CATHEDRAL CAVE: A ROCKSHELTER IN CARNARVON GORGE, QUEENSLAND.

J. M. BEATON

Anthropology
University of California, Davis

INTRODUCTION

Cathedral Cave is a large rockshelter site in the uplands of southeast central Queensland (Figure 1, Plate 1). In 1975 I excavated a sample of the site as part of a study into the regional prehistory of this remote part of Queensland. At that time, archaeological data of any kind for the state of Queensland was at a premium. At 1,727,000km^2, Queensland takes up about as much of the world's surface as do France, Italy, Spain, and Germany combined. Yet, by the early 1970's in this northeastern tropical and sub-tropical one-fifth of the Australian continent we had not quite a handful of archaeological studies. In 1963 R.V.S. Wright (1971) had broken ground in a rockshelter at Mushroom Rock, near Laura, on the spine of the Cape York Peninsula, and had also determined the human genesis of the massive shell mounds at Albatross Bay in the gulf waters of the west coast of the Peninsula. Laila Haglund (1976) had worked for several seasons during the years 1965 through 1968 at the the Broadbeach cemetery site in the far southeastern corner of Queensland, and the years of 1960, 1962 and 1964 had seen John Mulvaney's classic excavations in the south-central Queensland highlands (Mulvaney and Joyce 1965). It would be a decade, and later, before these pioneering studies would be followed by regional reconnaissance and excavations programs such as those of Geoff Bailey (1977) who in 1972 followed on from Wright's work at Albatross Bay, my own in 1974 through 1977 in the southeastern uplands (Beaton 1977, 1982, 1991-this volume, Beaton and Walsh 1977), Michael Morwood on the western slopes of the Dividing Range (Morwood 1979, 1980, 1981), Jay Hall and associates in the Moreton Bay area (Hall 1982, Hall and Hiscock 1988), and John Campbell (Campbell 1982) in the northeast.

My own investigations in the central Queensland uplands were inspired by two important considerations: firstly, John Mulvaney's excavations at Kenniff Cave and The Tombs had produced a chronostratigraphic record which provided a basic culture-historical record for the region, and was highlighted by Australia's first firm Pleistocene date for human occupation (Mulvaney and Joyce 1965); secondly, my reconnaissance of the region indicated that a number and range of archaeological site types occurred in micro-environmental situations, and I considered that these sites could be used to monitor subsistence and adaptive strategies among the foraging populations who had lived in the uplands. In the end, the direction of the research programme was to become focused on the exploitation of the toxic cycad (Macrozamia) and the significance of this for Australian prehistory.

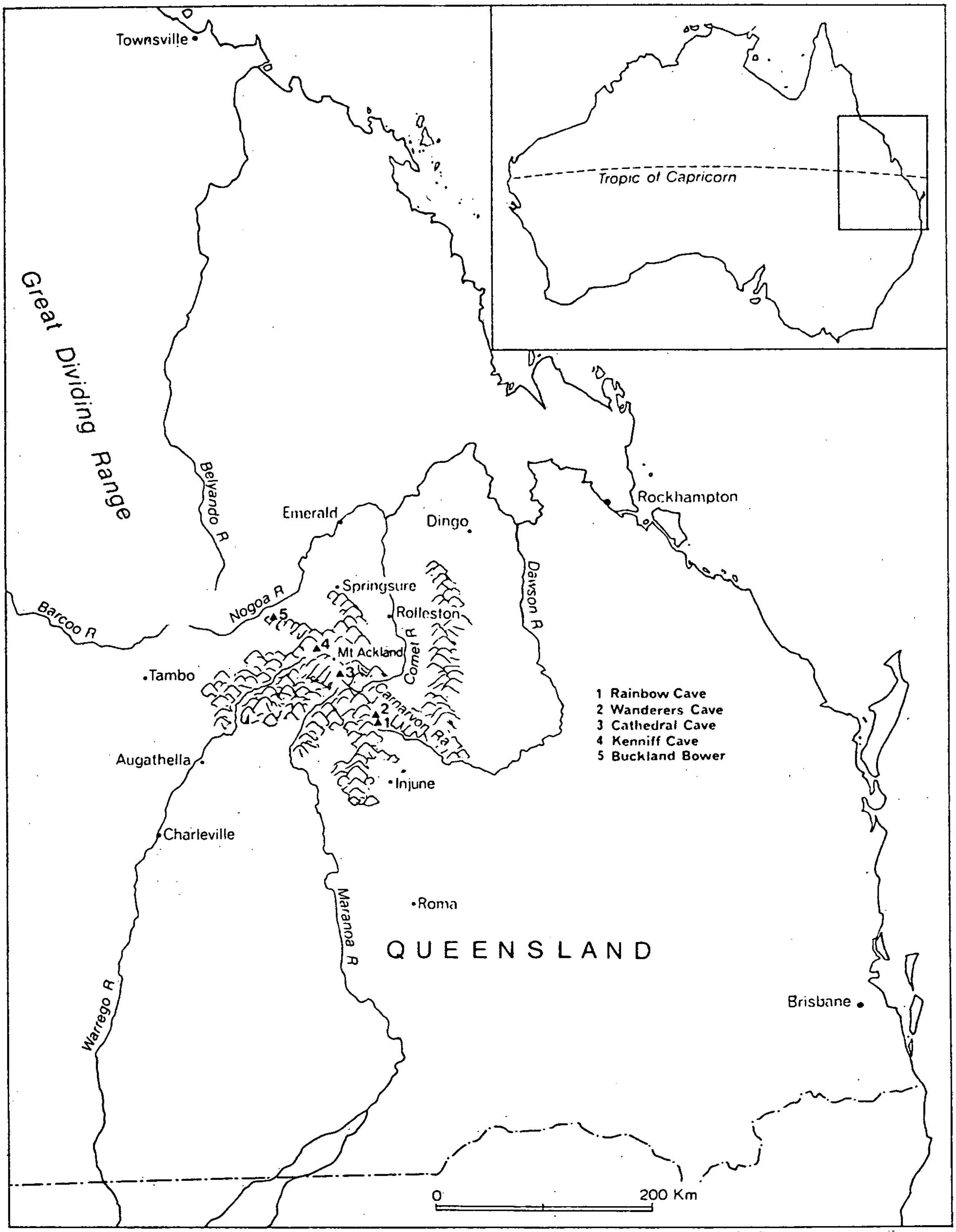


Figure 1. Map of Home of the Rivers.

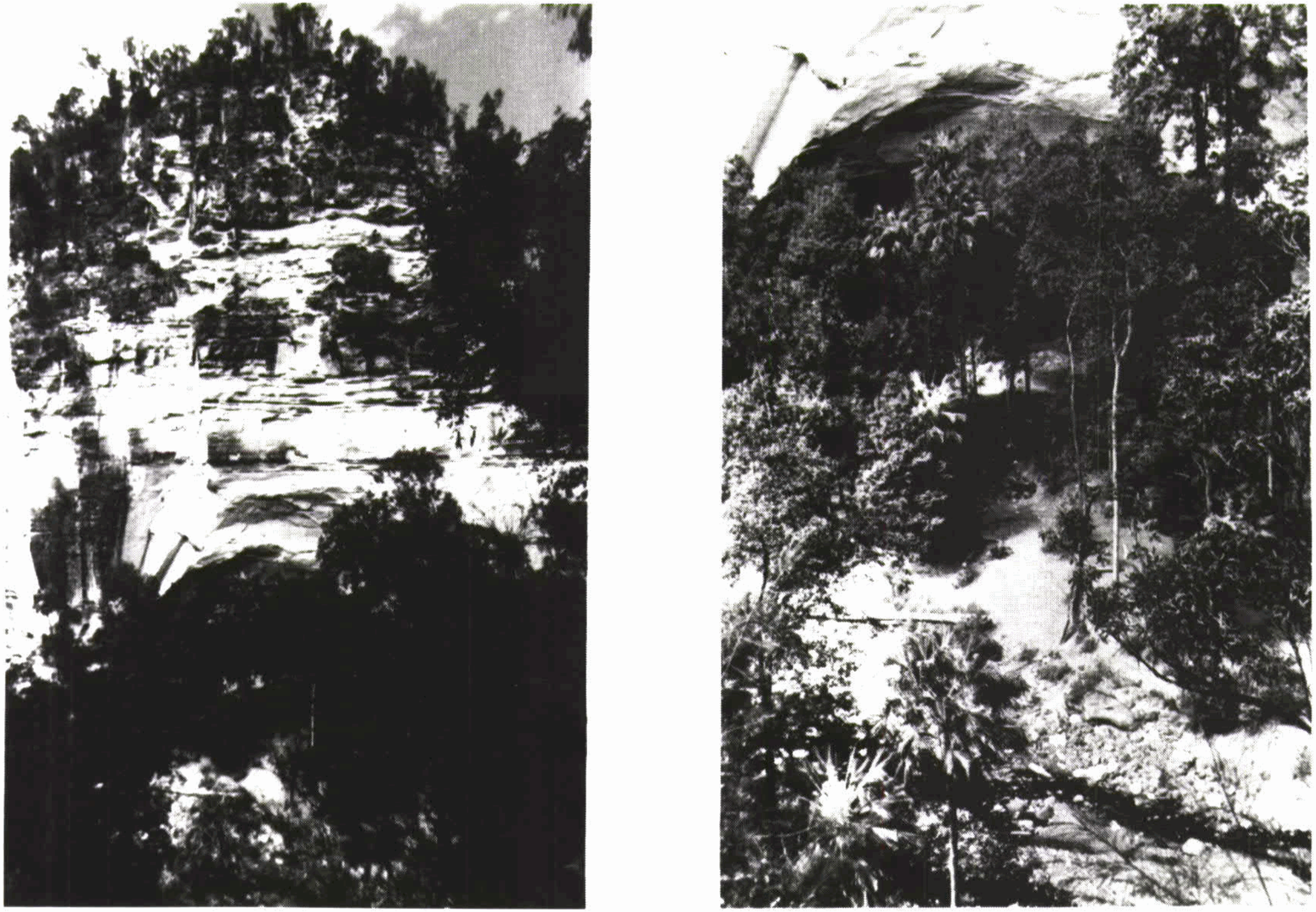


Plate 1. Views of Cathedral Cave.

PREVIOUS ARCHAEOLOGICAL WORK IN THE UPLANDS

In 1962 both of the largest rockshelter sites in the uplands were excavated, Kenniff Cave by D. J. Mulvaney, and Cathedral Cave by D. J. Tugby. While the Kenniff Cave report by Mulvaney and Joyce (1965) has become one of the benchmarks in the Australian archaeological literature, the excavations at Cathedral Cave remained unreported.

On the basis of their excavations at Kenniff cave and the Tombs, Mulvaney and Joyce were able to describe a long sequence, spanning some 19,000 years, with an early phase in which the stone tool material culture of the terminal Pleistocene and the first half of the Holocene was marked by a core and flake tool industry characterized by the comparatively large size of implements and restricted number of arguably discrete types. This early assemblage was subsequently augmented in the middle-to-late Holocene by the addition of an array of highly stylized microlithic forms and a great increase in the deposition of tools and debitage per unit volume of deposit. While the effect of the early work at Kenniff Cave was to stimulate research throughout Australia, the early investigations of Cathedral Cave were much less auspicious.

Early Investigations of Cathedral Cave

From 1937 to the early 1960's the Carnarvon Ranges were periodically visited by touring expeditions organized by D. A. O'Brien, then General Director and Secretary of the Royal Geographical Society of Australasia (Queensland). These expeditions, which numbered 40 by 1964 (O'Brien 1963/4:64), appear not to have had any focused scientific intent. O'Brien accepted subscriptions from patrons, members of the Society and others whom he would take on expeditions to the remote ranges. The financial difference between subscriptions and costs of the expeditions were the measure of the expedition's success (O'Brien 1963/4:64). O'Brien's many trips to the ranges never resulted in a serious published consideration or description of the Aboriginal occupation remains, even though O'Brien noted them and was in fact quite impressed by them (1939-40).

It was only O'Brien's third expedition (1940) that produced any real results. This expedition included important scholars not previously or subsequently known to have accompanied him. Among them were C. T. White, Government Botanist; Father Leo Hays, Ethnologist; R. H. Goddard, Chairman of the Anthropological Society, Sydney, and S. R. Mitchell (O'Brien 1957-9:35). An article entitled "Forgotten Paradise" appeared in late 1940 in **Walkabout**. It was authored by a C. C. D. Brammall and included a photograph of Cathedral Cave. O'Brien (1957) notes that a journalist named C. C. Bramwell (sic), representing the Brisbane Telegraph, also accompanied the 1940 expedition. The article is notable only for its photographs and adds to my conviction that the unnamed shelter, later written about by Goddard and referred to by Mitchell, was in fact Cathedral Cave.

In two nearly identical articles, Goddard (1940/41:369 and 41/42:75) described "an enormous rockshelter .. 270 feet long by 69 feet wide.." While the thrust of these articles concerned his imaginative and speculative interpretations of the rock art, Goddard did note that the shelter's floor was covered with the "empty husks of the kernels of the nut-like fruit of the species of Cycadaceae" (1940/41:370, cf. 1941/2: 77). In a note at the end of one of the articles, S. R. Mitchell refers to the shelter as "the 9-mile shelter" (1940/41:373) and says that it:

"yielded one flat stone used for grinding pigment and on which some pigment still adhered and a number of stones which were probably used for husking the nuts of the Macrozamia palm. It was reported that other material including stone axes had been collected in the past, but unfortunately no record has been kept".

In 1962, Dr. Donald J. Tugby, from The University of Queensland, mounted an expedition to Cathedral Cave. He did so with the aid of the University militia and an affiliated regular army unit. During one week the party excavated two units, but no report was made nor were records lodged in a public institution. Unpublished accounts of the stone artefacts (Clegg, n.d.) and of the excavated faunal remains (Bartholomai, n.d.) have been the only products of the Tugby expedition to Cathedral Cave; neither of these authors accompanied the expedition. It is alleged in the Clegg report that disgruntled members of the party mislabelled some of the excavation samples.

In August and September 1975 I carried out a second sampling of Cathedral Cave because it was known to have stratified deposits containing rich faunal and stone tool assemblages which I considered to be potentially good data to complement the picture described from the other sites which I excavated (Beaton, 1991 - this volume) as well as those reported by Mulvaney and Joyce (1965).

THE SITE AND SURROUNDS

Cathedral Cave is located along a bank of Carnarvon Creek, within the boundaries of Carnarvon National Park. Also within the park are numerous engraved and painted rock art sites, many of which have been described by Quinnell (1977). Carnarvon Gorge is 60km northwest of Wanderer's Cave and 25km southeast of Kenniff Cave. The elevation at the cave is about the same as the elevation Wanderer's Cave, ca. 650m (2000') above m.s.l. But there the resemblance ends.

Carnarvon Creek has cut through the massive Buckland Tableland and is tightly bordered by precipice sandstone cliffs up to 200m high. As Carnarvon Creek cuts away the sandstone it carries basalt cobbles which have weathered out from basalt flows and dykes upstream. The results of weathering and transport of the sandstones of the tableland are a proliferation of steep-sided gorges. Of these, Carnarvon Gorge is easily the most spectacular. The main gorge is some 30km long but its meandering course makes it somewhat longer to the foot traveller. The bottom of the gorge varies from about 100-200m in width. Numerous smaller gorges feed into the main gorge. The physiographic complexity that is given by the gorges and by the differentially exposed and wetted surfaces that they provide, has given rise to a very complex and patchy set of microenvironments. In dark and moist corners of the gorge, dense fern groves occur. Along the banks of the creek, stands of Casuarina flourish where they are exposed to sufficient light. In areas of more shade, stands of gum and cabbage palms (Livistona sp.) line the creek banks. The tall gums, palms and she-oaks are dwarfed by the walls of the gorge. Shrub vegetation is well developed and wattles and bottlebrush are common. In the downstream half of the gorge, thick groves of Macrozamia moorei can be found.

There are fewer large marsupials in the gorge than can be found in the more open country and on the plateau tops nearby. The dominant macropod in the gorge is the rock wallaby (Petrogale sp.). I have not seen any other macropod in the gorge proper, but wallaroo (Macropus robustus) could be expected upstream and several wallabies as well as the grey kangaroo (M. giganteus) are abundant on the plains below the mouth of the gorge. During the excavation, rock wallaby (Petrogale sp.), glider (Schoinobates sp.), bandicoot (Isoodon or Perameles), native cat (Dasyurus sp.) and goanna (Varanus sp.) were seen on the site primarily as nocturnal visitors, excepting the large Varanus lizards which would only appear during warm daylight hours.

Cathedral Cave sits on the south bank of Carnarvon Creek and the 40m-high arched facade which gives the site its name has a northerly exposure. The present floor of the site is about 4m above the bed of Carnarvon Creek. The total floor area of the site is ca. $1100m^2$, but a more realistic figure, subtracting the large area of roof-fall at the eastern end of the shelter, gives a useful floor area of $670m^2$, defined by the shelter walls and the dripline. Large and small blocks of sandstone have fallen from the tableland 40-150m above and have formed a low rampart at the mouth of the shelter (Figure 2). This area, as well as that immediately to the north, down the alluvial apron, is covered by a dense stand of trees including Eucalyptus species and the cabbage palm, Livistona sp. One very large old Macrozamia plant grows on the dripline at the east end of the shelter. No plants are found on the shelter floor itself.

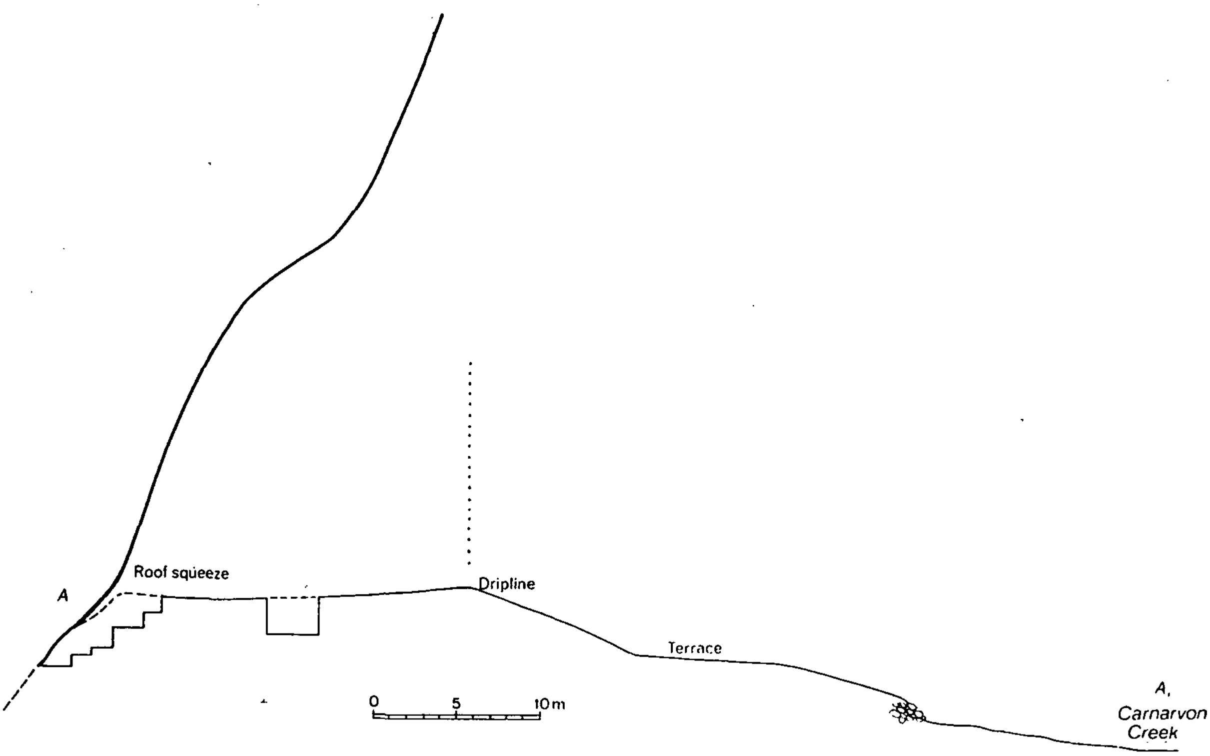


Figure 2. Section view of Cathedral Cave.

The floor of the deposit is flattish but at the western end of the shelter it gently inclines and mixes with decomposing sandstone which slowly enters the deposit by gravity and the effects of human/animal trafficking up and down the slope. At the east side of the shelter is a massive slump of white sand and sandstone blocks rising some 10m above the shelter floor. This slump probably occurred prior to the occupation of the site. No other large roof-fall accumulations are to be seen on the present surface of the site.

The shelter wall and ceiling consist of a very light coloured sandstone of mixed texture. The smooth wall surfaces are interrupted in places by numerous bedding and joint lines. The ceiling/wall abuts the shelter floor and arcs overhead on an angle of about 70^{o}. There is no area of low headroom in the shelter. The wall of the shelter is inscribed and painted with one of the largest and most spectacular rock art galleries in Queensland. On the wall are stencilled implements and body parts, chiefly hands, and some non-stencilled painting is also present. Engravings are abundant and depict mostly animal tracks but other less obvious representations occur as well.

Deposit and Excavation

A site map was made using a simple Abney type level, pocket compass and 30m tape. A datum was established directly beneath an engraved figure near the middle of the shelter, 50cm above floor level. The engraving is easily identified as it is the only vulva engraving circumscribed by a larger (20cm radius) circle and having further straight lines engraved in a radial fashion from the vulva to the outer circle. An aluminum tent peg was driven into the deposit at this location but was removed after excavation. The volume of the deposit within the area defined by the wall and dripline I estimated to be in the order of 4000-5000m^3. Because of this high volume, it was clear to me that only a very small sample of the site could be excavated.

When excavations began, the only fact known about the character of the material Tugby had excavated was Mulvaney's suggestion that the stone tools were comparable to the types excavated at The Tombs and in the microlithic horizons of Kenniff Cave (Mulvaney and Joyce 1965:209). No age determinations had been made for any strata of the site, nor was there any available record of the character or stratigraphy of the deposit. Therefore, I considered that the first requirement was a sounding of the deposit.

