom of each of the upper ten spits, and to calculate the approximate amount of time represented in each spit (see Table 3). Details of the dating and sedimentary data from P46 are given by Hiscock (1984).

Table 3. Age Range of Each Spit in P46

Spit	Age (Years B.P.)	Time Represented
P46/1	0 - 2,450	2,450 yrs
P46/2	2,450 - 7,300	4,850 yrs
P46/3	7,300 - 8,750	1,450 yrs
P46/4	8,750 - 11,850	3,100 yrs
P46/5	11,850 - 13,625	1,775 yrs
P46/6-7	13,625 - 13,800	175 yrs
P46/8	13,800 - 14,500	700 yrs
P46/9	14,500 - 15,900	1,400 yrs
P46/10	15,900 - 17,290	1,390 yrs

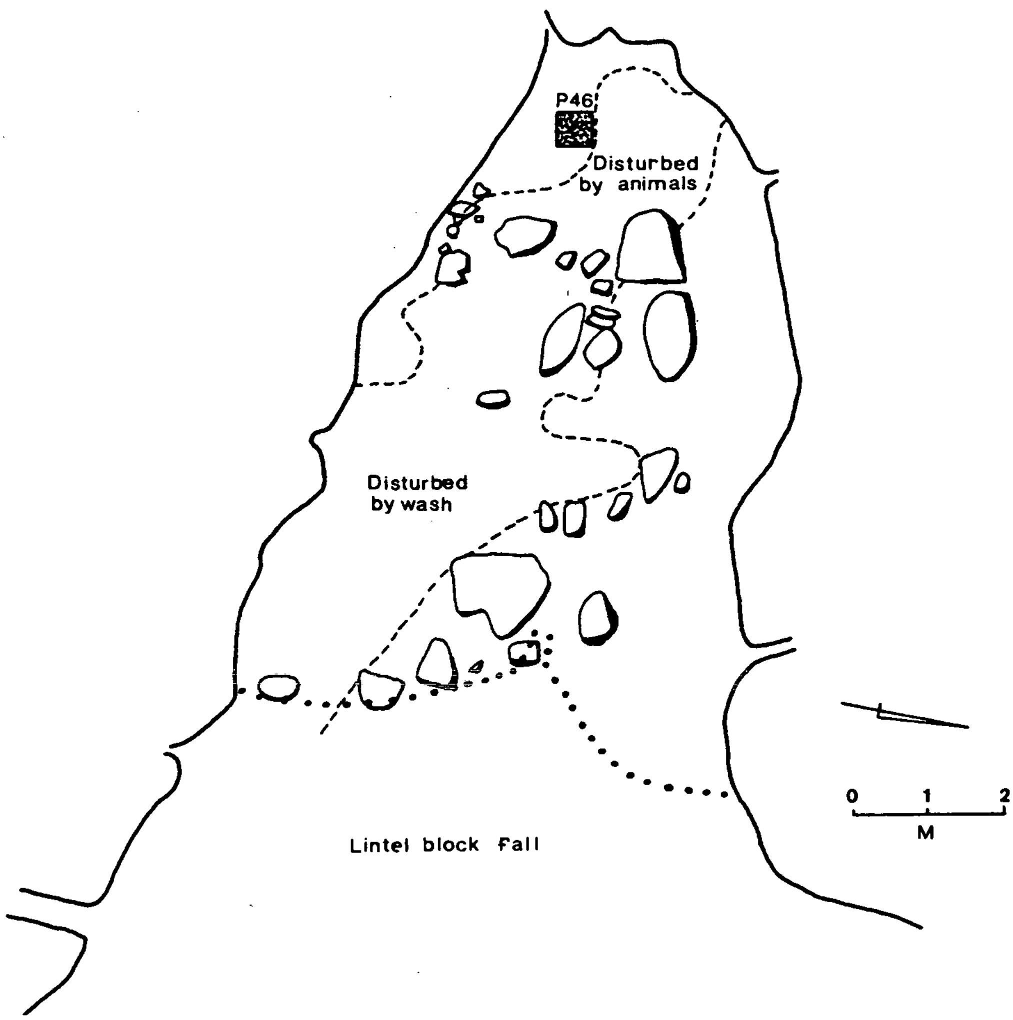

Figure 1. Plan of Colless Creek Cave showing the location of square P46.