To sound the deposit I sited Unit 1 near the centre rear of the floor (Figure 3). This 1.2 x 2 metre unit was subsequently enlarged to the north and south by the addition of Units 2 and 3. These three units formed a north-south trench. Two further units, 4 and 5, were excavated near the centre of the floor. Unit 8 was a 1m x 1m northward extension of Unit 5. All of these units were placed at this location to determine the extent of stratigraphic horizons recorded in Units 1-3 and to obtain a sample of material from this part of the deposit. Unit 6 was placed against the shelter wall on the western side of the site. The cave wall, against which the 1m x 2m excavation was fitted, was heavily painted and engraved. At that time Mr. M. C. Quinnell, Curator of Archaeology at the Queensland Museum, was making a study of the Carnarvon Gorge rock art. He had finished his field work but had agreed to visit my excavations to see what the character of the rock art was on the wall below the cave floor. Not only would the excavation of Unit 6 suit his purpose as well as mine, but also I had seen a photograph taken during the Tugby excavations which identified the location of one of the excavation units. Unit 6 was placed so that it would slightly overlap the Tugby excavation. This was done so that if the 1962 collections were ever to be made use of there would be a record of the stratigraphy of the area they came from. Clegg has said in his report that:

> "Both of these holes were dug in 'layers' but records do not survive to indicate how these were defined, how deep each was, or whether there is any correlation between the layers in the different holes" (n.d.:1-2).

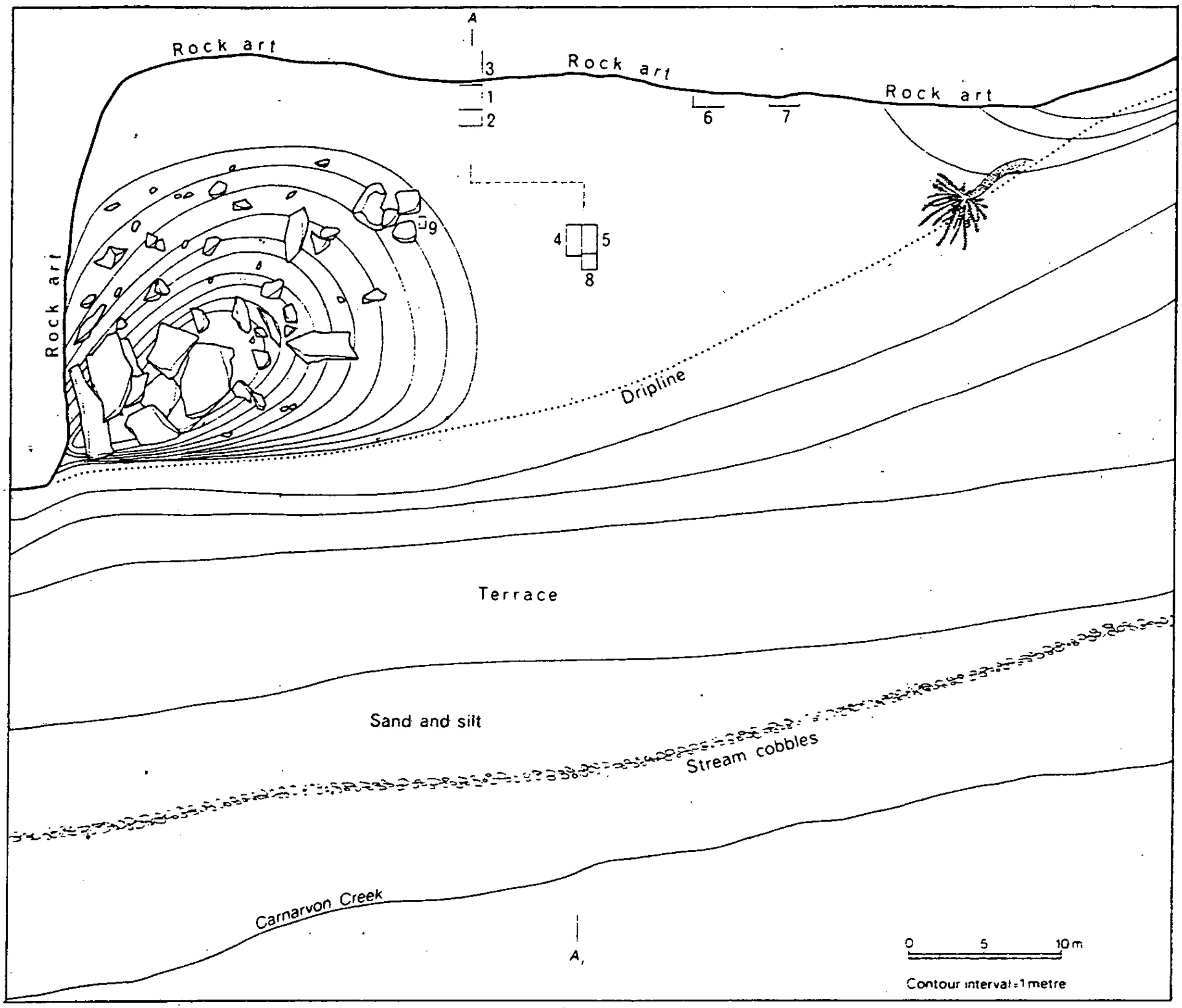


Figure 3. Plan view of Cathedral Cave.

Unit 7 was placed along the wall one metre west of Unit 6 to study a stratigraphic trend seen in the sections of the latter pit. Unit 9 was placed at the edge of the massive sandstone fall so that its relationship to the occupation horizons could be determined. The size, depth and volume of the excavation units are presented in Table 1.

Table 1. Cathedral Cave: excavation unit sizes.

Unit	Dimensions(m)	Area(m2)	Average Depth Excavated(m)	Maximum Depth Penetrated(m)	Approx. Volume(m3)
1	1.2 x 2	2.4	1.1	2.2	2.6
2	1.2 x 1	1.2	0.6	1.0	1.4
3	1.3 x 1.5-3.0	2.6±.8	2.0	4.2	5.2
4	1 x 2	2.0	1.8	2.4	3.6
5	1 x 2	2.0	1.8	2.4	3.6
6	1 x 2	2.0	2.0	2.3	4.0
7	1 x 2	2.0	2.0	2.3	4.0
8	1 x 1	1.0	1.8	2.4	1.8
9	1 x 1	1.0	1.0	1.5	1.0

In all, the units covered 17.5m^2 of the floor and excavated 27m^3 or about 0.5% of the deposit. At no time was bedrock struck by excavation, even though a depth of nearly 4m was excavated in one location (the far south of Unit 3). No excavation was attempted on the colluvial apron outside the shelter because of the tree growth and rock fall, and the likelihood of stratigraphic inversion. Casual inspection and digging on the terrace below the apron showed no evidence of Aboriginal use or waste disposal.

Cathedral Cave Stratigraphy

Numbering System

In the following discussion of the stratigraphic record at Cathedral Cave four notational systems are used to describe the strata and features of the depositional history. The notations refer to:

1. The stratigraphic model. A generalized stratigraphic summary is presented to outline the basic features of the deposit. Numbers which refer only to this summary are preceded with an "S".

2. The section drawings. In the text, where certain features of the stratigraphic profile are referred to, numbers in brackets, e.g. (1), are used to guide the reader's eye to the relevant part of the drawing, which is identified by the same number, also in brackets.

3. The sample collection numbers. These numbers identify the stratigraphic and horizontal provenience of objects. For instance, U1-L3 refers to the third stratigraphic horizon found below the surface of Unit 1. During excavation, the system was modified because some features required subdivision. In these instances, which are few, letters were added and given stratigraphic priority unless preceded by a number. Thus, an excavation sequence from top to bottom would read Level A, Level 1, Level 1A, Level 1B, and so forth.

4. The column sample. A separate notation series has been used to describe column sample levels because certain column sample strata, due to further subdivisions of natural strata, have no direct equivalents in the general stratigraphy.

Stratigraphic Summary

The stratigraphic profile of Cathedral Cave is complex, the deposits being comprised of the products of ceiling and floor decomposition, human occupation debris, some lesser amounts of "natural" plant and animal derived material, plus fluviatile sediments which were laid down periodically by Carnarvon Creek. Fluviatile and occupation deposits are easily distinguished from one another, but a reconstruction of the depositional history is not simple, nor are all the parameters well understood. Complications arise where massive roof-fall has occurred and where mixing is thought to have taken place within, and sometimes between, separate occupation horizons. Furthermore, the fluvial history of Carnarvon Creek is not at all well known and I can make only reasoned speculation about the factors contributing to the fluviatile deposits in the shelter. Where sedimentological data bear directly on the archaeology of the site, I have tried to incorporate them into the picture of the occupation of the site. In the following paragraphs a summary description of the stratigraphy is given. Further details about the deposit are described from the analysis of the column sample.

Stratigraphic Model

As a simplified overview, the human occupational and sedimentological history of Cathedral Cave can be described as one in which stream overflow is interlayered with archaeological deposit. There are as many as five occupation horizons separated by sterile sediment, though these may appear to be as few as three in some excavation units because of absence of interstitial fluviatile or other sterile deposits. In general, the stratigraphy can be outlined in the manner given in Table 2.

Table 2. Cathedral Cave: deposit summary.

Name	Summary Character of Deposit	Age
S1	thin (10 cm) surface occupation horizon	(sub-modern)
S2	thin sterile sediment	
S3	thin occupation horizon	(ca. 2300 BP)
S4	thin sterile sediment	
S5	thick (0.75 m) sterile sediment	
S6	thin occupation horizon	(ca. 2900 BP)
S7	thin sterile horizon	
S8	thin occupation horizon	(ca. 3500 BP)
S9	thick (at least 2.5 m) sterile sediments	

Stratigraphic Details

Units 1-3

In excavation Units 1, 2 and 3, four artifact bearing horizons were identified. The uppermost occupation deposit (S1) (Table 2) began at the surface and extended 10cm in depth. It was characterized by a sandy, dark-grey, ashy matrix that contained Macrozamia shells, flaked stone, ochre particles and a great deal of burned wood and charcoal. This horizon was underlain by a light brown, sandy, sterile layer (S2) that was loosely "ribboned", i.e., made up of finely banded brown deposits of variable hue. These were the first fluviatile deposits encountered. The stratigraphic contact between the two layers (the fluviatile and overlying occupation debris) was irregular and mixing between the adjacent parts of the two layers was suspected. The bottom of the second layer was clearly marked by a very fine textured reddish-orange layer that was laid down on top of the third major stratigraphic layer (S3), which was the second occupation horizon encountered.

The reddish-orange layer which sealed the top of S3 was no thicker than 0.5mm and seemed perfectly flat and undisturbed. It overlaid a clean white coarse sand layer, itself no more than 1.0mm in thickness. Over a 2m length of exposure, neither of these thin sedimentary layers dipped or appeared to be disturbed. Directly below these two very thin sediments a second occupation horizon (S3), also 10cm thick, was found. The top of the occupation level was in contact with the white coarse sand and appeared, as did the sand and reddish-orange layers, to be absolutely flat. The occupation horizon, like the uppermost level (S1), was sandy, dark-grey in colour and contained Macrozamia seed shells, mammal bone, some freshwater mussel shell, ochre and flaked stone tools. Here too the concentration of charcoal and burned wood was high. The bottom of this level was poorly marked and its contact with sterile deposits of the next level was gradual, again suggesting some mixing of the two.

The sub-occupation level (S4) was about 10cm in thickness. Its bottom was very well marked by a thin, red-brown, silty layer that had shrunk through time (Plate 2). The shrunken and edge-curled patches of silty sediments were the bottom of S4 and separated the upper deposits from a 750cm thick series of banded sterile sands and silts (S5) of fluviatile silts. Attempts to count individual bands resulted in estimates that varied between 180 and about 300. These sediments dipped toward the front of the shelter (north) at about 15° but the angle increased slightly to the north.

(S6), a thin occupation horizon dated to 2960±80 bp (ANU-1760), had a well defined upper limit, and poorly defined lower limit, but was only present in Unit 2 and did not extend to the cave wall. (S7), a 4cm-thick sterile layer, separated S6 from S8, the lowest occupation horizon encountered at the site. This lower most horizon,(S8), was dated to ca. 3500 BP (3560±80 [ANU-1762]).

Both strata (S6) and (S8) contained considerable burned wood and ash. Only very small fragments of bone and Macrozamia were seen. Few flaked stone chips were encountered. The designation (S9) is a simple summary notation for what is ca. 2m of sterile sediments. This series of sterile and silty fluviatile deposits became increasingly well compacted with depth. In the upper 2m of the deposit the sediments were very loose and cave-ins were a major concern. The lower levels of (S9) had to be removed with a pointed rock hammer, used as a pick.

Units 4, 5, 8

In Units 4, 5, and 8 the stratigraphic sequence is different due to complications resulting from massive roof-fall. In these units a surface occupation horizon continuous with (S1) of Units 1-3 was underlain by banded fluviatile sediments. These overlay a second occupation horizon sealed by a thin, reddish-orange, silty layer about 55cm below the surface. If the silty layer is the same as that seen at the same depth in Units 2 and 3, then the second occupation horizon in this unit is probably not continuous with any occupation horizon in Units 1-3. A C14 date of 1700±60 bp (ANU-1763) for this level suggests it is younger than the second occupation level (S3) of Unit 2. The difference of the dates and the stratigraphic position of this occupation horizon vis-a-vis those of Units 1-3 remain unresolved.

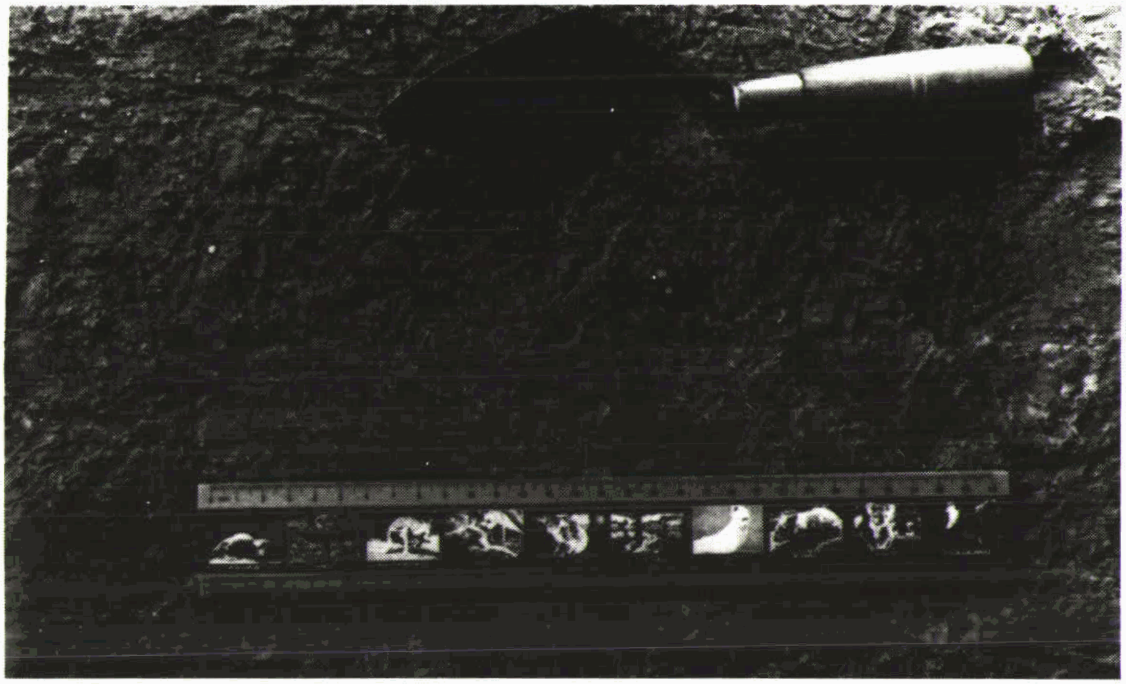
Beneath the second occupation level in Units 4, 5, and 8 a nearly pure white loose sand mixed only with decomposing fragments of white sandstone was found. This material is certainly a subsurface extension of the conical mass of roof-fall located at the east end of the shelter. I dug and probed through this sterile layer to a depth of 2.4m below surface without finding any change in its character.

Unit 9

In Unit 9 there was only a surficial occupation horizon of ca. 10cm thickness which gave way directly to the white sandy roof-fall of at least 1.5m thickness.

Unit 6

In Unit 6 a surface occupation horizon 20cm in thickness (Figure 4 [1]) was underlain by a fluviatile sterile layer (2) about 15cm thick.



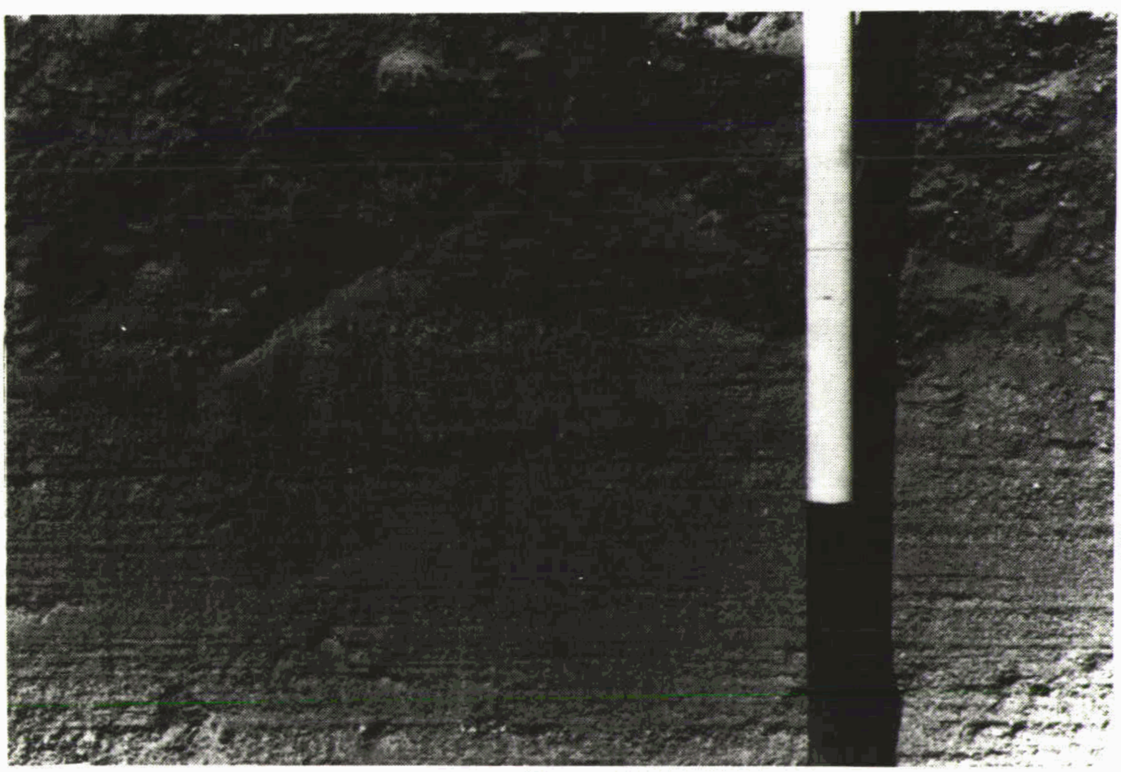


Plate 2. Cathedral Cave deposit characteristics. Cracked and shrunken fluviatile sediment (upper): Occupation horizon overlaying sterile sediments, note irregular contact (lower).

As in all instances where occupation layers overlay sandy uncompacted sterile layers, there was some mixing at the contact of the two. The texture of the sterile layer became finer towards its bottom, and its lowest extremity (3) had a very fine silty or clayey texture which terminated at 35cm below surface. The sterile sediment clearly sealed this second occupation horizon (4), which was separated from a third occupational horizon by a 4cm band of silt (5). The third occupation horizon (6) was only about 5cm in thickness and overlay white, unconsolidated, coarse sand (7). Below the white sand further sterile brown and yellowish-brown sterile layers (7, 8, 9) occurred. In this sediment occurred the only clear effect of wave action in the fluviatile deposits. Slight wave effect with an amplitude of 3-4cm was registered in the structure of the sediments. The overall band of wavy sediment became thicker and inclined at about 53^{o} to the east. This feature overlay a poorly sorted sediment 35cm thick (10) which had a fine silty sterile layer 4cm thick beneath it (11). This silty layer sealed the fourth occupation horizon (12), which was separated from the fifth only by a thin (0.5 mm) red-orange layer of clayey silt. The fifth occupation layer (13) was clearly sealed by the red-orange silt, but its bottom contact with coarse white sands was irregular. Substantial block roof-fall was noted beginning 190cm below the surface. Excavation of further sterile deposits (14) was stopped at 2.3m without finding bedrock or further archaeological deposits.

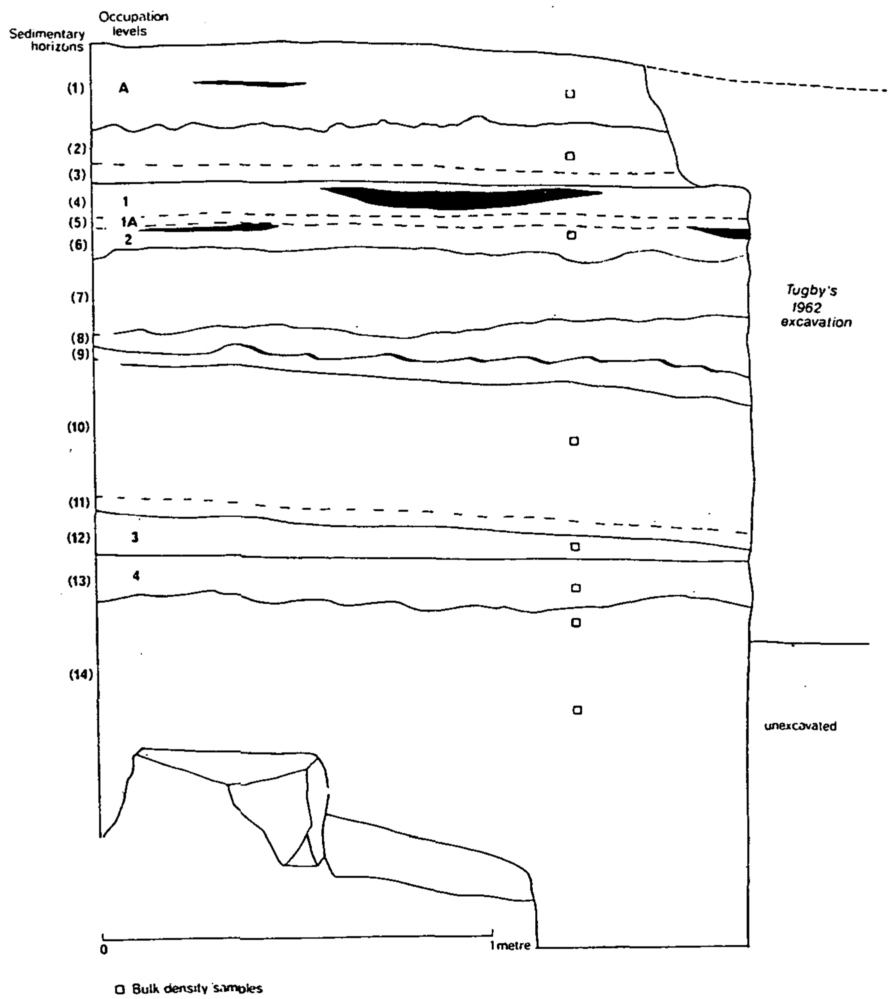


Figure 4. Cathedral Cave section, Unit 6, North wall.

All the exposed rock art of the wall abutting Unit 6 was engraved. No painted rock art was seen beneath where the surface sediments contacted the wall. I believe this to be due to poor survival. At this point, three facts about the position of rock art on this wall as seen during excavation should be noted:

1. There was engraving, but no painting on the wall below the uppermost reaches of (1), although painting is abundant on the wall surface not covered by deposit.

2. The lowest engraving extends no more than 90cm below the surface, just as in Unit 6, and therefore does not extend to the surface of the lowest occupation horizon.

3. There is no erosion of the wall to suggest that engravings ever extended further below the surface than they are found at present.

Unit 7

Unit 7, being west of Unit 6, is slightly elevated with respect to the latter, but the major stratigraphic horizons are similar (Figure 5). The slope of the surface at this location is 9-113 to the east. The uppermost level (1) was an occupation horizon of 20-30cm in thickness. In this occupation horizon an ashy concentration was recorded in the N-W corner of the unit. The feature was noted to be nearly pure ash and no economic remains or "hearth stones" were associated with it. Indeed, all of the ashy concentrations such as this in deposit had a similar lack of associated material. The loose poorly compacted nature of (S1) was evident, especially where it contacted (2), the sub-occupation horizon sterile layer. The contact of these two strata was a distinct oscillating interface which clearly showed about 6cm of vertical disturbance.

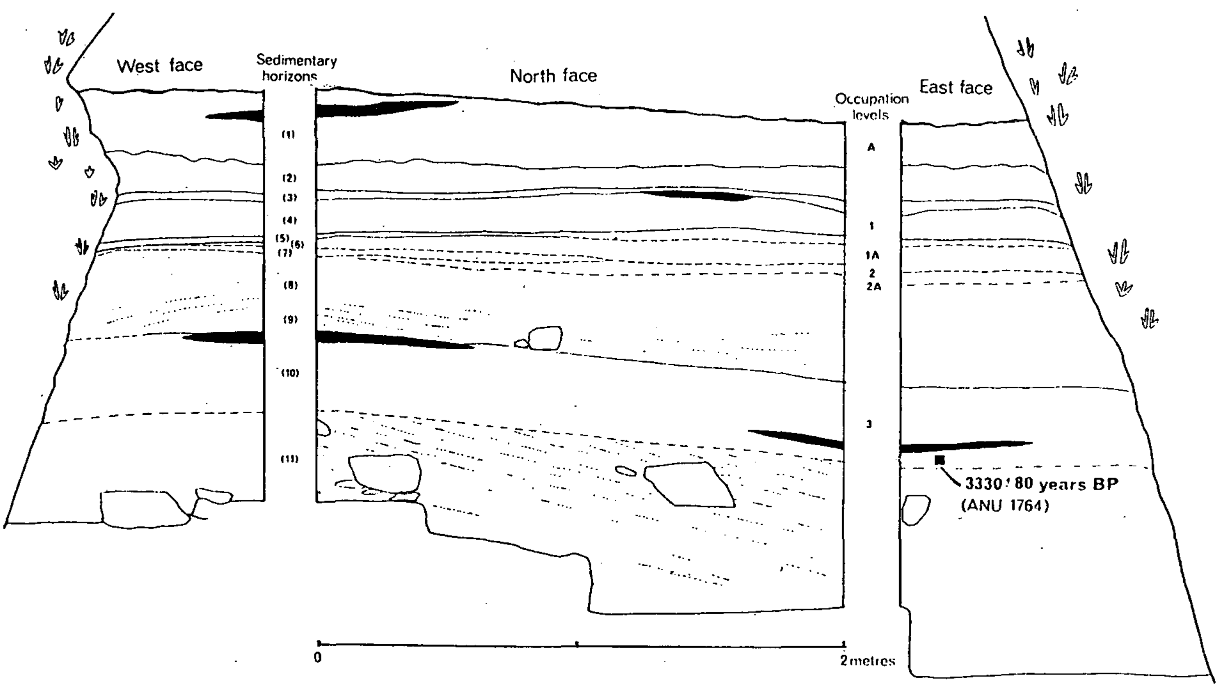


Figure 5. Cathedral Cave section, Unit 7.

Stratum (2) was an uncompacted mixture of fine to coarse sand and was devoid of archaeological deposit, except for its uppermost few centimetres where some mix with (1) had occurred. The second stratigraphic layer graded into (3), a fine-textured silty sand, also sterile. This fine-textured sterile layer sealed the second occupation horizon (4), which was about 10-12cm in thickness. The horizon (9) was separated from a lower occupation horizon (6) by a sterile, brown, silty layer (5), which thinned noticeably to the west (uphill). This sterile layer separated the occupation horizon (4) from a somewhat thinner occupation horizon (6), which itself became noticeably thinner to the west. Level (7) was a 4-6cm thick sediment layer which I interpreted at the time to be a mixture of the bottom of the overlaying occupation horizon (6) and the top of the sterile sediments (8). Level (8) was comprised of bedded sterile sediments that thinned to the west. The separate stratigraphic elements of this 30-40cm band dipped at 53^{o} to the east in the upper part and as much as 9-10^{o} in the lower quarter of the stratum. Layer (9) is distinguished from (8) in texture, the particles of (9) being very much finer than any part of (8). The change between the two strata was a very gradual one and no distinct line could be drawn between the two. Level (10) was the final occupation horizon found in the sedimentary sequence. This unit could not be subdivided as could the equivalent occupation level (12) and (13) of Unit 6. A radiocarbon date of 3330$\pm$80 bp (ANU-1764) was obtained for burned wood from a fire pit feature (Figure 5) in this horizon. A mixed contact imprecisely separated level (10) from level (11), which was a deep series of sterile fluviatile sediments. These were excavated to a depth of 80 cm below (10) without detecting any further occupation evidence. In level (11) some blocks of roof-fall occurred.

Column Sample

A column sample of 225cm^2 was taken from the west wall of Unit 3. It was collected in the manner described for the column samples from Rainbow and Wanderer's Caves (Beaton, 1991 - this Volume), except that natural stratigraphy was used to mark levels. Some major stratigraphic elements had to be collected in several parts because of their bulk, hence, within levels 4, 5, and 6 (see Table 3), sub-samples were collected separately even though a summary of the stratigraphy might fairly lump levels, such as 5-7, as one thick sterile band.

<u>Column Sample: Particle Size</u>

A mechanical sieving of each of the column sample strata was done in the same manner as described for Rainbow and Wanderers Caves (Beaton 1991 - this volume). The results are given in Table 4 and are also graphically presented as cumulative frequency diagrams (Figure 6) which show that occupation horizons tend to have coarser constituent materials than sterile sediments. Some sterile fluviatile sediments (e.g. 5 mid, 5 bottom) have virtually no coarse particles of any kind in them. Their description would be more skewed toward fine sediments if the silt and clay fractions had been analyzed. Although this was not done, all the sediment has been saved and has been accessioned to the Queensland Museum for reference if further analysis of the sediments is desired by other researchers.

It is worth noting that the sterile sedimentary bands upon which the occupation horizons are overlain are the levels which tend to have greatest amounts of coarse material of the non-occupation horizons.

This is taken as support for what was seen in the field, i.e., that mixing occurs most where occupation has taken place on unconsolidated sandy surfaces.

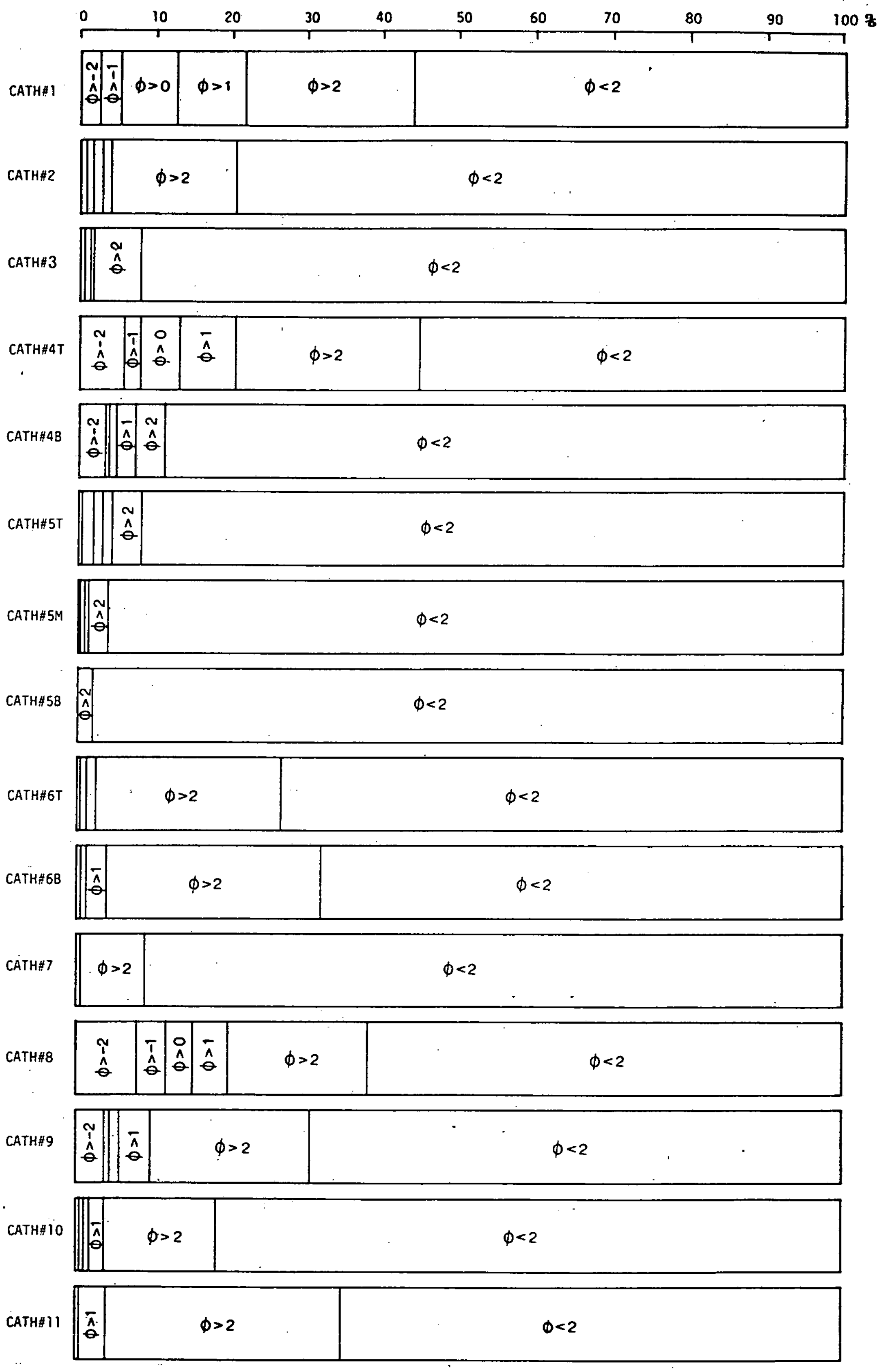


Figure 6. Cathedral Cave column sample particle size distributions.

Table 3. Cathedral Cave: column sample strata.

Summary Strata Notation (text)	Field Collection Sample No.	Column Sample Level Designations	Sediment type	Depth from Surface to Bottom of Strata (cm)
S1	1	L1	Human occupation	10
S2	2	L2	Sandy sterile	26
	3	L3	Silty sterile	32
S3	4	L4 top	Human occupation ill-defined bottom	45 c.2300 BP
S4	5	L4 bottom	Brown sub-occupation	58
	6	L5 top	Banded silty sterile	65
	7	L5 mid	Banded silty sterile	72
	8	L5 bottom	Grey	78
S5	9	L6 top	Top poorly sorted sterile	90
	10	L6 bottom	Bottom of above	111
	11	L7	Brown silty sterile	125
S6	12	L8	Human occupation	131 c.2900 BP
S7	13	L9	Brown sub-occupation	135
S8	14	L10	Human occupation	150 c.3500 BP
S9	15	L11	Sterile sediments	180+

Table 4. Cathedral Cave: column sample particle size distributions.

Sample Name	Total Sample	Particle Sizes Ø>-2 >4mm Mesh Number 5	Ø>-1 >2<4mm 10	Ø>0 >1<2mm 18	Ø>1 >.5<1mm 35	Ø>2 >.25<.5mm 60	Ø<2 <.25mm	Unsampled Residue
Cath#1	1294	36.2	37.2	95.0	05.6	13.4	34.1	1074
%	(100)	(2.8)	(2.87)	(7.34)	(9.11)	(22.04)	(55.75)	
Cath#2	1092	10.2	10.2	13.3	00.7	08.5	40.7	1055
%	(100)	(0.96)	(0.93)	(1.21)	(1.27)	(16.28)	(78.64)	(1005.1)
Cath#3	482	03.1	01.1	03.2	00.3	03.0	44.8	425
%	(100)	(.64)	(.22)	(.66)	(.59)	(6.10)	(90.53)	
Cath#4T	951	57.0	22.7	48.9	04.3	14.2	32.3	769
%	(100)	(5.99)	(2.38)	(5.14)	(7.25)	(24.03)	(54.68)	
Cath#4B	859	30.5	03.6	08.8	01.3	01.8	41.8	764
%	(100)	(3.58)	(.42)	(1.03)	(2.7)	(3.78)	(88.42)	
Cath#5T	417	02.7	06.4	05.0	00.7	02.0	48.3	352
%	(100)	(.64)	(1.53)	(1.19)	(1.26)	(3.79)	(90.87)	
Cath#5M	418	00.5	01.3	01.9	00.3	01.3	49.4	364
%	(100)	(.12)	(.31)	(.45)	(.57)	(2.52)	(96.01)	
Cath#5B	443	00.0	00.01	00.2	00.1	00.9	49.0	393
%	(100)	(0.0)	(.002)	(.04)	(.17)	(1.77)	(97.9)	
Cath#6T	1025	04.2	02.7	04.5	00.8	12.7	37.5	963
%	(100)	(.41)	(.26)	(.43)	(1.39)	(24.45)	(72.57)	
Cath#6B	925	02.3	03.9	07.4	01.3	14.5	34.4	860
%	(100)	(.24)	(.42)	(.77)	(2.53)	(28.28)	(67.26)	
Cath#7	1272	00.2	00.9	02.0	00.2	04.8	50.0	1214
%	(100)	(.016)	(.071)	(.15)	(.37)	(8.5)	(90.67)	
Cath#8	425	34.8	16.5	14.8	02.8	11.4	36.8	308
%	(100)	(8.18)	(3.88)	(3.48)	(4.57)	(18.30)	(60.53)	
Cath#9	709	26.7	05.5	09.3	02.3	11.7	37.0	614
%	(100)	(3.76)	(.77)	(1.31)	(4.17)	(20.86)	(67.8)	
Cath#10	1098	05.0	05.0	08.2	00.9	06.7	37.3	1035
%	(100)	(.45)	(.45)	(.74)	(1.92)	(14.67)	(81.53)	
Cath#11	503	00.3	00.3	01.6	01.8	16.0	32.2	450
%	(100)	(.06)	(.06)	(.31)	(3.5)	(31.0)	(64.0)	

Column Sample: Components

The four coarsest fractions of each column sample level were hand sorted to six identifiable components, an "unidentified" group and one residual category. The components sorted out were:

1. **Macrozamia.** This category includes fragments of nut/shells.
2. **Bone.** Both burned and unburned bone of all descriptions.
3. **Wood.** Very small fragments of wood occurred in the site, usually too small to be collected by field screening. This category includes only unburned wood.
4. **Leaves.** Virtually all the leaf material collected in the column sample were the tough fibrous leaves of Macrozamia.
5. **Stone.** All rock material larger than individual sand grains is included in this category.
6. **Charcoal.** This category includes the highly carbonized particles found and other burned wood.
7. **Unidentified.**

The weights of each component, per level, per size fraction are given in Tables 5-8. These data are presented in cumulative frequency diagrams (Figures 7-10). Both absolute values and percentages are given because both are needed to arrive at an understanding of the components of the deposit. For instance, the cumulative frequency diagrams can be misleading if considered without reference to actual fraction weights. Figure 7 would suggest that all the identified material in level 5M was charcoal, which would indicate an organic rich sediment. Consulting Table 5, however, shows that the actual amount of charcoal was 0.4g, which was the only material >4mm in level 5M. In the level immediately below 5M no material of the size 4mm or larger was trapped in the sieve. In the level immediately below 5M no material of the size 4mm or larger was trapped in the sieve. Consequently, the Tables and Figures pertaining to the sediment components need to be considered together for a realistic understanding of the makeup of the deposit.

The information provided by the analysis can be summarized:

1. There are no sediments in Cathedral Cave which do not have charcoal/burned wood included in them. This could be taken as the effect of mixing of archaeological and "sterile" sediments were it not for the seemingly unbroken nature of some of the thin, red-orange, sterile layers and the multiple banded sediments which also appear undisturbed but contain charcoal. It is concluded that the charcoal in the "sterile" levels was transported in during flood periods.

2. Sediments found immediately below the occupation horizons have substantial mix from above. This is taken as further support of the stratigraphic profile which suggested vertical mixing had occurred.

3. The presence of bone in the coarser fractions was a good marker of occupation horizons, even though the column sample was a very small fraction of the total deposit.

4. Even in the acidic sediment, small particles of wood were preserved, albeit in minute quantities, even in "sterile" layers.

5. Once a sedimentary deposit had been overlain by several centimetres of further deposit, no upward or downward "migrations" of materials was seen.

Table 5. Cathedral Cave: column sample components >4mm.

Sample Name	Macrozamia	Wood	Leaves	Bone	Unident.	Other	Stone	Charcoal
Cath.level 1>4mm (Ø>-2.0)	02.98	00.21	00.02	00.98	21.34	00.89	00.00	09.67
%	(8.26)	(.58)	(.005)	(2.71)	(59.13)	(2.46)	*	(26.79)
Cath.level 2>4mm (Ø>-2.0)	02.60	05.05	00.03	00.00	00.00	00.22	00.00	02.47
%	(25.07)	(48.69)	(.28)	*	*	(2.12)	*	(23.81)
Cath.level 3>4mm (Ø>-2.0)	*	02.98	00.01	*	00.09	00.005	*	00.06
%	*	(94.60)	(.31)	*	(2.85)	(.16)	*	(1.90)
Cath.level 4T>4mm (Ø>-2.0)	00.30	00.25	00.00	00.72	49.00	*	*	05.75
%	(.53)	(.45)	*	(1.29)	(87.47)	*	*	(10.26)
Cath.level 4B>4mm (Ø>-2.0)	*	*	*	*	29.98	*	*	00.17
%	*	*	*	*	(99.44)	*	*	(.56)
Cath.level 5T>4mm (Ø>-2.0)	*	00.03	*	*	*	*	01.83	00.5
%	*	(1.27)	*	*	*	*	(77.54)	(21.18)
Cath.level 5M>4mm (Ø>-2.0)	*	*	*	*	*	*	*	00.40
%	*	*	*	*	*	*	*	(100.00)
Cath.level 5B>4mm (Ø>-2.0)	*	*	*	*	*	*	*	*
%	*	*	*	*	*	*	*	*
Cath.level 6T>4mm (Ø>-2.0)	*	03.67	*	*	*	*	*	00.45
%	*	(89.07)	*	*	*	*	*	(10.92)
Cath.level 6B>4mm (Ø>-2.0)	*	*	*	*	*	*	*	02.21
%	*	*	*	*	*	*	*	(100.00)
Cath.level 7>4mm (Ø>-2.0)	*	00.03	*	*	*	*	*	00.12
%	*	(20.0)	*	*	*	*	*	(80.00)
Cath.level 8>4mm (Ø>-2.0)	00.18	*	*	02.50	01.31	*	*	30.40
%	(.52)	*	*	(7.26)	(3.80)	*	*	(88.39)
Cath.level 9>4mm (Ø>-2.0)	*	*	*	*	26.04	*	*	00.50
%	*	*	*	*	(98.11)	*	*	(1.88)
Cath.level 10>4mm (Ø>-2.0)	*	*	*	00.33	02.20	*	*	02.5
%	*	*	*	(6.56)	(43.73)	*	*	(49.7)
Cath.level 11>4mm (Ø>-2.0)	*	*	*	*	00.12	*	*	00.10
%	*	*	*	*	(54.54)	*	*	(45.45)

Table 6. Cathedral Cave: column sample components >2mm

Sample Name	Macrozamia	Wood	Leaves	Bone	Unident.	Other	Stone	Charcoal
Cath.level 1>2mm (Ø>-1.0)	00.10	00.78	00.15	00.62	26.67	00.29	00.30	07.91
%	(.27)	(2.11)	(.40)	(1.68)	(72.43)	(.78)	(.81)	(21.48)
Cath.level 2>2mm (Ø>-1.0)	*	03.80	00.93	*	00.38	00.19	*	04.50
%	*	(38.77)	(9.48)	*	(3.87)	(1.93)	*	(45.91)
Cath.level 3>2mm (Ø>-1.0)	*	00.21	00.20	00.08	00.20	*	00.02	00.31
%	*	(20.58)	(19.60)	(7.84)	(19.60)	*	(1.96)	(30.39)
Cath.level 4T>2mm (Ø>-1.0)	00.79	00.60	00.01	00.28	16.57	*	00.13	03.98
%	(3.53)	(2.68)	(TRACE)	(1.25)	(74.10)	*	(.58)	(17.79)
Cath.level 4B>2mm (Ø>-1.0)	*	*	*	00.05	03.24	*	00.10	00.22
%	*	*	*	(1.38)	(89.75)	*	(2.77)	(6.09)
Cath.level 5T>2mm (Ø>-1.0)	*	00.03	*	*	00.11	*	04.02	01.75
%	*	(.05)	*	*	(1.86)	*	(68.02)	(29.61)
Cath.level 5M>2mm (Ø>-1.0)	*	00.005	00.005	*	*	*	00.03	01.18
%	*	(.04)	(.04)	*	*	*	(2.45)	(96.72)
Cath.level 5B>2mm (Ø>-1.0)	*	*	*	*	*	*	*	00.01
%	*	*	*	*	*	*	*	(TRACE)
Cath.level 6T>2mm (Ø>-1.0)	*	00.22	*	00.01	*	00.07	*	02.18
%	*	(8.87)	*	(.40)	*	(2.82)	*	(87.90)
Cath.level 6B>2mm (Ø>-1.0)	*	00.20	*	*	00.05	*	00.09	03.44
%	*	(5.29)	*	*	(1.32)	*	(2.38)	(91.0)
Cath.level 7>2mm (Ø>-1.0)	*	00.18	*	*	00.11	*	*	00.53
%	*	(21.95)	*	*	(13.41)	*	*	(64.63)
Cath.level 8>2mm (Ø>-1.0)	00.41	*	*	00.23	02.07	*	02.20	13.40
%		*	*	(1.41)	(12.69)	*	(1.22)	(82.15)
Cath.level 9>2mm (Ø>-1.0)	00.05	00.20	*	00.22	04.28	*	00.08	00.65
%	(.91)	(3.64)	*	(4.01)	(78.1)	*	(1.45)	(11.86)
Cath.level 10>2mm (Ø>-1.0)	*	00.40	*	00.19	03.31	*	00.01	01.27
%	*	(.81)	*	(3.86)	(67.41)	*	(2.03)	(25.86)
Cath.level 11>2mm (Ø>-1.0)	*	*	*	*	00.21	*	*	00.09
%	*	*	*	*	(70.00)	*	*	(30.00)

Table 7. Cathedral Cave column sample components >1mm.