Cooking

Some of the fragments of stone found in the cave have been created by excess heating. Potlids occur when stone is rapidly raised to high temperatures. Differential expansion of the rock and ultimately potlid fractures result (Purdy 1975). Potlids can therefore be taken to indicate "cooking" of the stone, probably when fires or hearths are placed on top of the artefacts lying on the floor of the cave. It can be argued that for a given amount of burning the frequency of potlids is proportional to the amount of stone material directly exposed to excessive heat, and thus one indication of the amount of burning will be the ratio of potlids to artefacts. Figure 2 shows the number of potlids per 100 grams of artefacts for each spit in Unit A of square P46 at Colless Creek Cave. The pattern is a complex one with a variable but decreasing proportion of potlids from 13,500 until the present. Prior to this, from 13,500 until about 16,000 BP, potlids were uncommon in comparison to artefacts. Below this, spit 10 again shows a high amount of potlids. From this data it is clear that in the rear of Colless Creek Cave the amount of burning which occurred during the period 13,500 - 16,000 BP was relatively low whereas the discard rate of artefacts peaked at that time (Hiscock 1984).

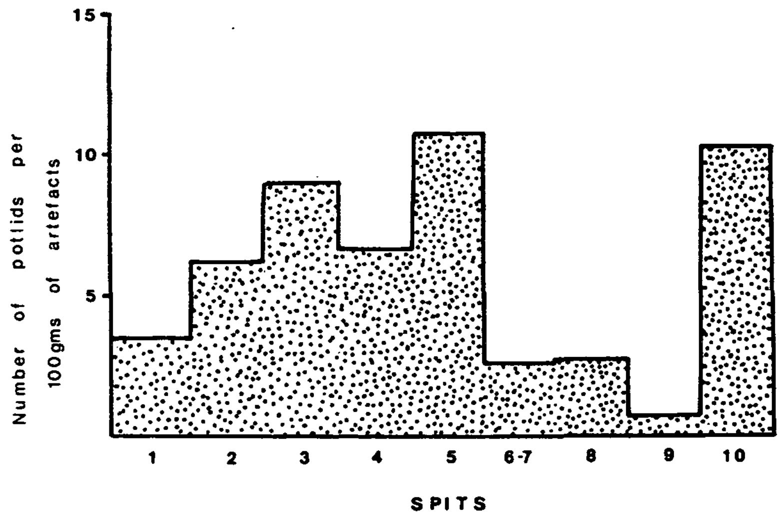

Figure 2. The number of potlids per 100gms of artefacts for each spit in Unit A, square P46, Colless Creek Cave

Treadage

Some of the artefacts in Colless Creek Cave are broken. It has already been suggested that transverse snapping of flakes will often occur when people stand on flakes lying on the ground surface. If this is the case the rate of flake breakage should be inversely related to the rate of sediment accumulation; when sediment accumulation is slow and artefacts remain for long periods on the ground surface the frequency of breakage should be high, but when sediment accumulation is rapid and artefacts are exposed for only a short time artefact breakage should be relatively infrequent. If the amount of treadage which occurs in the site per unit time is constant throughout the history of occupation, then the expected inverse relationship between the frequency of transversely broken flakes and the rate of sediment accumulation should be observed. Deviation from this relationship may be explained by increases or decreases in the amount of walking which took place at a particular phase in the accumulation of the deposit. More details of these expectations can be found elsewhere (Hiscock and Walters in prep).