Sample Name	Macrozamia	Wood	Leaves	Bone	Stone	Other	Unident.	Charcoal
Cath.level 1>1mm (Ø=0.0)	00.29	01.59	00.32	00.43	87.67	*	00.30	06.85
%	(.29)	(1.63)	(.32)	(.44)	(89.96)	*	(.30)	(7.02)
Cath.level 2>1mm (Ø=0.0)	*	06.00	03.06	*	00.81	*	00.33	07.86
%	*	(33.22)	(16.94)	*	(4.48)	*	(1.82)	(43.52)
Cath.level 3>1mm (Ø=0.0)	00.08	00.33	00.96	00.06	01.00	*	00.05	00.90
%	(2.36)	(9.76)	(28.40)	(1.77)	(29.58)	*	(1.47)	(26.62)
Cath.level 4T>1mm (Ø=0.0)	00.03	00.57	00.21	00.12	40.20	*	00.15	02.85
%	(TRACE)	(1.29)	(.47)	(.27)	(91.09)	*	(.33)	(6.45)
Cath.level 4B>1mm (Ø=0.0)	*	00.11	*	00.02	07.75	*	00.10	00.70
%	*	(1.26)	*	(.23)	(89.28)	*	(1.15)	(8.06)
Cath.level 5T>1mm (Ø=0.0)	*	00.03	*	*	00.29	*	01.67	02.08
%	*	(.73)	*	*	(7.13)	*	(41.03)	(51.10)
Cath.level 5M>1mm (Ø=0.0)	*	00.07	00.07	*	00.01	*	00.01	01.73
%	*	(3.70)	(3.70)	*	(.53)	*	(.53)	(91.53)
Cath.level 5B>1mm (Ø=0.0)	*	00.01	00.01	*	*	*	00.01	00.09
%	*	(8.3)	(8.3)	*	*	*	(8.3)	(75.00)
Cath.level 6T>1mm (Ø=0.0)	*	00.33	00.05	*	00.20	*	00.10	03.81
%	*	(7.34)	(1.11)	*	(4.45)	*	(2.22)	(84.85)
Cath.level 6B>1mm (Ø=0.0)	*	00.53	00.07	*	00.35	*	00.19	05.45
%	*	(8.04)	(1.06)	*	(5.31)	*	(2.88)	(82.70)
Cath.level 7>1mm (Ø=0.0)	*	00.10	00.01	*	00.02	*	00.02	01.50
%	*	(6.06)	(.60)	*	(1.21)	*	(1.21)	(90.90)
Cath.level 8>1mm (Ø=0.0)	00.05	00.08	00.01	00.10	04.23	*	00.31	09.30
%	(.35)	(.56)	(.07)	(.71)	(30.00)	*	(2.20)	(66.05)
Cath.level 9>1mm (Ø=0.0)	*	00.10	*	00.03	08.78	*	00.10	00.52
%	*	(1.04)	*	(.31)	(92.13)	*	(1.04)	(5.45)
Cath.level 10>1mm (Ø=0.0)	*	00.14	*	00.20	06.37	*	00.09	01.05
%	*	(1.78)	*	(2.54)	(81.14)	*	(1.14)	(13.37)
Cath.level 11>1mm (Ø=0.0)	*	00.08	*	*	01.13	*	00.05	00.20
%	*	(6.47)	*	*	(77.39)	*	(3.42)	(13.69)

Table 8. Cathedral Cave column sample components >0.5mm.

Sample Name	Macrozamia	Wood	Leaves	Bone	Stone	Other	Unident.	Charcoal
Cath.level 1>0.5mm (Ø+1.0)	*	00.05	*	00.05	05.10	*	00.05	00.40
%	*	(.88)	*	(.88)	(90.26)	*	(.88)	(7.07)
Cath.level 2>0.5mm (Ø+1.0)	*	00.15	00.05	*	00.21	*	00.02	00.20
%	*	(23.80)	(7.93)	*	(33.33)	*	(3.17)	(31.74)
Cath.level 3>0.5mm (Ø+1.0)	*	00.09	00.03	*	00.07	*	00.05	00.10
%	*	(26.47)	(8.82)	*	(20.58)	*	(14.70)	(29.41)
Cath.level 4T>0.5mm (Ø+1.0)	*	*	*	*	04.15	*	*	00.15
%	*	*	*	*	(96.51)	*	*	(3.48)
Cath.level 4B>0.5mm (Ø+1.0)	*	*	*	*	01.20	*	*	00.12
%	*	*	*	*	(90.90)	*	*	(9.09)
Cath.level 5T>0.5mm (Ø+1.0)	*	*	*	*	00.05	*	00.25	00.40
%	*	*	*	*	(7.14)	*	(35.71)	(57.14)
Cath.level 5M>0.5mm (Ø+1.0)	*	00.03	*	*	*	*	*	00.27
%	*	(10.00)	*	*	*	*	*	(90.00)
Cath.level 5B>0.5mm (Ø+1.0)	*	*	*	*	00.01	*	*	00.04
%	*	*	*	*	(20.00)	*	*	(80.00)
Cath.level 6T>0.5mm (Ø+1.0)	*	00.04	*	*	00.40	*	00.04	00.32
%	*	(5.00)	*	*	(50.00)	*	(5.00)	(40.00)
Cath.level 6B>0.5mm (Ø+1.0)	*	00.10	*	*	00.75	*	00.05	00.40
%	*	(7.69)	*	*	(57.69)	*	(3.84)	(30.76)
Cath.level 7>0.5mm (Ø+1.0)	*	00.01	*	*	00.05	*	00.01	00.13
%	*	(5.00)	*	*	(25.00)	*	(5.0)	(65.00)
Cath.level 8>0.5mm (Ø+1.0)	*	*	*	*	01.75	*	00.05	01.00
%	*	*	*	*	(62.5)	*	(1.78)	(35.71)
Cath.level 9>0.5mm (Ø+1.0)	*	00.05	*	*	02.10	*	00.05	00.10
%	*	(2.17)	*	*	(91.3)	*	(2.17)	(4.14)
Cath.level 10>0.5mm (Ø+1.0)	*	*	*	*	00.75	*	00.03	00.12
%	*	*	*	*	(83.33)	*	(3.33)	(13.33)
Cath.level 11>0.5mm (Ø+1.0)	*	00.04	*	*	01.52	*	00.04	00.16
%	*	(2.27)	*	*	(86.36)	*	(2.27)	(9.09)

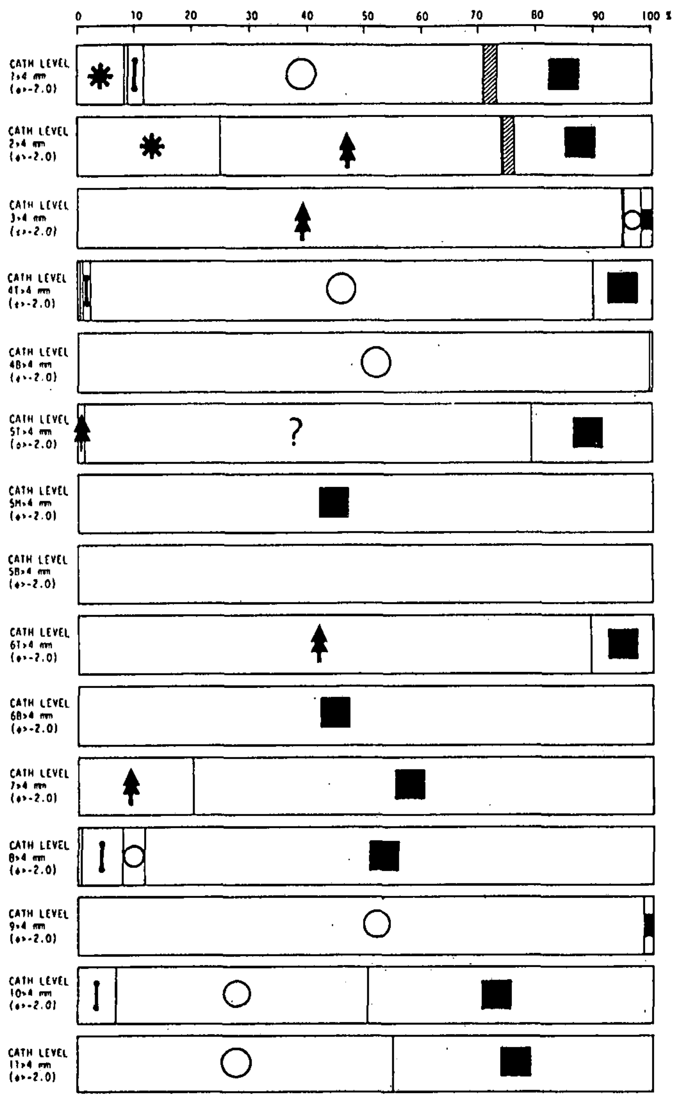
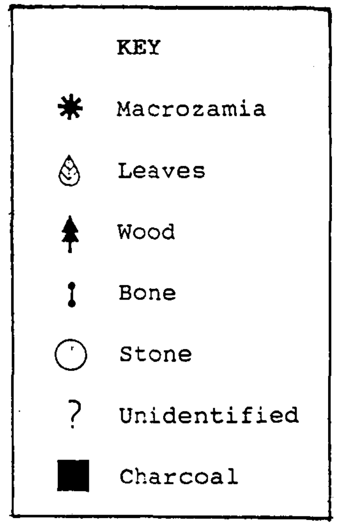


Figure 7. Cathedral Cave column sample components of sizes >4.0mm.



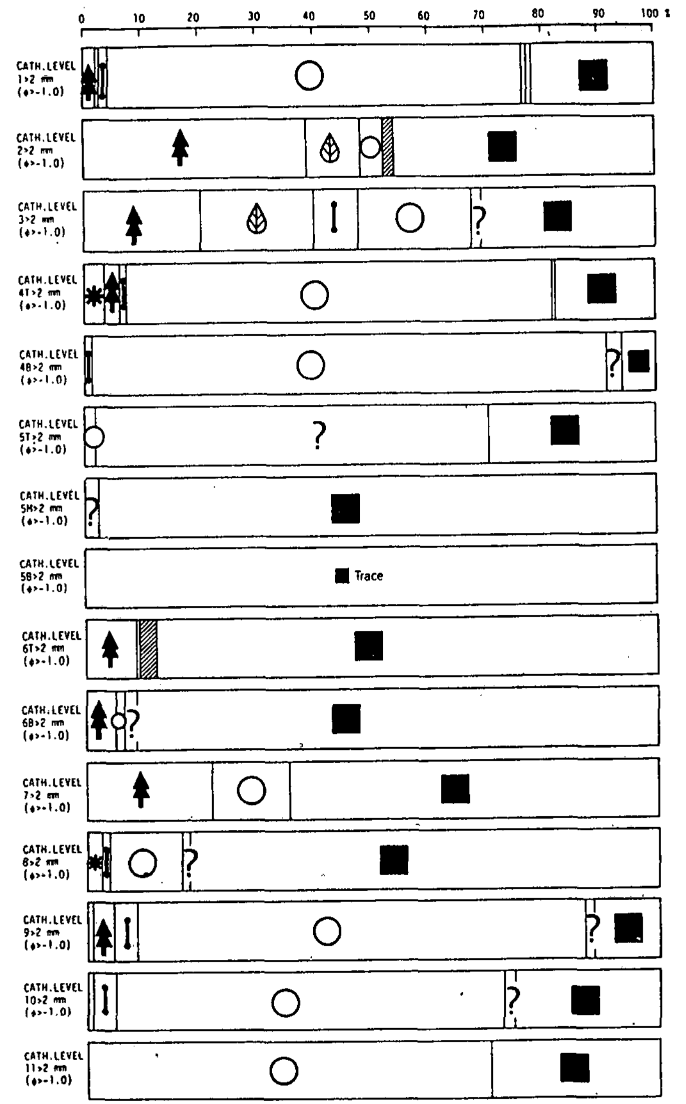


Figure 8. Cathedral Cave column sample components of sizes <4mm >2mm.

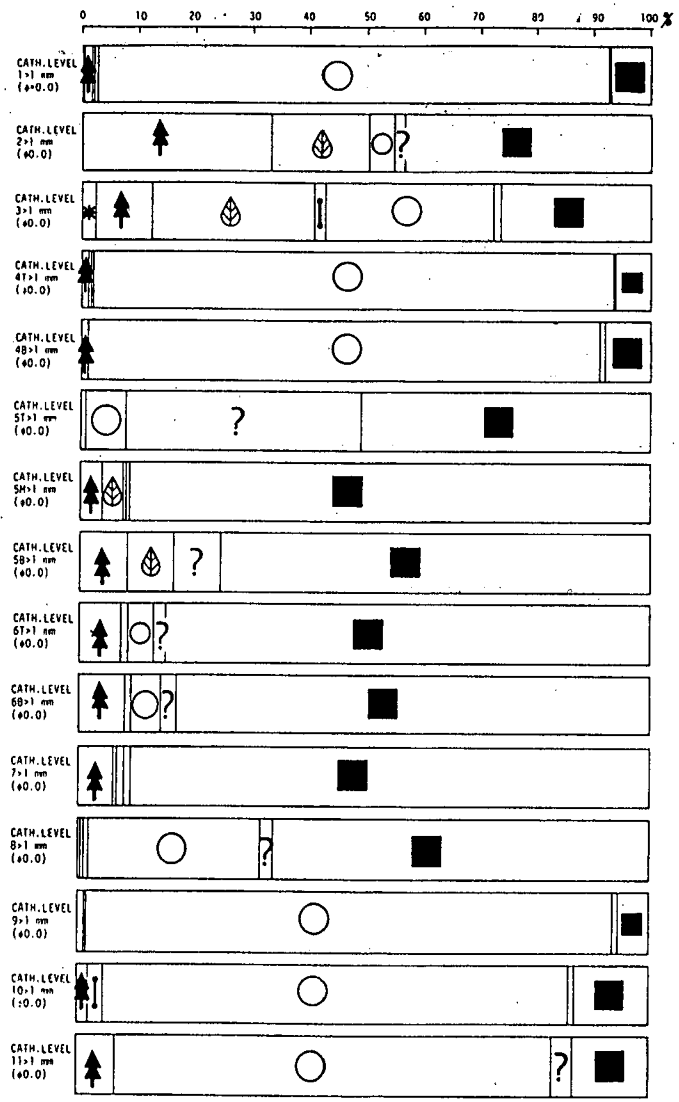
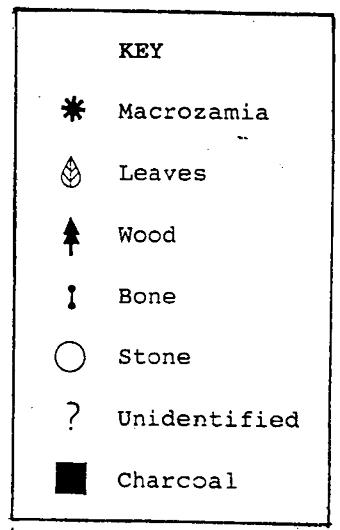


Figure 9. Cathedral Cave column sample components of sizes <2mm >1mm.



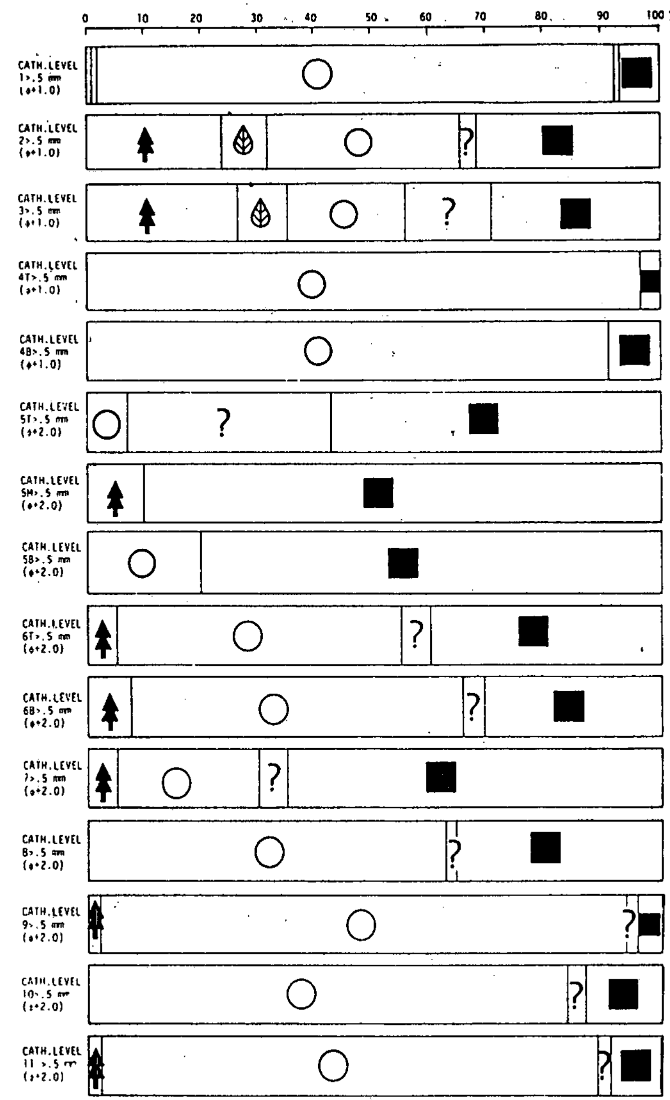


Figure 10. Cathedral Cave column sample components of sizes <1mm >0.5mm.

Bulk Density Sample

Commonly used by soil scientists to measure compaction, bulk density samples may also be put to other uses, particularly as an aid in estimating organic matter content of the deposits. It was thought that this might be put to good use at Cathedral Cave if, as at other sandstone shelters, the organic matter decayed rapidly with increasing age.

One technological problem encountered was that commercial sampling devices, which are designed to collect volumetrically consistent samples, were too large for archaeological purposes. Being 20cm or more in diameter and designed to be forced into a soil profile, each sample would have encompassed several sedimentary or occupation horizons. With this in mind I made a more suitable sampling device from square-section brass tubing with an inside diameter of 1.6mm. The tubing was cut to lengths of 78mm, giving a volume of ca. 20cm^3. One end was bevelled on all four edges to make it easier to force into a sediment profile (for an illustration see Beaton 1985:29).

In the field, the unsharpened end of the sampler was taped closed, with a corner left slightly open to let air escape, and the sampler was gently driven horizontally into sediment layers until it was completely filled. It was then removed and inspected to be sure that it was absolutely full, and the contents then were bagged, sealed and labelled. Thus, nearly identical volumes of different sedimentary facies were collected for bulk analysis.

In the laboratory, the samples were sequentially weighed, air dried, weighed, oven dried, weighed, heated to ignition and weighed a final time. The results give estimates of the relative density of strata, percentage of moisture and the percentage of organic matter.

The results for the samples taken parallel to the column sample in Unit 2 are given in Figure 11. These data suggest that the small samples are reasonably good indicators of occupation horizons and possibly even trends within them. The occupation horizon L4 Top (column sample notation) is clearly indicated by the high organic matter content, as are the mixed zones beneath and above it. The archaeologically sterile column sample levels 5 Top and 6 Bottom also appear to be relatively high in organic matter and this is confirmed by the column sample component analysis. The strongest indication of organic matter content is given for column sample L8 which by component analysis contained 35% to 88% charcoal, depending on the particle size fraction examined.

The samplers were also used in Units 6 and 4. In Unit 4, only two distinct occupation horizons were present and the results are shown in Figure 12b. In Unit 6, the bulk density samples were taken from eight locations, both in apparently sterile layers and occupation horizons. The results are given in Figure 12a. The sample locations are illustrated in Figure 4. The samples seem to be good indicators of occupation horizons, and percentage of organic matter is the best measure. It seems too that simple relative weight of constant volumes might also be a reasonably accurate and simple indicator. In Cathedral Cave this is suggested by the fact that sterile layers are heavier per unit volume than occupation horizons, due to the fact that the organic matter, which occurs most abundantly in occupation horizons, is light in weight relative to sand, silt and clay.

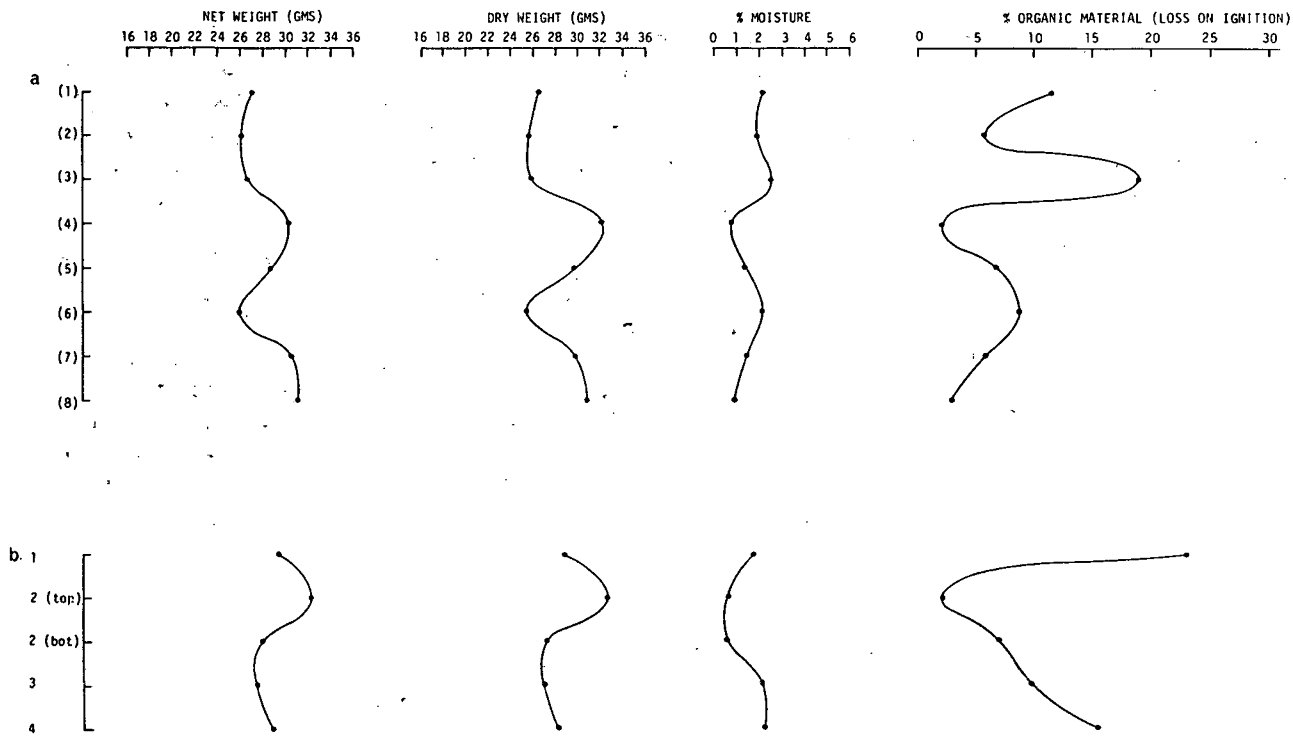


Figure 11. Cathedral Cave: sediment characteristics of column sample levels (data from bulk density samples).

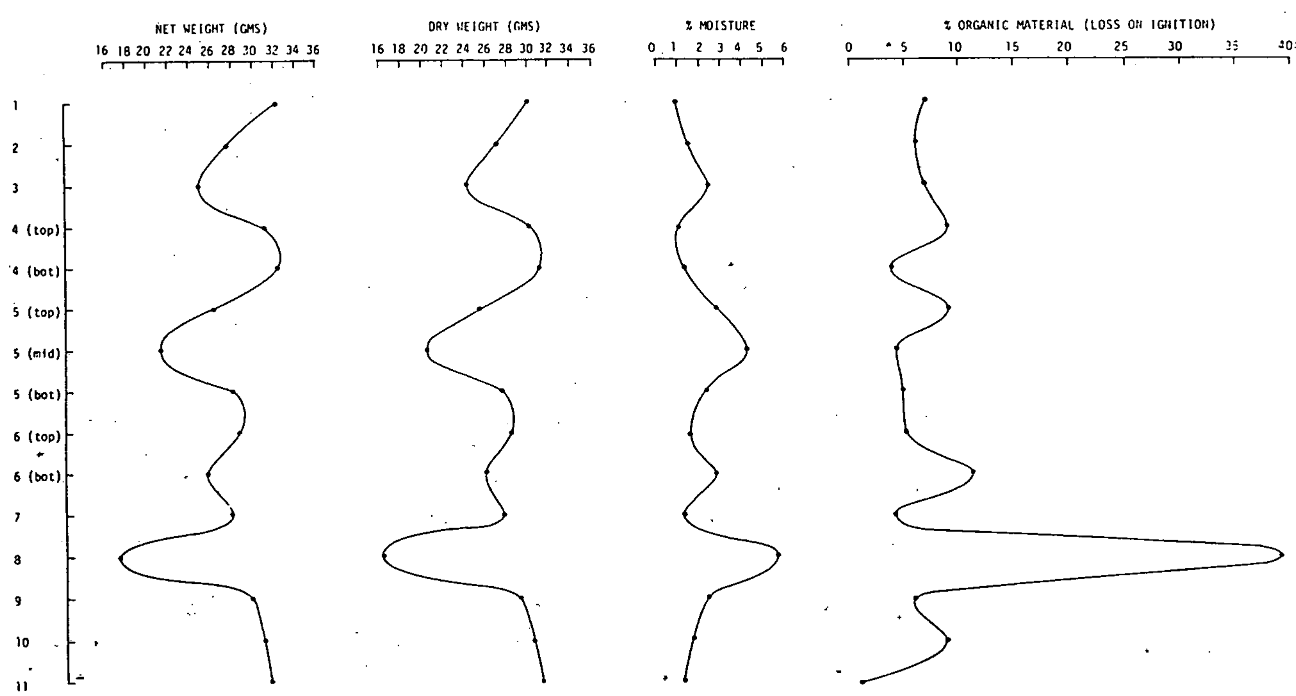


Figure 12. Cathedral Cave: sediment characteristics of Units 6(A) and 4(B) (data from bulk density samples).

The bulk density samples, though small, show a high agreement with the larger volume column sample. The weakness of the bulk density method of identifying organic-rich strata is that it does not differentiate between occupation horizons and organic-rich non-anthropogenic sediments. However, in archaeological sites, particularly rockshelters, where long term periods of occupation and abandonment are suspected, this technique would seem a convenient and accurate supportive indicator of occupation derived deposits when used with other stratigraphic analyses.

Discussion of the Stratigraphy

The deposit in Cathedral Cave is made up of both fluviatile and occupation-derived sediments. The deepest sediments in the shelter show no evidence of any occupation debris. The first occupation deposits were laid down upon sterile sediments about 3500 years ago. There is nothing to suggest that earlier deposits had been scoured from the shelter. The shelter wall shows no signs of having been abraded by water-borne particle matter, nor are there lenses of coarse gravel in the sediment matrix that would suggest a powerful stream flow. Since the first occupation of Cathedral Cave, the shelter floor has been flooded at least three, probably four, and possibly more times.

The nature of the sterile sediments can be viewed to characterize the shelter flooding events. Given the highly bonded and flattish character of the strata, there could be two possible explanations. Firstly, the myriad thin (<1.0mm) bands of fine particles may have been due to repeated floodings of the shelter, each flood depositing a new band(s) of sediment. An alternative explanation would have the shelter floor flooded with sediment rich waters which then receded and/or percolated through the deposit, leaving behind a multiplicity of different sediment layers which settled out at different rates due to their suspension qualities, meaning mostly their weight.

The bulk of the evidence tends to support this latter hypothesis. The reddish-orange shrunken layer seems to be an effect of settling, and it seems certain too that this thin and fragile layer dried and shrank back after it was overlain by other sediments. Animal traffic in the shelters in the region is quite high and for such a fragile sedimentary band to have survived at all it must have been immediately protected by overlying deposit. The 0.5mm layer of coarse white sand below this shrunken layer appears to be particle roof-fall. The layer is about 3-5 grains of sand in thickness and suggests that no great period of time elapsed between abandonment of the shelter and a flood.

The shape of the occupation horizons themselves has something to say about the fluviatile sediments. It was noted during excavation that the surfaces of occupation horizons which were covered by fluviatile sediments were quite flat, unlike the corrugated surfaces of the present shelter floor. This contrasted markedly too with the irregularity of the stratigraphic contacts where the bottoms of occupation horizons met sterile sediments. This suggests that the sediment-charged waters had a levelling effect on the surface of the occupation horizons.

The bottom of the occupation horizons, where they contact sterile sediments, show a feature normally only guessed at in most sandstone rockshelters, i.e. the effect of disturbance of the archaeological deposit (Hughes and Lampert 1977). The picture indicated at several locations in the Cathedral deposit is that human activity on unconsolidated sands tended to disturb the vertical placement of particle matter by about 4-8cm on average and 10cm maximally. Also, there is no evidence that any of the archaeological materials have "migrated" either upwards or downwards in the deposit. Certainly no great leaching or percolating effect, where minute particles of occupation horizon were carried downward by water seeping through the deposit, was detected. Nor was there any evidence of upward movement of artifacts, even where one archaeological horizon overlay another (Figure 4, [4], [5] and [6]).

Where the major sterile bands of sedimentary deposits are considered, they show a tendency to become finer toward their lower levels, e.g. Figure 4(2), (3) and (10); Figure 5(2), (3), (8) and (9). This is quite the opposite of what I would expect if a pool of water rich in suspended sediment was allowed to settle. Consequently, I can not suggest that Cathedral Cave was simply flooded three or four times. I suggest that, while the sediments were most likely deposited during four general periods of fluvial deposition, the true picture is probably much more complicated. Since Cathedral Cave was first used by humans, each period of flooding was itself a series of events where the water level rose into the shelter several times during particularly wet periods.

The circumstances that allowed water to get into the shelter can only be guessed at. Carnarvon Creek is not the sort of creek where one expects water to back-up and pond. During the excavation, a portion of Carnarvon Creek from 0.5km upstream of Cathedral Cave to 1.5km downstream of the cave was mapped for its gradient. The fall in the vicinity of the shelter is 1%, the creek falling 4m in elevation in 400m of distance. In this area the creek bed is 250m wide and continues to be of such width for many kilometres downstream. It seems that for water to be repeatedly backed up at the Cave there would need to have been a blockage in the creek that lasted for several thousand years. This could only have come from a large sandstone fall. The only gap in the sandstone cliffs within a reasonable distance downstream, which might be the source of such a fall, is at a place locally referred to as "Ward's Shortcut", 1.75km downstream of the shelter. I tentatively concluded that such a fall did occur in mid-Holocene times and that the material constituting the dam has been subsequently eroded and transported downstream.

The development of a raised lip at the dripline also may have contributed to the depositional history. This feature, which would have developed as a product of falling rock from the cliff above, could have trapped water behind it and allowed the sediment to settle out in still water. A similar structural phenomenon has been suggested for the development of a clay wedge in the Burrill Lake shelter deposit (Jennings 1971).

In light of the likelihood of shelter floor disturbance, it is something of a surprise to identify any structural features in the occupation horizons. The only features seen and recorded were the ash lenses. Given the colour of the occupation horizons, which is invariably a very dark grey, it seems unlikely that all the colour could be derived from the ash, charcoal, and burned wood fragments of the number of fires that would be represented by the frequency of extant ash lenses. Surely many fires were lit and had burned down and their remains scattered throughout the deposit by various occupation activities and other agents. Indeed, in unconsolidated sand it would be rare that features would be preserved, given human and other traffic on the deposit. Why then are three distinct lenses of ash in the Cathedral Cave deposit? It may simply be that random process has preserved a small fraction of the total number of fires lit in Cathedral Cave. Also, it may even be that ash lenses which appear to be well-preserved are only partly so, and that their uppermost parts and thin edges have been scuffed away. This may be true in some instances but if it was a general explanation one would expect to see ash lenses in all stages of disarray. The persistence of some well defined ash lenses in a deposit which appears to be otherwise well mixed remains unexplained.

The ash lens features seemed to be simply that, lenses of ash. Economic remains, such as animal bone or Macrozamia shells, did not occur in ash lenses in higher frequencies than they did elsewhere in the deposit. In fact, they seemed to be less frequently found in the ash lenses. The ash lenses may have resulted from "sleeping fires", lighted for warmth on cold nights.

EXCAVATED MATERIALS

The excavations at Cathedral Cave produced 454 identifiable stone implements and 5394 fragments of chipping debitage. The collection includes a minor component of ground stone implements and a larger number of flaked stone tools.

Ground Stone

The ground stone assemblage is made up of several edge ground stone axes and a number of small fist-sized pebbles with ground surface facets. The distribution of all ground stone is presented in Table 9. A number of the ground pebbles were stained with various colours of ochre. The distribution and colour stain of these implements are presented in Table 10.

Ochre

Small pieces of ochre were found during excavations. Their colours and distributions are presented in Table 11.

Flaked Stone

The most numerous flaked stone tools were very fine scrapers which accounted for c.40% of all flaked stone implements. Side and amorphous scrapers contributed about 20% and 15% of the collection, respectively. No other types contributed more than c. 5%. The numbers and percentage contribution of each type of implement are presented in Figure 13.

The backed blades and chisels are described separately from the scrapers. Their characteristics are presented in Tables 12 and 13.

<u>Measurement of scrapers</u>

1-3. Outside dimensions: Scraper dimensions are presented in Table 14. Means ($\bar{X}$) are given for each type. The outside dimensions show the scrapers to be squarish, with breadth (width)/length ratios averaging 1:1.2 (width 82% of length). They are also low in profile, ranging in height from about 3cm (core scrapers) to about 0.6cm (very fine scrapers).

Table 9. Cathedral Cave stone tool distribution.

	SIDE	DISC	NOTCH	END	CORE	AMORPH.	BACKED BLADES	CHISELS BURREN	CHISELS TULA	HAMMER STONE	GRIND STONE	V.F.S.
UNIT 1												
LEVEL 1	8	0	4	2	2	2	1	0	2	0	5	13
LEVEL 2	0	0	0	0	0	0	0	0	0	0	0	2
LEVEL 3	1	0	0	0	0	0	0	0	0	0	0	2
UNIT 2												
LEVEL 1	2	0	2	1	1	4	0	0	0	0	2	3
LEVEL 2	1	0	0	0	0	0	0	0	0	0	0	0
LEVEL 3	5	0	1	0	0	4	2	0	1	0	0	7
LEVEL 6	0	0	0	0	0	1	0	0	0	0	0	0
LEVEL 8	0	0	0	1	0	0	0	0	0	0	1	0
UNIT 3												
LEVEL 1	12	1	2	3	3	2	0	1	0	0	5	3
LEVEL 2	0	0	0	0	0	0	0	0	0	0	0	1
LEVEL 4	0	0	0	0	0	1	0	0	0	0	0	0
LEVEL 6	1	0	0	0	0	0	0	0	0	1	1	0
LEVEL 7	0	0	0	0	1	0	0	0	0	0	0	0
UNIT 4												
LEVEL 1	2	0	0	0	0	1	0	0	0	0	0	16
LEVEL 3	2	0	1	1	0	2	0	1	0	0	1	13
UNIT 5												
LEVEL 1	0	0	1	0	0	0	0	0	0	0	1	4
LEVEL 3	1	0	0	0	0	2	0	0	1	0	1	4
UNIT 6												
LEVEL A	6	2	1	2	0	3	0	1	1	0	0	16
LEVEL 1A	3	1	1	0	0	0	0	1	0	0	3	2
LEVEL 1	8	0	4	7	0	7	2	2	1	0	1	23
LEVEL 2	2	0	0	0	0	0	0	0	0	0	0	1
LEVEL 3	7	0	1	1	2	2	9	2	1	0	2	8
LEVEL 4	8	0	0	2	0	3	1	2	0	0	2	11
UNIT 7												
LEVEL A	0	2	1	2	1	7	0	0	3	1	3	9
LEVEL 1	8	2	5	0	1	10	1	2	0	0	1	17
LEVEL 1A	2	0	0	1	0	0	0	0	0	0	2	2
LEVEL 2A	6	0	1	0	0	2	1	0	0	0	0	1
LEVEL 2	1	0	0	0	0	2	0	0	0	0	0	0
LEVEL 3	7	0	2	3	0	6	3	2	0	0	3	4
LEVEL 4	1	0	0	0	0	1	0	0	0	0	0	0
UNIT 8												
LEVEL 1	2	0	0	0	0	1	0	1	0	0	0	4
LEVEL 3	3	0	0	1	0	1	0	0	1	0	1	2
UNIT 9												
LEVEL 1	0	0	0	0	0	2	0	0	0	1	0	3

Table 10. Cathedral Cave ochre grinding implements, distribution, Munsell colour code and number (n).

LEVELS	UNIT 1 Colour (n)	UNIT 2 Colour (n)	UNIT 6 Colour (n)	UNIT 7 Colour (n)	UNIT 8 Colour (n)	UNIT 9 Colour (n)
1	10R3/6 (1) dark red		7.5R4/4 (1) weak red	10R4/8 (1) red		
			7.54/6 (1) red			
			10R7/8 (1) yellow			
3			7.5R4/6 (1) red	104/4 1 weak red		
4			7.5R5/6 (1) red			

Table 11. Cathedral Cave ochre fragments: distribution, Munsell colour code designations and numbers of fragments (n).

Units 1 and 2		Units 4,5,8	Unit 6		Unit 7
Level 1	Level 3	Level 1	Level A	Level 3	Level A
7.5R4/4 (2) weak red	7.5R4/4 (2) weak red	7.5R3/6 (2) dark red	7.5R4/4 (1) weak red	7.5R3/4 (2) dusky red	7.5R3/6 (1) red
7.5R4/6 (2) red	7.5R4/6 (2) red		7.5R4/6 (1) red	7.5R4/4 (4) weak red	7.5R4/6 (1) red
		Level 3			
10R4/4 (2) weak red	7.5R5/6 (1) red	7.5R4/4 (1) weak red	10R5/8 (1) red	7.5R4/6 (3) red	
					Level 1A
10R5/6 (1) red	10R5/6 (2) red	10R4/8 (1) red	10YR5.8/8(1) yellow	7.5R5/4 (1) weak red	7.5R4/8 (1) red
10R5/8 (2) red	7.5R7/8 (1) strong brown	10R5/8 red	Level 1	10R4/6 (3) red	
	10YR8/8 (1) yellow	2.5YR5/6 (1) red	10R4/4 (1) weak red	10R4/8. (1) red	Level 2A
Level 2					10R4/6 (1) red
2.5YR5/8 (2) red	10R4/3 (1) weak red	2.5YR5/8 (1) red	10R5/6 (1) red	Level 4	
7.5YR5/8 (1) strong red	10R5/8 (1) red	7.5YR7/6 (1) reddish yellow	10R5/8 (3) red	10R5/4 (1) weak red	Level 3
2.5Y7/6 (1) yellow	10YR6/8 (1) brownish yellow			10R5/6 (1) red	10R4/8 (1) red
7.5R3/2 (1) dusky red	10YR7/8 (1) yellow		2.5YR5/8 (3) red	10R5/8 red	10R5/7 (2) red
7.5R3/4 (1) dusky red			Level 1A	10R6/8 (1) light red	10R3/6 (1) dark red
7.5R4/6 (1) red			10R4/6 (2) red	2.5YR4/8 (1) red	10R4/6 (1) red
10R4/3 (1) weak red			Level 2	2.5YR5/8 (2) red	2.5YR5/8 (2) red
10R4/4 (3) weak red			10YR7/6 (1) yellow	5YR5/6 (1) yellowish red	10YR7/6 (1) yellow
10R4/6 (2) red			10YR7/8 (1) yellow	5YR6/8 (1) reddish yellow	
10R4/8 (2) red				10YR7/6 (1) yellow	

Table 12. Outside dimensions, weight and grain-size of backed blades.

	Outside Dimensions (cms)				
N = 20	length	width	height	Weight (g)	Grain-Size
X	1.61	0.49	0.2	0.77	3.61
S	0.84	0.13	0.08	1.05	1.0

Table 13. Outside dimensions, weight and grain-size of chisels.

Type & N.	Outside Dimensions (cms) length	width	height	Weight (g)	Grain-Size
Tula					
N = 11					
X	2.22	1.18	0.99	3.93	2.0
S	0.92	0.30	0.38	3.77	0.96
Burren					
N = 13					
X	2.80	1.41	1.12	4.50	2.76
S	1.79	0.80	0.90	1.98	1.2

Table 14. Cathedral Cave: maximum outside dimension measurements for scrapers.

	SIDE	DISC	NOTCH	END	CORE	AMORPH.	VFS
1. Length (cms)							
N =	100	8	27	28	11	66	173
X =	4.64	3.75	3.56	3.94	4.16	3.25	2.63
S =	1.77	1.66	1.29	1.72	1.76	0.99	0.79
2. Width							
X =	3.17	3.66	3.81	2.75	3.53	2.50	1.99
S =	1.19	1.68	1.05	1.25	1.43	1.02	0.68
3. Height							
X =	1.72	1.48	1.34	1.31	2.94	1.15	0.62
S =	0.71	0.57	0.90	0.74	1.59	0.58	0.25

4. Weight: All implements have been weighed. Mean weights (X) and standard deviations (S) for each type are presented in Table 15.

5. Retouch/use: The amount of retouch/use of scraper edges is presented in Table 16. About 85% of the flake tools measured have less than half their total margin either retouched or use worn. The trend is for the implements to have about 1/3 of their margin modified. It is only rarely (about 12% of all flake tools) that more than half of an implement is either visibly use-worn or retouched.

Table 15. Cathedral Cave: implement type weights (grams).

	Side	Large Disc	Scrapers Notch	End	Core	Amorph	Very Fine Scrapers	Chisels	Backed Blades
N =	100	8	27	28	11	66	173	2-4	20
X =	23.74	30.28	19.29	22.28	64.36	10.93	2.97	4.24	0.77
S =	43.61	29.6	38.51	45.47	81.01	15.55	2.63	3.77	1.05

Table 16. Cathedral Cave: scraper retouch/use - number of implements compared to % retouch/use.