Figure 3 shows the relationship between the number of transversely broken flakes per complete flake and the depth of sediment accumulated per 100 years in square P46 at Colless Creek Cave. Not all of the spits lay along a single line, but it is suggested that the line drawn in Figure 3 represents a similar amount of prehistoric treadage. This line is given by the equation B=1/S13, where B is the number of broken flakes per complete flake and S is the rate of sediment accumulation. The majority of spits lay along, or very close to this line and it is concluded that during the periods in which these spits (1, 2, 3, 4, 5, 9 and 10) built up there was approximately the same amount of walking carried out in the cave.

In contrast, there are relatively high numbers of transversely broken flakes in spits 6/7 and 8. Even though sedimentation in these levels was very rapid flakes were frequently broken. This pattern probably results from much greater amounts of walking in the cave during the accumulation of spits 6/7 and 8, between 13500 BP and 16000 BP, than at any other period of occupation. Support is given to this inference by the fact that these levels also contain the highest discard rates of artefacts, bone and shell debris.

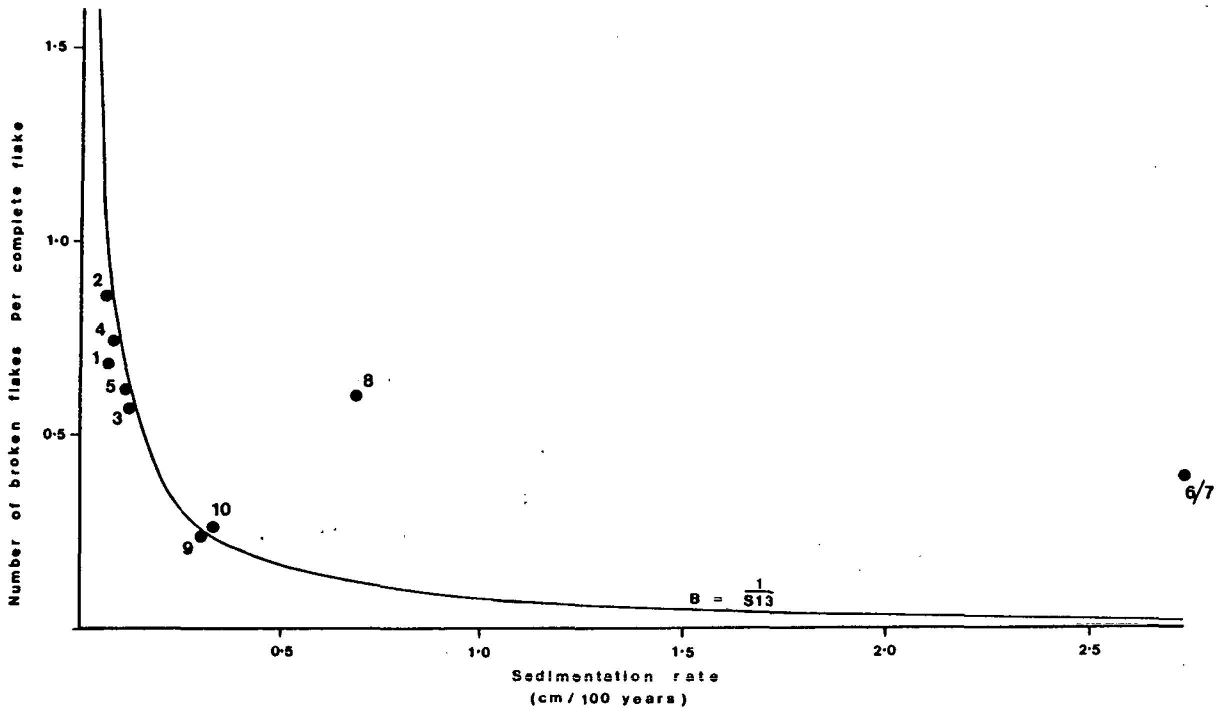

Figure 3. The relationship between the number of transversely broken flakes per complete flake and the depth of sediment accumulated per 100 years in square P46.