Percent of Edge Retouch/Use	10-19	20-29	30-39	40-40	50-59	60-69	70-79	80-89	90-99
N =	91	130	96	64	27	10	5	6	1
% =	21.16	30.23	22.32	14.88	6.27	2.32	1.16	1.39	0.23

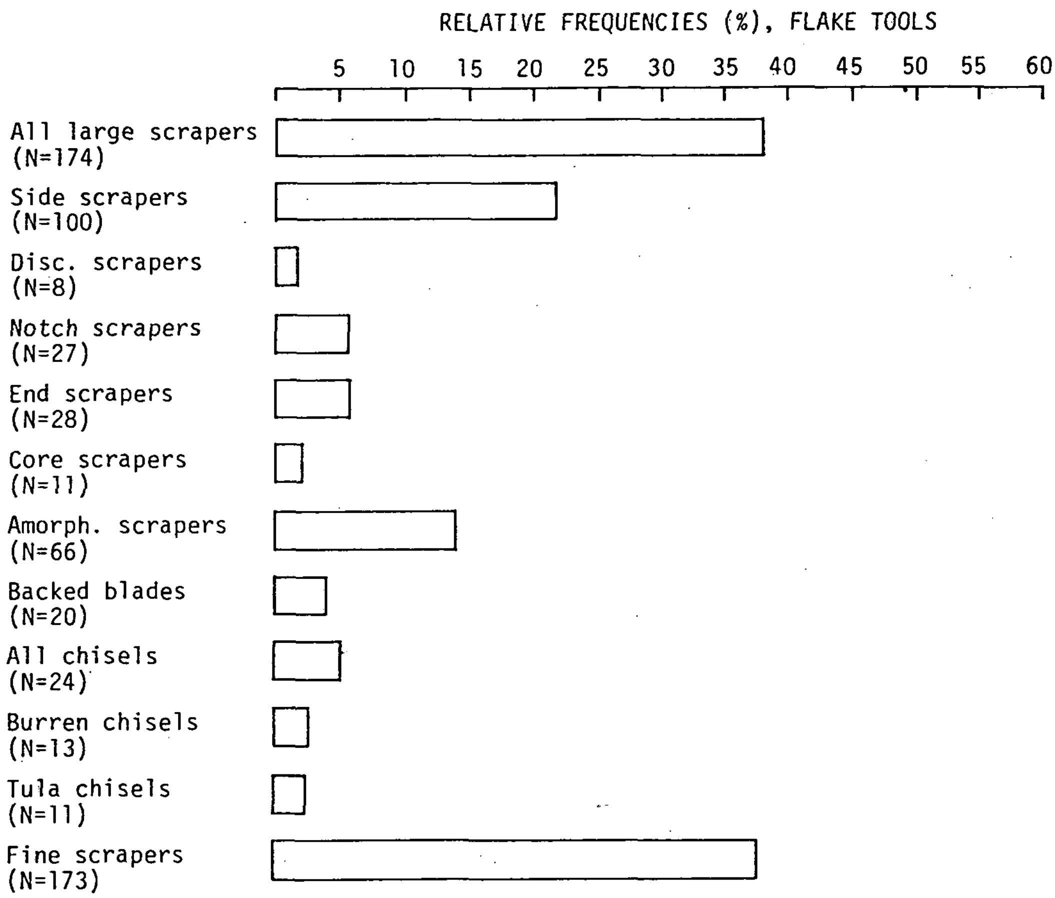


Figure 13. Cathedral Cave flaked stone implements.

6. **Edge/angle:** Edge/angle means and standard deviations are given below for each scraper group (see also Table 17).

Table 17. Cathedral Cave: scraper edge angles

	Side	Disc	Notch	End	Core	Amorph	VFS
N =	100	8	27	28	11	66	173
X (¦) = 49	72	68	70	94	49	40	
S (¦) = 15	13	11	14	15	18	18	

The scraper angles do not vary greatly within the group which comprises the "large" scrapers (i.e., all but the Very Fine Scrapers). The range is from a mean of 49°for the side and amorphous scrapers up to 94° for the few core scrapers. The very fine scraper group stands out at 40° as having the most acute angle edges. The mean of all large scraper angles is 67°. The angle means and standard deviations of all scraper types and the summary group "large scrapers" are shown graphically in Figure 14.

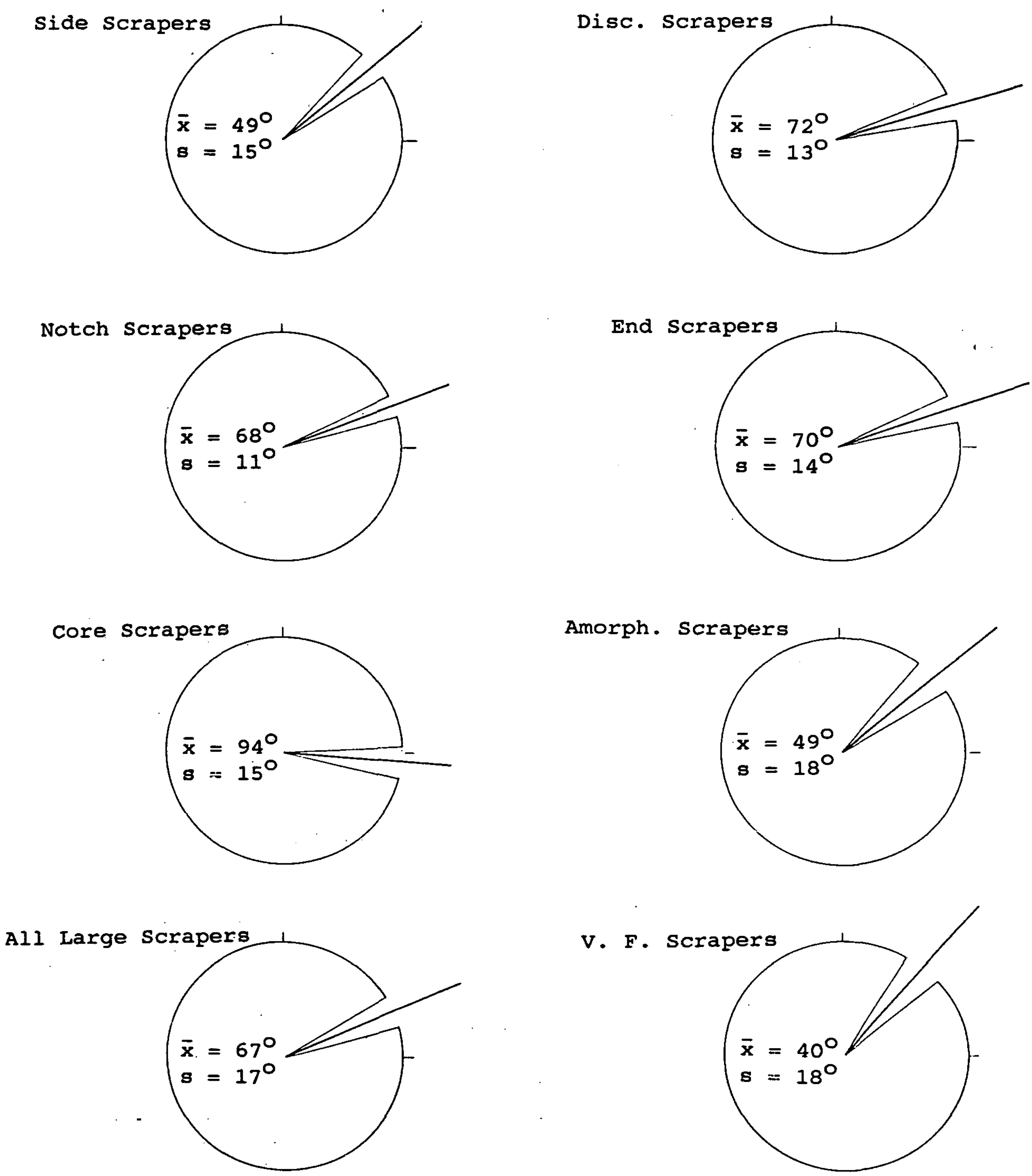


Figure 14. Cathedral Cave: scrapers, mean edge angles and standard deviations.

7. Grain-size: Grain-size has been estimated for all 454 implements. The number of implements per grain-size class (Table 18) shows that for flake tools very little coarse material, if any, was used by the stone knappers at Cathedral Cave. The number of implements are almost evenly divided between grain-size classes 2, 3 and 4. Only one grain-size class 1 implement, a very fine scraper, was identified in the collection.

Table 18. Cathedral Cave: grain-size class implement numbers..

(Finest)		Grain-Size Increasing				(Coarsest)
1	2	3	4	5	6	Total
1	135	112	184	-	-	454

The Relationship of Grain-Size to Weight in Flaked Stone Tools: The relationship between grain-size and weight of flake tools, regardless of type, is presented in Figure 15. Although there were no implements in classes 5 and 6, and only a single implement in class 1, there is still an apparently strong positive relationship between increasing weight of implements and the coarseness of the material from which they were made.

The relationship between the mean weight of tool types and the mean grain-size of types is presented in Figure 16. These data suggest that chisels and very fine scrapers, but not backed blades, were consistently fashioned from fine-grain material.

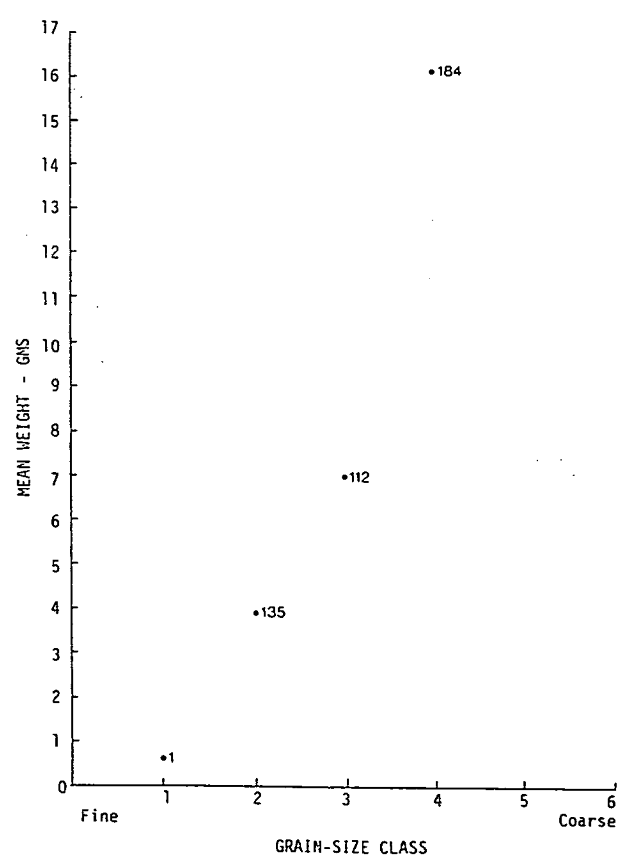


Figure 15. Cathedral Cave: flaked stone tools, mean weights of grain size classes.

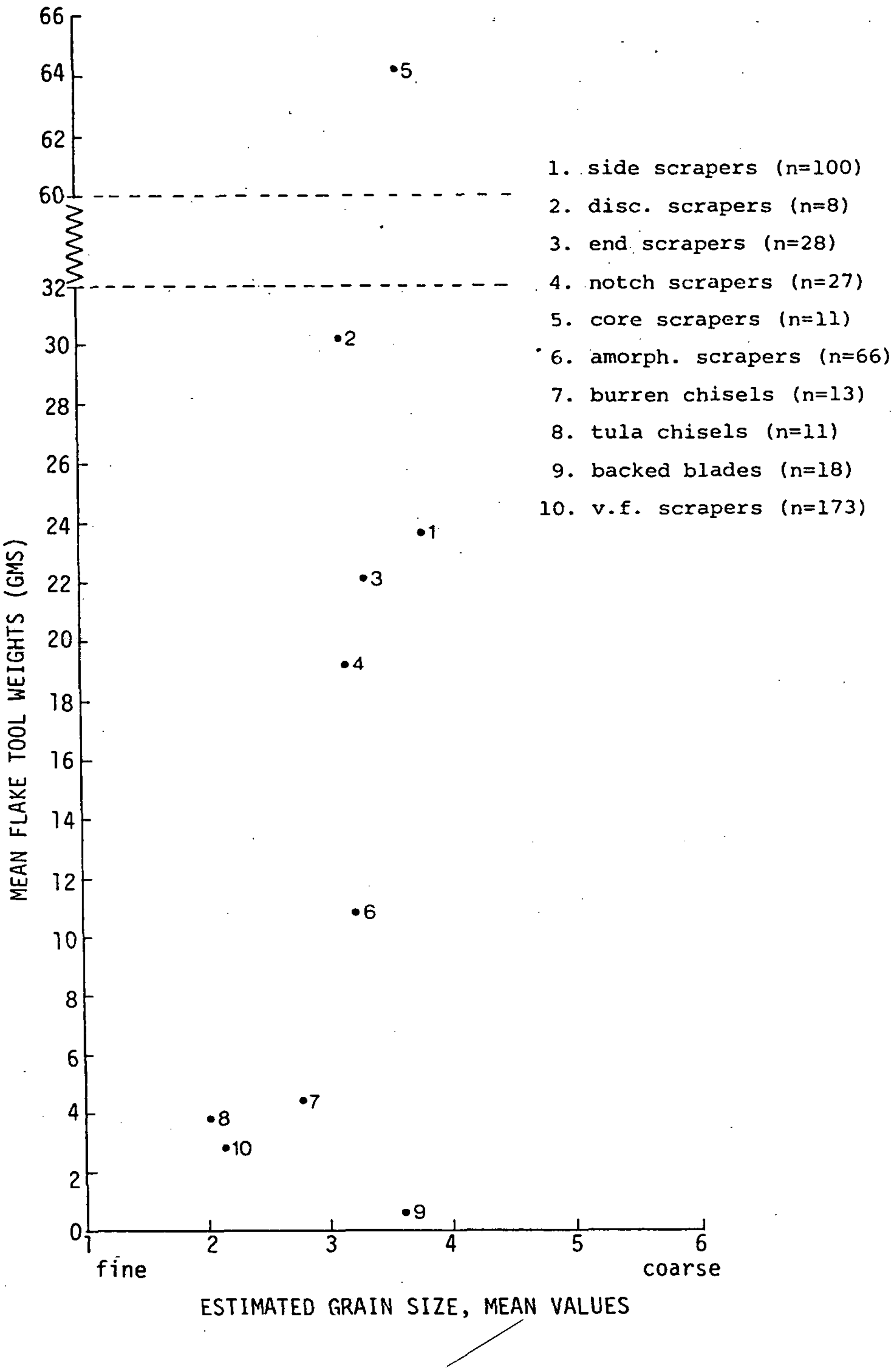
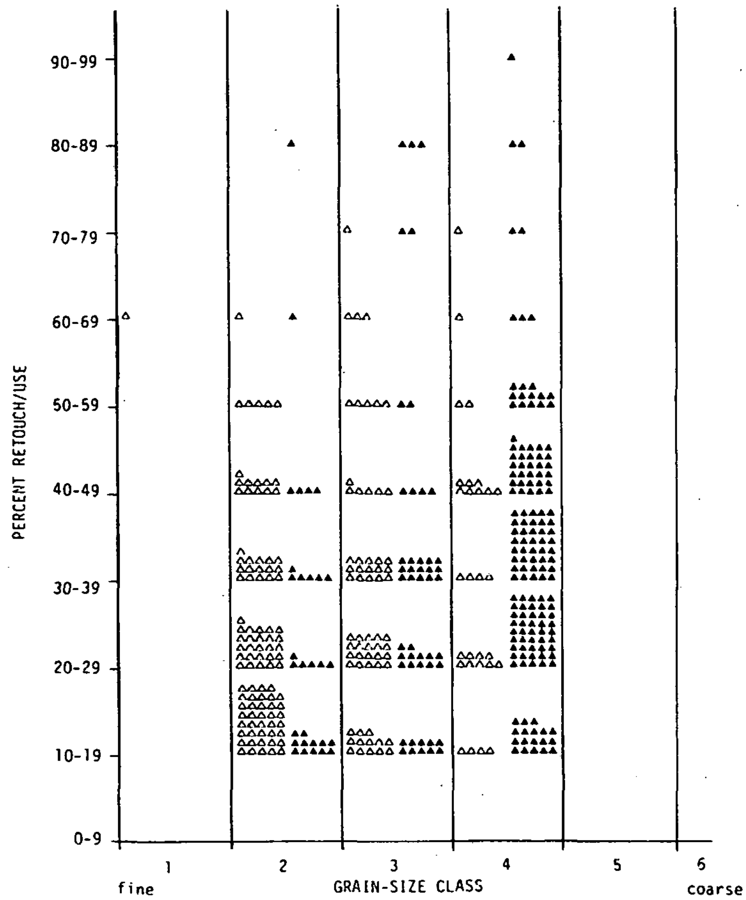


Figure 16. Cathedral Cave: flaked stone tools, mean weights and grain size estimates for types.

The Relationship of Grain-Size and Retouch/Use in Flaked Stone Use

The relationship between the amount of edge damage or retouch and grain-size is presented in Figure 17. All tool types are not considered together but the larger scrapers are plotted separately from the very fine scrapers. The figure suggests that, although finer grained materials are used for the very fine scrapers, there is no increase in the degree to which finer grained tools are retouched.



	1	2	3	4	5
▲ No. Lg. scrapers	-	37	48	155	
%	-	27.41	42.86	84.24	
△ No. V.F. scrapers	1	98	64	29	
%	100	72.59	57.14	15.76	
total	1	135	112	184	432
%	0.23	31.25	25.93	42.59	100%

Figure 17. Cathedral cave: Large and Very Fine Scrapers. Comparison of percent edge retouch/use by grain size class.

Bone Tools

One hundred and twenty three bone tools were collected during the excavation. This number was predominantly made up of implements fashioned from wallaby fibulae and mandibles. About one half of all bone tools are made on wallaby fibulae. One quarter are made on wallaby mandibles and the remainder are made on unidentified bones. The types which I identified are described below. The distribution of types is presented in Table 19. Most of the bone tools were found broken but could be identified as bone tools by use-polish, striations or damage. One feature of the bone tools is that they were better preserved than other faunal material. I believe this is due to the preserving effect of their being impregnated with oil or fat absorbed by the bone during its use-life. This gives the bone tools a rich tawny yellow colour and gloss not seen on bone from food remains. The oil and/or fat may have come from contact with the manufactured articles on which the tools were used. Alternatively, and more directly, the tools may have picked up oil from the hands of the manufacturer or user.

Table 19. Cathedral Cave: distribution of bone tools.

	Fibulae spatulate	Fibulae pointed	Fibulae tip broken	Bi-points	Tubular	Flaked	Mandibles	Ground or polished fragment	Total
<u>UNIT 1</u>									
LEVEL 1	2	1	1	1	-	1	1	-	7
LEVEL 3	3	2	3	2	-	-	1	-	12
<u>UNIT 2</u>									
LEVEL 1	1*	-	2	-	-	-	1	-	4
LEVEL 3	3^{1*}	-	-	-	-	-	-	1	4
<u>UNIT 3</u>									
LEVEL 1	2	1	3	-	-	-	1	-	7
LEVEL 3	-	-	-	-	1	-	-	-	1
<u>UNIT 4</u>									
LEVEL 1	2	-	2	-	-	-	-	3	7
LEVEL 3	-	-	1	1	-	-	1	2	5
<u>UNIT 5</u>									
LEVEL 1	3	1*	3	-	-	-	2	-	9
LEVEL 3	-	-	1	-	-	-	-	1	2
<u>UNIT 6</u>									
LEVEL A	2	-	4	-	-	-	2	-	8
LEVEL 1	-	-	-	2	-	-	1	-	3
LEVEL 1A	1*	-	3	-	1	-	1	-	6
LEVEL 2	2	-	1	-	-	-	1	-	4
LEVEL 3	2	1*	1	1	-	1	1	-	7
LEVEL 4	2	1	1	-	-	-	-	-	3
<u>UNIT 7</u>									
LEVEL A	1*	-	3	-	-	-	1	-	5
LEVEL 1	2	2	1	-	-	1	2	2	10
LEVEL 1A	-	-	1	-	-	-	1	-	2
LEVEL 3	-	2	-	1	-	-	-	-	3
<u>ROOF SQUEEZE</u>	-	-	-	-	-	-	15	-	15
TOTAL	28	12	30	8	2	2	32	9	123
%	22.5	9.5	24.1	6.4	1.6	2.4	25.8	7.2	

* see text

Bone tool types

1. Spatulate bone tools were found in all major occupation horizons but were absent in some levels of some units. These types take two forms. Firstly, there were broad spatulate tools made from split long-bone of large marsupials. These have a well polished tip with striations both parallel and perpendicular to the long axis of the tool. Striations are not found further than a centimetre or so from the highly polished tip. Only one reasonably complete broad spatulate tool was excavated, although three broken tips or parts of what appear to be separate tips were found. In Table 19 the broad spatulate tools are denoted by an asterisk. One is illustrated in Plate 3 (bottom). A second variety of spatulate bone tool was made from wallaby fibulae. These are a much narrower implement type than those made from split long-bone shaft. Many of these fibulae tools were broken, more often than not near the tip. A complete specimen is pictured in Plate 3 (second from top).

2. Single pointed bone tools are of two forms. One is a large relatively blunt variety and the other is a very delicate and sharp implement. The large pointed implements were found in Unit 1 Level 3, Unit 5 Level 1 and Unit 6 Level 3, which together span the occupation periods. Three of these blunt pointed tools, two of which were broken, are pictured in Plate 4. Like the spatulate tools, these too are preserved by oil or fat impregnation.