Weathering

Some of the stone artefacts at Colless Creek Cave are very fresh in appearance while others are highly weathered. Some artefacts are so weathered that they are barely recognisable. Initial inspection of the assemblage indicated that the older artefacts were more weathered than younger ones, suggesting that the weathering occurred *in situ*. If this was the case each spit should contain a greater proportion of weathered artefacts than the one above it. Measurement of the increasing proportion of weathered artefacts necessitates a division of the assemblage from each spit into a number of classes which describe the variations in the amount of weathering the assemblage has undergone. Although weathering is a continuous process four categories could be easily and consistently distinguished as follows:

FRESH - in which the fracture surfaces of the chert are hard, lustrous, and the same as the interior of the artefact.

LIGHT PATINATION - where the surface of the artefact is mottled, some areas having the appearance of fresh unpatinated chert and others appear to have a dull white film over the surface.

PATINATED - where the surface of the artefact is white and the texture of the surface has become dull and rough. Broken specimens reveal that while the weathering is not confined to the surface it need not occur throughout the entire artefact.

HEAVILY WEATHERED - where the artefact is a bright white colour, porous, and has become crumbly and powdery. Broken artefacts show that this degree of weathering occurs uniformly throughout the entire artefact.

Table 4 shows the percentage of chert artefacts in each weathering category for the spits in square P46. The proportion of artefacts in each weathering class varies vertically in a manner which supports the argument that weathering has occurred since the deposit formed. Lightly Patinated artefacts do not become common until spit 5, Patinated artefacts become dominant in spit 8, and Heavily Weathered artefacts are not common until spit 11. Within Unit B (spits 11-23) there is a progressive decay of chert artefacts, with all being Heavily Weathered at the base.

Table 4. The percentage of chert artefacts in each weathering class for each spit of P46 at Colless Creek Cave.

Spit	Sample Size	Stratum	Fresh	Lightly Patinated	Patinated	Heavily Weathered
1	217	A	85	14	1	0
2	220	A	85	11	3	1
3	113	A	86	10	1	0
4	82	A	81	19	0	0
5	71	A	53	43	4	0
6	22	A	18	59	23	0
7	81	A	11	48	41	0
8	86	A	0	38	61	1
9	137	A	0	14	83	3
10	269	A	1	16	61	22
11	272	B	0	5	33	62
12	64	B	0	2	22	76
13	70	B	0	0	19	81
14	73	B	0	0	18	82
15	40	B	0	0	18	82
16	31	B	0	0	13	87
17	22	B	0	0	14	86
18	22	B	0	0	18	82
19	16	B	0	0	6	94
20	15	B	0	0	7	93
21	14	B	0	0	0	100
22	20	B	0	0	0	100
23	13	B	0	0	0	100

One way of calculating the rate at which this weathering occurred is to look at the amount of time it takes for the majority of artefacts in each spit to reach a particular stage of weathering. It took approximately 13,500 years for the majority of artefacts in a spit to become lightly patinated. The transition from Light Patination to Patinated occurred more rapidly, with the majority of artefacts in a spit becoming Patinated after a further 1-2,000 years. Virtually all the Heavily Weathered artefacts are older than 17,000 years BP, and since they occur only in Unit B (spits 11-23) and in the gravel lag immediately above Unit B (spit 10) it can be suggested that they are much older than 17,000 years (cf. Hiscock 1984:125). In assessing the contrast between the sediments of Unit A and Unit B Hughes (1983:61) remarked for Unit B that:

> The relatively high degree of pedogenic organisation indicates considerable weathering of the deposit over a long period of time under much wetter conditions than today.

Since the artefacts in Unit B are so much more weathered than those in the base of Unit A this conclusion is equally applicable to the artefacts. The transition from Patinated to Heavily Weathered probably took much longer than the transition from Lightly Patinated to Patinated.

The crumbling and rounding of edges and the discolouration and roughening of artefact surfaces which accompanied the weathering process could be expected to obscure and erase many of the attributes used to identify and classify artefacts. In examining material from P46 Hiscock (1984:139) recognised a class of artefacts called Flaked Pieces. These were fragments of stone which were definitely artefacts, but which could not be classified as cores, flakes, or retouched flakes because many of their surfaces were weathered or formed by incipient fracture planes. The proportion of flaked pieces in P46 increases with depth, and is particularly high in levels older than 14,000 BP, that is in spits 8-23. Part of this increase in flaked pieces is probably due to the progressive degradation of artefacts, most pronounced in the lowest levels. An even more startling implication of stone degradation is the effect of weathering on artefact recognition. Hiscock (1984:142) argued that many of the small non-artefactual fragments of chert, called Non-diagnostic (ND) fragments, probably resulted from artefact manufacture even though this is not demonstrated by morphological traits. Many of the ND fragments from the lower levels of the deposit are highly weathered and it is possible that many were once small artefacts which have since been so badly weathered that they are no longer recognisable. Figure 4 shows that compared with recognisable artefacts these ND fragments are more frequent in Unit B (spits 11-23) than they are in Unit A (spits 1-10). This increase in the lower spits coincides with the levels in which most artefacts are Heavily Weathered and it can therefore be suggested that many of the ND fragments may indeed be degraded artefacts.

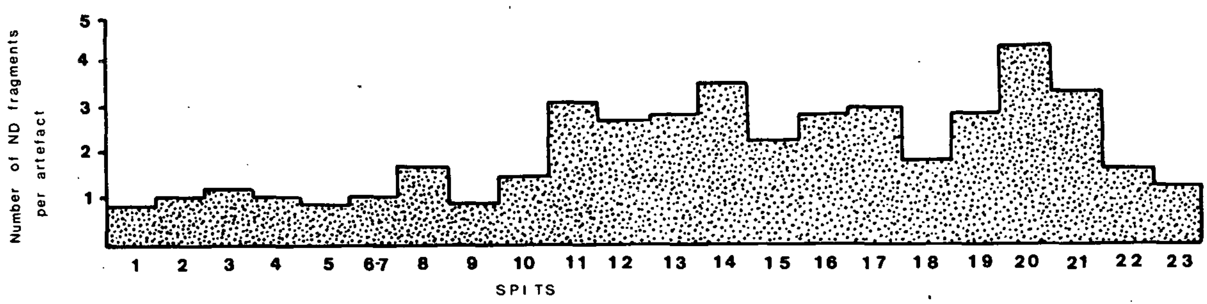

Figure 4. The number of Non-diagnostic fragments per artefact in each spit in square P46.

Vertical changes in the degree of artefact weathering provides a test of the integrity of the deposit. The sharp changes which occur indicate that there has been only limited post-depositional vertical movement of artefacts. For example, fresh artefacts are completely absent from Unit B and Lightly Patinated artefacts are present only in the upper two spits of that Unit. This suggests that there is little, if any, downward movement of artefacts from Unit A to Unit B. The seven flakes with Light Patination which occur in Unit B may have fallen down cracks from spit 10, indicating that a very small proportion of artefacts may have moved downwards up to 4cm. On the other hand it is equally likely that these artefacts have not been vertically displaced but are merely stones which have been relatively slow to weather. A similar situation occurs between spits 7 and 8. Only two fresh artefacts were found below spit 7, again indicating that if vertical movement is occurring it involves only very small numbers of artefacts. Given the lack of any reservior in spits 8 and 9 from which the fresh artefacts in spit 10 could have derived, however, it is again possible to explain these anomalously fresh artefacts as a result of some pieces of chert being relatively resistant to weathering.