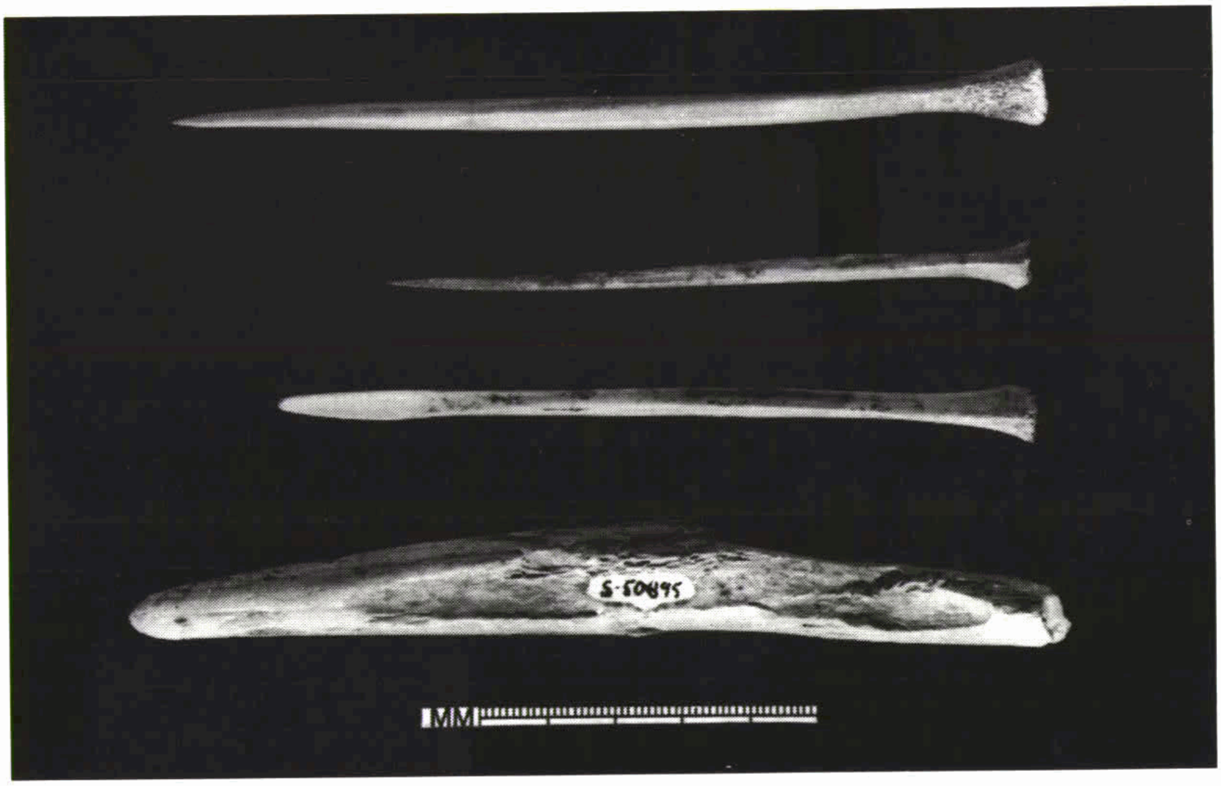


Plate 3. Cathedral Cave: spatulate and single-pointed bone tools.

Plate 4. Cathedral Cave: single-pointed bone tools, blunt variety.

The second variety of pointed implements found were sharp, sometimes needle sharp tools fashioned from wallaby fibulae (Plate 5 top). These implements (eight in all) were found in occupation horizons spanning the entire history of the site. This type of tool, sometimes called bone points (Bowdler 1974, Figure 4), have a Pleistocene antiquity in Australia (Bowdler 1974:8) and a wide distribution over the continent (Dortch 1973).

3. Bi-pointed bone tools, another familiar Australian type, were also found at Cathedral Cave. Their distribution in the deposit included the lower occupation horizons of Units 6 and 7 and the upper horizon of Unit 1. The small (2-5cm) bi-points do not have the oiled appearance of the bone spatulate and pointed fibulae described above. There are striations present and they are for the most part longitudinal, and may only be evidence of manufacture of the implement itself and not an indication of its use-history. Two of the bi-points have indications of hafting gum present (Plate 5). Although the evidence for hafting is clear, it is not clear whether the bone points were hafted as tips of compound implements or as barbs. Their small size, especially once hafted, suggests that they would be better spear barbs than points.

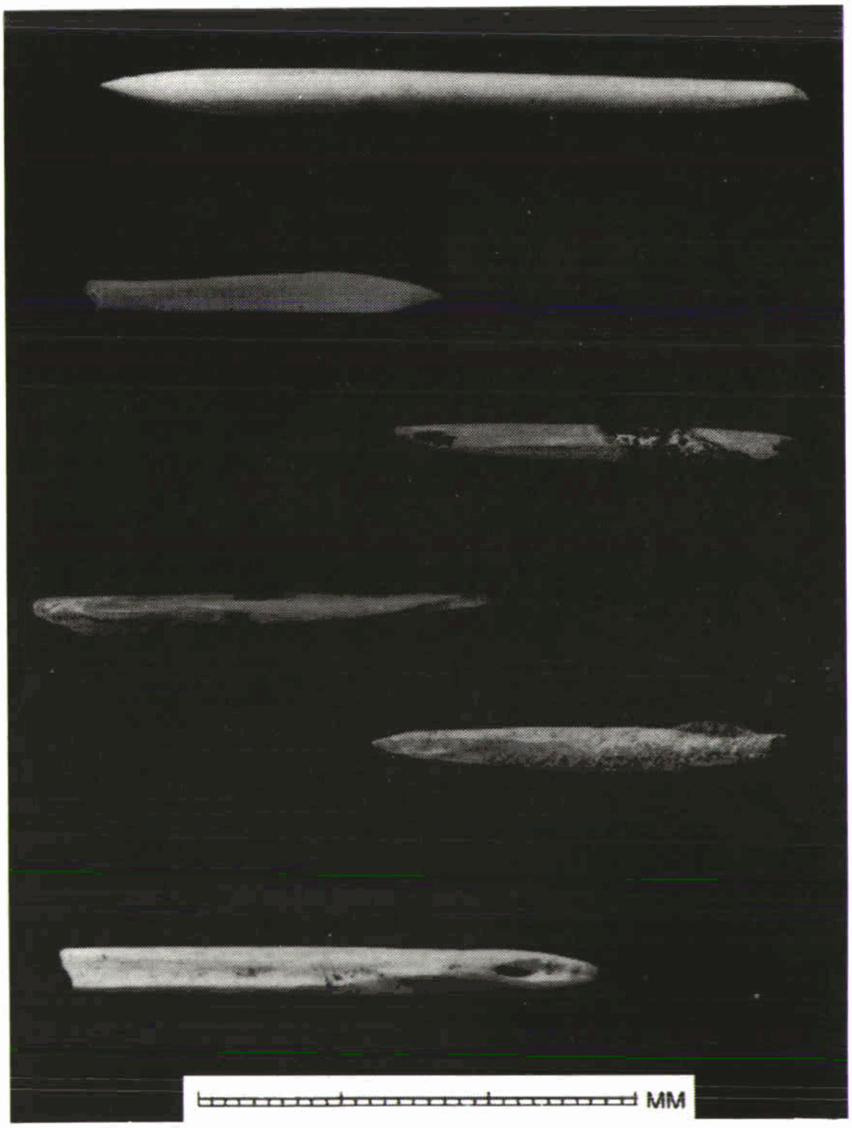


Plate 5. Cathedral Cave: bone tool tips, including bi-points with hafting gum.

4. Tubular bone tools were found in Unit 3 Level 3, and Unit 6 Level 1A. One is made of mammal bone, probably a section of macropod long-bone. It is incompletely ground smooth on one end only. It is 10.5cm long and shows signs of an oiled and polished surface only in the immediate vicinity of its ground end. There are striations present, also at the ground end, and they occur at 45^{o} to the long axis of the shaft. The second tubular implement is 4cm long and also appears to be a section of macropod long-bone. It has use-polish on both ends and no striations, but there are tiny spot-abrasions on the outside diameter near both ends.

5. Flaked bone tools are an uncommon find in Australian sites. I am not aware of a published account of any. Two flaked bone tools were recorded during excavation, one in Unit 1 Level 1 and the other in Unit 6 Level 3. The former is pictured in Plate 6. It is made on a split long-bone of a large animal and one margin is undoubtedly bi-facially flaked. The flaking was done on an edge which looks likė part of an edge of one of the split long-bone spatulate tools. This surviving pre-flaking edge is oiled in appearance and ground smooth. The bone tool appears to have been broken after flaking, as the margin parallel to the flaked edge is a clean sharp fracture with no apparent subsequent handling or use. The "flaking" may have resulted from battering rather than retouching of the edge.

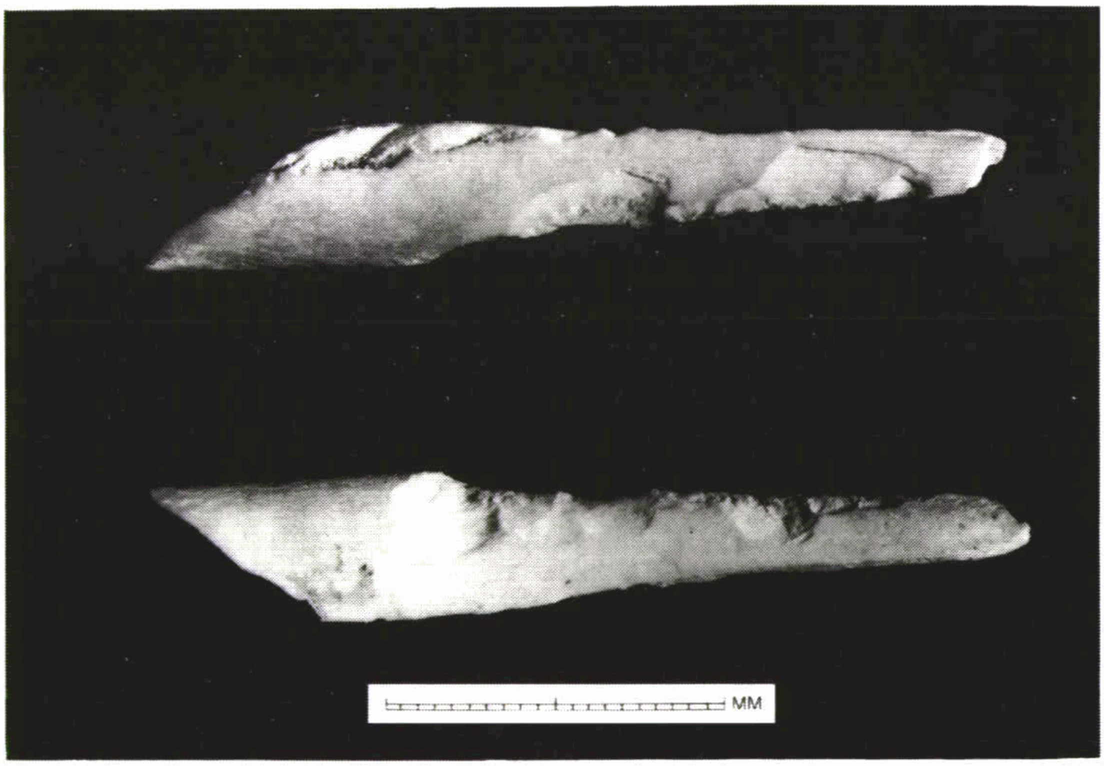


Plate 6. Cathedral Cave: flaked bone.

6. Mandible tools were numerous at Cathedral Cave. Fifteen of the identified 32 specimens came from an area termed the "roof squeeze" (Figure 2). This area is a gap between the sediment and the cave wall in the area of Unit 3. The 5-20cm slot has acted as a trap for debris and no stratigraphic association can be given to the material found there. Other mandible tools were recovered elsewhere in the site, though not from the deepest occupation. The oldest specimen is from Unit 6 Level 3, nearly the lowermost occupation horizon in that Unit.

These tools are made on either left or right mandibles of wallabies. Identification of mandibles as tools is based on damage observed on incisors. Typically, damage was observed as fracturing of the incisor which resulted in the loss of the distal 0.5-1cm of the tooth (Plate 7). Also noted were damage marks which resulted in small chips having been removed from near the tip of the incisor. In Plate 8, a close-up comparison is made between an undamaged non-archaeological wallaby mandible and examples of the excavated specimens.

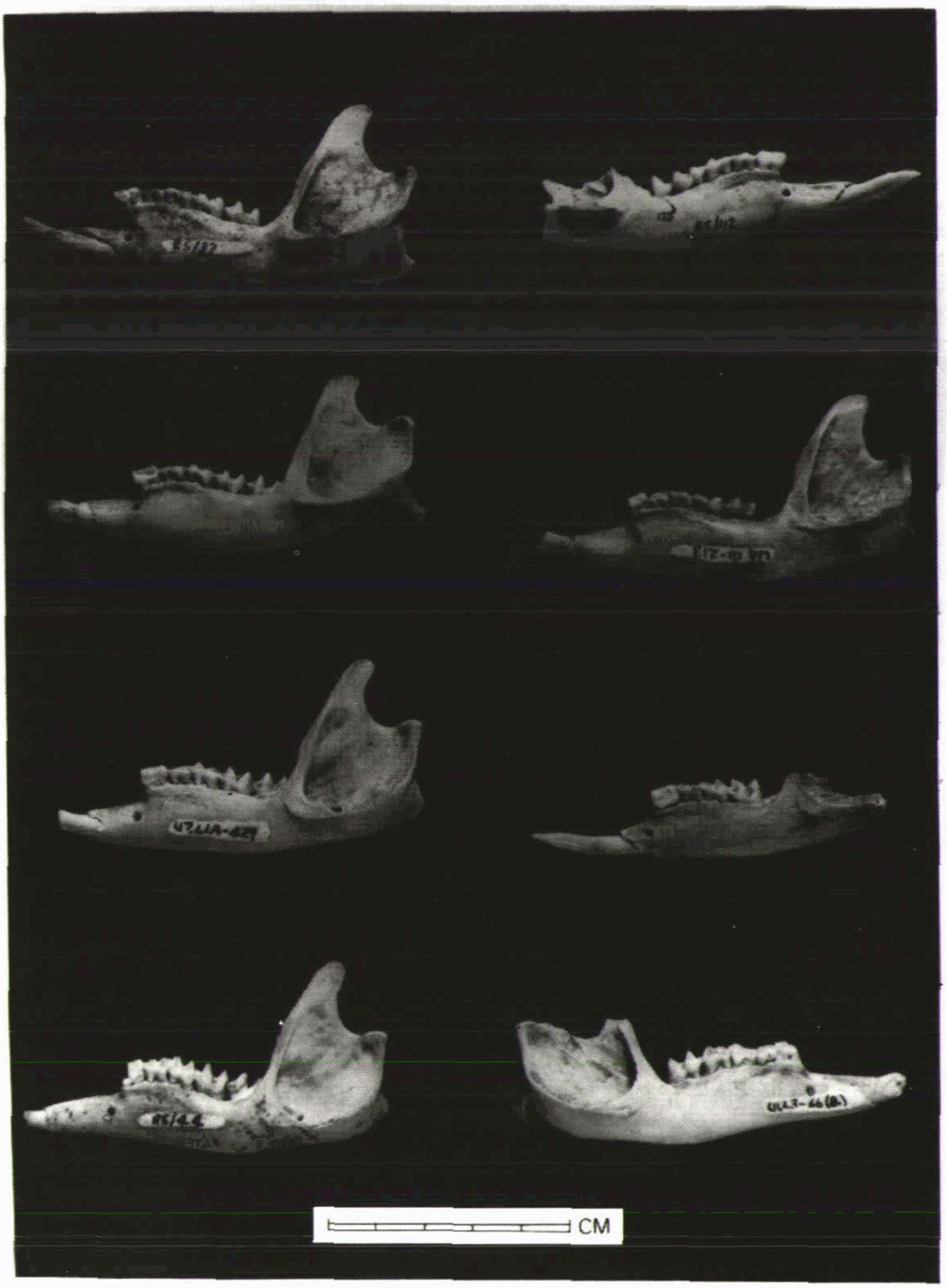


Plate 7. Cathedral Cave: wallaby mandible tools (note damaged incisors).

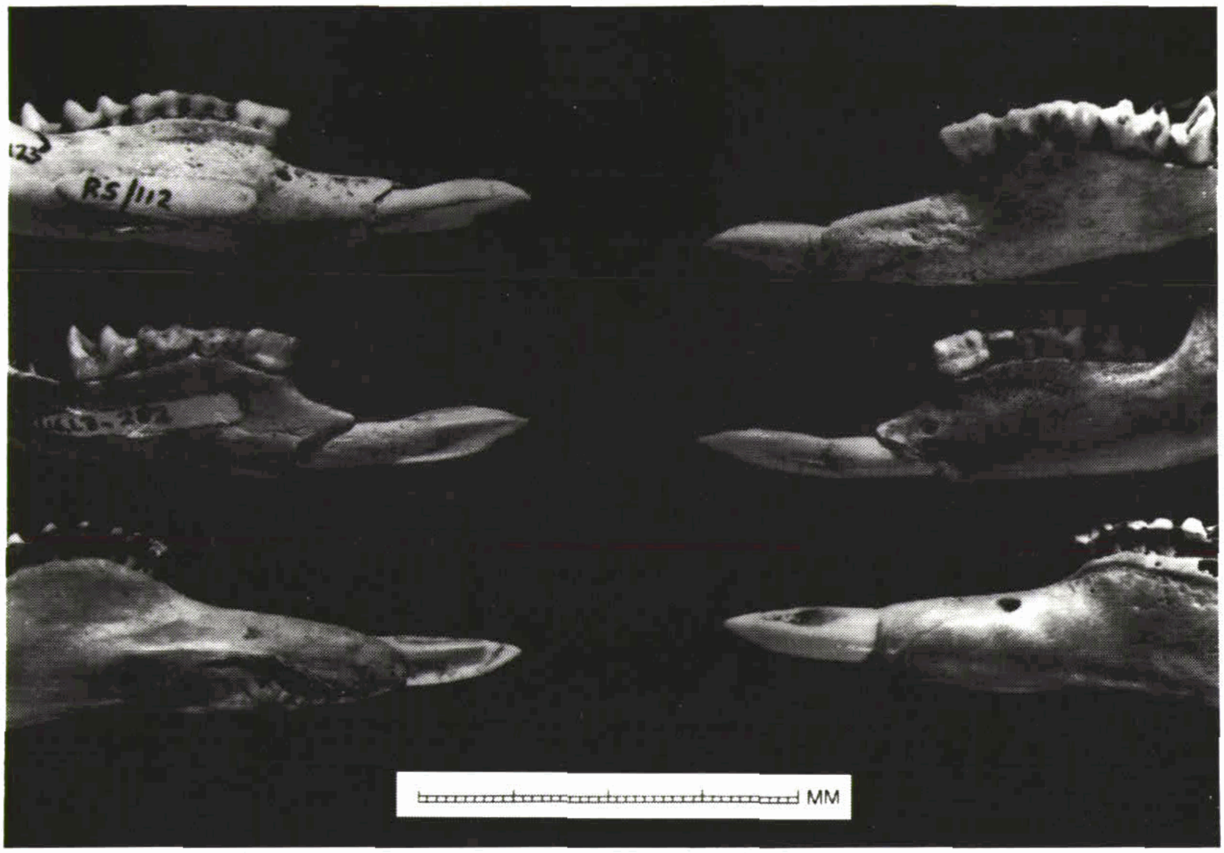


Plate 7. Cathedral Cave: left and right views of three Wallaby mandibles. The top two show incisor damage compared to an undamaged non-archaeological specimen below.

7. Ground bone fragments numbering nine were excavated. It is impossible to determine the type of working tip these fragments were once part of, but because most were used on split long-bone shafts it is likely that they were once broad spatulate tools.

Use of bone tools

Together, the spatulate and pointed bone tools share three characteristics, highly polished and striated tips, plus a tawny yellow colour, presumably derived from their impregnation with natural hand oil or fat. These observations are consistent with one of the kinds of applications to which bone tools such as these are said to have been put in Australia, i.e., skin dressing (Mulvaney 1975:99). If this group of bone tools performed this function, then they could be expected to absorb oil from the user's hands as well as animal fat from hides.

Unfortunately, as is the usual case, the "soft goods" of Aboriginal material culture have not survived in the excavated archaeological deposits of the uplands. However, some of the rich material culture of the uplands has been preserved in dry caves in the area. Some of this material has been collected by interested persons over the last 100 years. Some of the "soft goods", which may have required the use of bone tools, are pictured in Plates 9 and 10. Plate 9 shows the fine lacing found on an animal skin. This kind of work requires that punctures be aligned in preparation for lacing. The pointed fibulae tools would be appropriate. Trimming of the hides would require a very sharp implement, and if any tool excavated in the uplands would be appropriate it would be a Very Fine Scraper.

Plate 9. Fragment of possum skin article; note lacing.

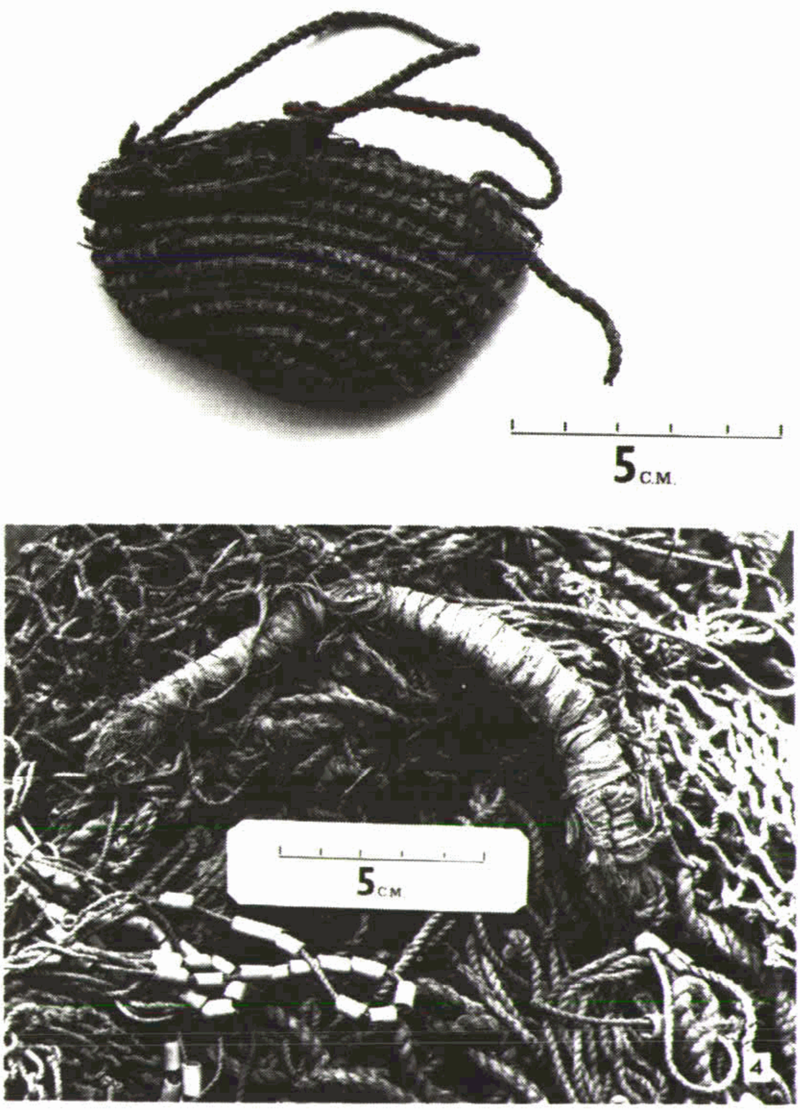


Plate 10. Basketry and netting from the Carnarvon Range.