The rate at which artefacts weather is largely dependent on the nature of the stone on which they are made and the conditions of the deposit in which they rested. Purdy and Clark (1979) have argued that chert which has been subjected to heat weathers more rapidly than unheated samples, and it is well known that many volcanic rock types weather quickly because of their unstable mineralogy. Chert, being composed predominately of silica, is usually relatively resistant to weathering. The cherts which were made into artefacts at Colless Creek Cave are variable in their chemical composition, with some nodules being composed almost entirely of chalcedony while in others there is up to 30% carbonate grains and small rhombs of carbonate in addition to chalcedony (Watchman 1982). Surface samples of carbonate rich chert develop a white patina not found in other chert samples in the area and it is probable that carbonate rich nodules of chert weather more rapidly. If this is the case it is to be expected that there would be artefacts of a number of weathering classes present in each spit, because both carbonate rich and poor cherts are known to occur in all spits. Thus, even artefacts made and deposited contemporaneously would not weather synchronously. This fact lends weight to the argument that relatively unweathered artefacts might exist in spits where most artefacts are distinctly more weathered, and yet be approximately the same age. On the basis of the rapid weathering of artefacts which occur within Colless Creek Cave it can be concluded that at the rear of the cave the downward movement of artefacts is a rare phenomenon.

Rapid weathering of the stone on which artefacts are made may also reveal patterns of scavenging by prehistoric humans. The reuse and/or reflaking of old artefacts may account for the occurrence of weathered artefacts in recent strata. This may explain the existence of Heavily Weathered artefacts in spit 2, and of Patinated artefacts in spits 1-3. In these upper levels there are also a number of flakes which have Patinated dorsal surfaces but which have Fresh ventral surfaces. An examination of such artefacts might reveal the criteria prehistoric inhabitants used when they selected old artefacts for reuse.

CONCLUSIONS AND IMPLICATIONS

Until demonstrated otherwise it should be assumed that the taphonomic mechanisms at work in the Hunter Valley and at Colless Creek Cave have their counterparts elsewhere. The existence of taphonomic processes and their ability to alter stone assemblages must be acknowledged. On some occasions, perhaps many, the result of those processes will be the significant alteration of assemblages. Unless archaeologists are aware of such transformations our perception of the past could be grossly distorted. Consequently, before archaeological sites containing stone artefacts are interpreted and their significance assessed the taphonomic processes which have acted upon them should be described, just as any acceptable study of settlement patterns is today expected to describe factors such as the degree to which old land surfaces are exposed as a result of erosion or sediment accumulation. Specific and sophisticated recording methodologies will be needed to measure the nature and extent of attrition an assemblage has undergone.

An understanding of taphonomic processes will enable better estimates to be made of the original assemblage. In areas such as the Hunter Valley, in which the outcome of degradational processes vary widely between sites and raw materials, it will not be possible to accurately infer the human past without reconstructing the assemblages as they were when they were first discarded. More importantly, new measurements of prehistoric human behaviour can be based upon the effects of some of the processes of decay. The Colless Creek Cave study showed that the degradation which occurs to artefacts after they are discarded can contribute data about the nature and amount of prehistoric activities. These data provide a further perspective on the debate about which characteristics are appropriate measurements of the "intensity of site usage" (cf. Hiscock 1981). At Colless Creek Cave the effects of degradation of the stone artefacts can be seen to reflect the amount of burning and the amount of walking which occurred within the cave at various periods. Weathering of artefacts in the Colless Creek Cave deposit appears to have occurred <u>in situ</u>, thereby providing an indication of the scale of post-depositional vertical movements.

Ingenuity on the part of archaeologists will probably reveal a large range of other attritional mechanisms which may obscure the original nature of the assemblage or which may be used as indices of prehistoric activities. A refined understanding of taphonomic mechanisms which affect stone artefacts would provide a better basis for interpreting archaeological assemblages. Further experimental research could profitably be undertaken in a number of areas. Examples include the effect of raw material on weathering and breakage, the effect of heat treatment or burning on weathering or breakage, the mechanisms and rates of patination and weathering, and the causes of various types of breakage and heat shatters. With principles established by such experiments it should be possible to more accurately interpret the prehistoric past, and to infer scenarios which have remained hidden to more traditional approaches.

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