I have been informed (Kim Ackerman, pers. comm.) that Aborigines in the Kimberley district of Western Australia still use many bone tools similar to those found at Cathedral Cave. In the Kimberleys, according to Ackerman, men use wallaby mandibles as chisels and gravers when fashioning wooden implements such as shields and throwing sticks. The tip is purposefully broken off square to broaden its working surface. This use would fit the breakage pattern of the excavated specimens but there is no independent corroborating evidence such as observed use-wear striations. The records of W. E. Roth add a further interesting note. He described the use of these implements (gravers) and wrote that in north Queensland they were a "staple article of barter" (1904:21).

Flora and Flora

The faunal assemblage, particularly the number of macropod species from Cathedral Cave, reflects the complexity of the local environment. Very few of the faunal remains are suspected to have been "naturally" incorporated in the deposit. Cathedral Cave is not a haven for owls or other predatory birds which might add faunal elements to the deposit. Hence, all the faunal elements listed in the Tables are considered at this time to be prey species of the occupants of Cathedral Cave, unless otherwise stated.

Mammals

The excavation produced potoroo, pademelon, two kinds of rat kangaroo, swamp, whiptail, agile, red-shouldered, and rock wallaby plus the grey kangaroo and wallaroo; no fewer than 10 different macropods. To these, add greater glider, ringtail and brushtailed possums, brindled, short-nosed, and long-nosed bandicoots, and water rat and a fairly broad based exploitation of mammals is apparent. A species of bat, native cat and marsupial mouse may also be added, though their numbers are small. Table 20 gives the distribution in the deposit of fauna, which was identified solely by dentary and cranial elements. Assuming these species were exploited as food resources, they represent a very broad exploitation of the microenvironments in and around the gorge. Indeed more macropod species are incorporated in the deposit than are extant in the area today. An unquestionable specimen of the agile wallaby, Macropus agilis was recovered from Unit 6 Level 3 (approx. 3000 BP). This medium-sized wallaby is currently restricted to more northerly latitudes, and its presence in Cathedral Cave probably extends its mid-Holocene distribution southward. Microenvironments of the uplands also make it possible that isolated populations of M. agilis survived there after their Holocene extinction in the rest of central Queensland. It is interesting to note that the red-shouldered wallaby, M. rufogriseus, a forest/grassland adapted wallaby (like M. agilis), which is now very common in the uplands, is entirely missing in the faunal assemblage. This may reflect the replacement in the area, fairly recently, of M. agilis by M. rufogriseus. Some other species occurring in the deposit now seem locally extinct. These include Bettongia, Isoodon sp. cf. I.obesulus and Thylogale sp.

One example of the native cat (Dasyurus hallucatus) was collected in an area of the site termed the "roof squeeze" (Figure 2). The identification was made on dentary and skull fragments and this specimen is thought to have died naturally in the "roof squeeze". Three species of bandicoot from two genera were excavated from the earliest to latest occupation horizons, suggesting consistent use of those animals as food.

Table 20. Cathedral Cave: distribution of cranial and dentary faunal remains.

	UNIT 1					UNIT 2			UNIT 3				UNIT 4			UNIT 5		UNIT 6						UNIT 7					UNIT 8		UNIT 9		
	1	2	3	4	5	1	2	3	1	2	3	4	1	2	3	1	3	A	1A	1	2	3	4	A	1	1A	3	4	1	3	1	RS	
Fish (cf. Tandanus sp.)						1																		1			1						catfish
Amphibolurus barbatus			1		1						1				1					1			1	1	1								bearded dragon
Chlamydosaurus sp.								1			1	1						1								1							frilled lizard
Gekkonid	1																																gekko
Tiliqua scincoides											1												1				1						eastern blue tongue lizard
?Egernia cunninghami																				1		1	1		1		1						Cunningham's skink
Morelia spilotes								1										1															carpet snake or diamond python
Dasyurus hallucatus																							1	1								1	little northern native cat
Antechinus flavipes								1																									yellow footed marsupial mouse
Perameles nasuta						1					1																1						long nosed bandicoot
Isoodon sp. cf. I. obesulus			1																					1	1		1						brown or short nosed bandicoot
Isoodon sp. cf. I. macrourus	1			1		1												1	1			1	1	1	1	1	1		1		1	1	brindled bandicoot
Trichosurus vulpecula	1		1	1		1					1	1			1	1	1	1	1	1		2	1	?	1	1	1	1				1	brushtailed possum
Pseudocheirus peregrinus	1			1		1		1												1			1	?								1	common ringtail
Schnoinobates volans																			1					1								1	great glider
Potoroid																								1									potoroo
Aepyprymus rufescens																											1						rat kangaroo
Bettongia sp.			1	1		1												1		1		1			1							1	rat kangaroo
Potorous sp. cf. P. tridactylus																			1			1	1				1						potoroo
?Thylogale sp.	1	1																1														1	pademelon
Wallabia bicolor						1																1	1										swamp wallaby
Petrogale sp.	3	1	1	2		2	1	1			1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1		1	1	rock wallaby
Macropus sp.																						1					1						wallaby/kangaroo
Macropus sp. cf. M.parryi																						1				1	1					1	whiptail wallaby
Macropus agilis																						1											agile wallaby
Macropus giganteus	1										1									1			1										grey kangaroo
M. robustus				1		1																			1								wallaroo
Small rodents	1	1											1												1		1					1	
Hydromys chrysogaster	1																							1			1					1	water rat
Tadarida sp. cf. T. planiceps	1																																little flat bat

One bandicoot (Perameles nasuta) suggests wet conditions, and another bandicoot (Isoodon sp. cf. I. obselus) a dry habitat (M. Archer, pers. comm.). Together they imply an exploitation of both the gorge bottom and plateau top by the occupants of Cathedral Cave.

The brushtailed possum (Trichosurus vulpecula), now very common in the gorge, has a wide distribution throughout the occupation deposit being found in all major occupation horizons. It appears to be considerably more common in the deposit than either the ringtail possum (Pseudocheirus peregrines) or the greater glider (Schoinobates volans). These three tree dwelling species are nocturnal and would most likely have been chopped from their hollow tree sleeping quarters in daytime by hunters using stone axes.

The real proliferation in fauna is seen in the numbers of species in kangaroo/wallaby types found in the deposit. The most interesting implication of the large number and kind of species recovered is that it is very unlikely that all the species could have been collected within a short distance, say 4-5km radius. Those that would, on present distributions, be most easily captured are the rock wallaby (Petrogale sp.) and the wallaroo (Macropus robustus). Carnarvon Gorge, as a habitat for rock wallabies, could hardly be improved upon. Their abundance in the deposit (Table 20) may reflect this. One feature noted during excavation was that the rock wallabies used "pads" or trails with considerable regularity. I inadvertently erected a small tent in a part of Cathedral Cave which was directly on a rock wallaby pad and the animal jumped on the top of, and then over, the tent the first and second nights the tent was so placed. The animal showed no intention of varying its course to water and preferred to land awkwardly and noisily on a slick rubberized tent rain-fly than hop around the tent. After the second night the tent was moved. Based on the presence of such well established rock wallaby pads and the animal's unwillingness to be intimidated by man's works, I propose that if any animals were trapped by means of snares, it was the rock wallaby. Other wallabies found in the deposit (e.g., whiptail and swamp wallabies) presently live in more open country, as does the grey kangaroo. The wallaroo may be found only a few hundred metres from Cathedral Cave, but that distance would be a vertical one. I have no information on the present distribution of rat kangaroos, potoroos or pademelons, but their habitat requirements would not exclude them from the gorge proper.

Among the remaining mammals found in the deposit only the water rat (Hydromys chrysogaster) would seem to be a reasonable-sized food species. Because of their incorporation in the occupation deposit, the yellow footed marsupial mouse (Antechinus flavipes) and the bat (Tadarida sp.), however small, cannot be discounted as food species. Mammals missing among the fauna, though currently present in the immediate vicinity and which might have been food species, were the dingo and koala. These were the only species recovered in the 1962 excavation and not found in the 1975 excavation. My excavation has added Perameles nasuta, Macropus agilis, Isoodon obesulus, Schoinobates volans, Thylogale sp., Wallabia bicolor, Macropus giganteus, Hydromys chrysogasta, and Tadarida sp. to the known fauna from Cathedral Cave.

Reptiles

Among the reptiles there were four lizards, a gecko, a skink and one snake. Of the lizards, the bearded dragon, frilled lizard and eastern blue-tongue occur in frequencies high enough to suggest their use as food by cave occupants. The gecko is represented by a single individual found on the surface of Unit 1 Level 3. Remains of the large carpet snake, or diamond python (Morelia sp.), were found in Unit 2 Level 3 and Unit 6 Level 1. The skink (Egernia cunninghamii), along with the bearded dragon (Amphibolurus barbatus) and frilled lizard (Chlamydosaurus sp.), make up the bulk of the reptilian fauna from the excavation. Conspicuously missing from the reptile collection are the remains of the monitor lizards or goannas (Varanus sp.), which are presently abundant in Carnarvon Gorge and were identified by Bartholomai in Tugby's collection. In all, the reptilian fauna is a minor component in terms of amount of bone and species numbers, when compared with the mammals.

Fish

Only one fish, the catfish (Tandanus sp.), has been identified in the collection. These are pond, billabong or lake-dwelling species and the rocky upper reaches of Carnarvon Creek would seem to be an inappropriate habitat for them. If, however, over the last few thousand years, Carnarvon Creek has been ponded in the vicinity of Cathedral Cave, then these fish may well have lived in close proximity to the site. I have no information regarding the presence or absence of this fish in Carnarvon Creek today.

Invertebrates

A small amount of freshwater mussel shell was found in the occupation levels. Its distribution is given in Table 21.

Table 21. Cathedral cave: Distribution and weight (g.) of freshwater mussel shell.

U1-L2	3.28	U6-LA	3.79
U1-L3	36.25	U6-L1A	8.43
U2-L1	0.87	U6-L1	100.40
U2-L3	3.95	U6-L2	0.40
U3-L3	24.60	U7-L1A	19.63
U4-L1	1.19	U7-L1	84.10
U4-L2	0.30	U7-L3	0.21
U5-L1	0.31	U8-L3	124.00
U4-L3	57.34	U9-L1	0.97

Post-Cranial Remains

The post-cranial remains have been sorted into rough groupings based on my ability to sort fragments of mammal bone from bird, reptile, etc. In sorting the bone, arbitrary decisions had to be made when assigning bone to "large" vs. "small" mammal categories. This was fairly easily done in the case of mammal long-bones, pelves and some other major bones. But, for small vertebrae highly fragmented ribs, etc., decisions were not so easy. This is reflected by the amounts of "unidentified" bone in the collection. Once the bone had been sorted to the small mammal, large mammal, birds, fish, etc., each group was subdivided into burned and unburned classes. These groups were then counted, weighed and relative percentages calculated. The results, for each occupation horizon, are presented in Table 22.

Table 22. Cathedral Cave: distribution of postcranial faunal remains.

	Small Mammal				Large Mammal				Birds			
	No.	Wt(g)	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
PROVEN.	BURNED		UNBURNED		BURNED		UNBURNED		BURNED		UNBURNED	
U1-L1	265	43.78	195	22.74	156	241.44	108	140.45	51	45.87	55	54.41
%	(17.0)	(2.81)	(12.51)	(1.45)	(10.01)	(15.49)	(6.93)	(9.03)	(3.27)	(2.94)	(3.53)	(3.49)
U1-L2	2	0.01	6	0.49	10	3.60	11	12.00	2	01.80	3	05.80
%	(2.57)	T	(7.71)	(.63)	(12.86)	(4.63)	(14.14)	(15.43)	(2.57)	(2.31)	(3.85)	(7.45)
U1-L3	1	0.01	28	2.53	30	15.35	230	247.50	6	3.40	63	91.73
%	(.10)	T	(3.03)	(.25)	(3.25)	(1.66)	(24.94)	(26.84)	(.65)	(.36)	(6.83)	(9.95)
U1-L4	*	*	3	0.28	7	2.70	86	81.39	*	*	11	4.88
%	*	*	(1.20)	(.11)	(2.81)	(1.08)	(34.59)	(32.74)	*	*	(4.42)	(1.96)
U1-L5	*	*	*	*	*	*	*	*	*	*	*	*
%	*	*	*	*	*	*	*	*	*	*	*	*
U2-L1	4	0.09	5	0.31	168	142.04	42	36.16	9	4.51	13	19.43
%	(.69)	T	(.86)	T	(29.16)	(24.65)	(7.29)	(6.27)	(1.54)	(.78)	(2.25)	(3.37)
U2-L2	1	0.10	*	*	5	0.90	7	1.47	*	*	1	0.01
%	(4.89)	(.48)	*	*	(24.46)	(4.40)	(34.24)	(7.19)	*	*	(4.89)	(.04)
U2-L3	3	0.35	8	1.84	34	16.90	96	91.70	1	1.10	24	16.40
%	(.74)	(.08)	(1.98)	(.45)	(8.43)	(4.19)	(23.81)	(22.74)	(.24)	(.27)	(5.95)	(4.06)
U2-L6	*	*	*	*	6	2.54	34	23.18	3	3.60	1	0.37
%	*	*	*	*	(6.68)	(2.82)	(37.86)	(25.81)	(3.34)	(4.00)	(1.11)	(.41)
U2-L8	*	*	*	*	*	*	10	17.99	*	*	*	*
%	*	*	*	*	*	*	(31.32)	(56.35)	*	*	*	*
U3-L3	*	*	2	0.18	13	9.50	86	162.99	*	*	9	13.71
%	*	*	(.57)	(.05)	(3.73)	(2.72)	(24.69)	(46.81)	*	*	(2.58)	(3.93)
U3-L4	*	*	*	*	3	1.22	29	28.70	2	0.43	*	*
%	*	*	*	*	(4.30)	(1.74)	(41.57)	(41.14)	(2.86)	(.61)	*	*
U3-L6	*	*	*	*	*	*	*	*	*	*	*	*
	*	*	*	*	*	*	*	*	*	*	*	*
U3-L7	*	*	*	*	*	*	*	*	*	*	*	*
%	*	*	*	*	*	*	*	*	*	*	*	*
U4-L1	*	*	2	0.20	32	19.25	30	30.12	*	*	6	5.79
%	*	*	(1.03)	(.10)	(16.53)	(9.94)	(15.50)	(15.56)	*	*	(3.10)	(2.58)
U4-L2	*	*	*	*	3	2.47	3	0.55	*	*	*	*
%	*	*	*	*	(29.52)	(24.31)	(29.52)	(5.41)	*	*	*	*
U4-L3	*	*	*	*	27	9.30	117	95.20	*	*	9	4.70
%	*	*	*	*	(7.65)	(2.63)	(33.18)	(27.00)	*	*	(2.55)	(1.33)
U5-L1	*	*	*	*	19	18.84	15	4.70	1	0.47	2	1.97
%	*	*	*	*	(21.12)	(20.94)	(16.67)	(5.22)	(1.11)	(.52)	(2.22)	(2.19)
U5-L2	*	*	*	*	1	0.47	1	1.10	*	*	*	*
%	*	*	*	*	(28.01)	(13.16)	(28.01)	(30.81)	*	*	*	*
U5-L3	1	0.07	4	0.38	15	4.62	84	94.10	*	*	4	1.64
%	(.35)	(.02)	(1.43)	(.13)	(5.37)	(1.65)	(30.11)	(33.73)	*	*	(1.43)	(.58)
U6-LA	*	*	*	*	43	47.59	70	89.55	*	*	8	7.90
%	*	*	*	*	(13.08)	(14.48)	(21.30)	(27.25)	*	*	(2.43)	(2.40)
U6-L1	*	*	*	*	61	37.0	219	294.75	7	5.86	41	34.72
%	*	*	*	*	(6.68)	(4.05)	(23.98)	(32.27)	(.76)	(.64)	(4.49)	(3.80)
U6-L1A	*	*	*	*	29	14.60	115	98.38	*	*	8	5.12
%	*	*	*	*	(8.66)	(4.36)	(34.34)	(29.38)	*	*	(2.38)	(1.52)
U6-L2	*	*	*	*	*	*	22	27.27	*	*	5	8.0
%	*	*	*	*	*	*	(32.90)	(40.79)	*	*	(7.47)	(11.96)
U6-L3	*	*	1	0.10	56	39.45	343	315.05	1	0.48	10	7.79
%	*	*	(0.1)	(.01)	(5.79)	(4.08)	(35.47)	(32.58)	(.1)	(.04)	(1.0)	(.80)
U6-L4	*	*	*	*	84	53.94	264	238.33	*	*	10	3.95
%	*	*	*	*	(9.21)	(5.91)	(28.95)	(26.13)	*	*	(1.09)	(.45)
U7-LA	*	*	*	*	248	112.10	172	152.10	14	11.40	15	8.55
%	*	*	*	*	(29.28)	(13.23)	(20.31)	(17.96)	(1.65)	(1.34)	(1.77)	(1.0)
U7-L1	*	*	*	*	98	39.82	278	288.53	4	1.81	32	27.16
%	*	*	*	*	(10.05)	(4.08)	(28.51)	(29.95)	(.41)	(.18)	(3.28)	(2.78)
U7-L1A	*	*	*	*	24	11.45	184	143.17	1	0.90	20	19.99
%	*	*	*	*	(4.70)	(2.24)	(36.03)	(28.03)	(.19)	(.17)	(3.91)	(3.91)
U7-L2	*	*	*	*	4	6.80	26	18.59	*	*	2	4.41
%	*	*	*	*	(5.60)	(9.52)	(36.42)	(26.04)	*	*	(2.80)	(6.17)
U7-L2A	*	*	*	*	7	4.07	47	27.43	*	*	1	1.29
%	*	*	*	*	(7.01)	(4.07)	(47.09)	(27.48)	*	*	(1.0)	(1.29)
U7-L3	*	*	*	*	41	35.59	274	306.17	2	1.60	28	26.07
%	*	*	*	*	(41.13)	(3.58)	(27.60)	(30.84)	(.20)	(1.16)	(2.82)	(2.62)
U7-L4	*	*	*	*	*	*	11	7.82	*	*	*	*
%	*	*	*	*	*	*	(58.44)	(41.55)	*	*	*	*
U8-L1	*	*	*	*	12	5.84	22	18.71	*	*	1	1.06
%	*	*	*	*	(18.38)	(8.94)	(33.71)	(28.66)	*	*	(1.53)	(1.62)
U8-L3	*	*	*	*	20	5.86	91	81.83	*	*	5	7.41
%	*	*	*	*	(7.93)	(2.16)	(33.62)	(30.23)	*	*	(1.84)	(2.73)
U9-L1	*	*	*	*	58	37.21	16	14.52	*	*	11	5.70
%	*	*	*	*	(37.15)	(23.83)	(10.24)	(9.30)	*	*	(7.04)	(3.65)
Total	277	44.41	254	28.6	1314	942.46	3143	3191.5	104	83.23	396	389.96
%		.33		.21		7.15		24.21		.63		2.95
%			1.04				59.03				6.76	

Table 22 Continued.

PROVEN.	Fish No. BURNED	Fish Wt. BURNED	Fish No. UNBURNED	Fish Wt. UNBURNED	Reptile No. BURNED	Reptile Wt. BURNED	Reptile No. UNBURNED	Reptile Wt. UNBURNED	Unidentified Wt. BURNED	Unidentified Wt. UNBURNED	TOTAL
U1-L1	31	3.08	44	8.79	8	1.98	8	1.53	*	72.95	637.02
%	(1.98)	(.19)	(2.82)	(.56)	(.51)	(.12)	(.51)	(.09)	*	(4.68)	
U1-L2	*	*	2	0.60	*	*	*	*	7.80	9.65	41.75
%	*	*	(2.57)	(.77)	*	*	*	*	(10.03)	(12.41)	
U1-L3	*	*	17	4.20	*	*	10	5.34	12.50	154.33	536.87
%	*	*	(1.84)	(.45)	*	*	(1.08)	(.57)	(1.35)	(16.74)	
U1-L4	*	*	2	0.09	*	*	*	*	*	50.24	139.58
%	*	*	(.60)	(.03)	*	*	*	*	*	(20.21)	
U1-L5	*	*	*	*	*	*	1	*	*	*	0.0
%	*	*	*	*	*	*	(100)	*	*	*	
U2-L1	*	*	10	3.90	2	0.03	*	*	62.43	54.15	323.05
%	*	*	(1.73)	(.67)	(.34)	T	*	*	(10.83)	(9.40)	
U2-L2	*	*	*	*	*	*	*	*	1.68	2.25	6.44
%	*	*	*	*	*	*	*	*	(8.21)	(11.15)	
U2-L3	*	*	4	0.99	1	0.39	3	1.23	18.58	79.70	229.18
%	*	*	(.99)	(.24)	(.24)	(.09)	(.74)	(.30)	(4.60)	(19.76)	
U2-L6	*	*	*	*	1	1.25	1	1.13	0.13	11.59	43.79
%	*	*	*	*	(1.11)	(1.39)	(1.11)	(1.25)	(.41)	(12.90)	
U2-L8	*	*	*	*	*	*	*	*	*	3.93	21.92
%	*	*	*	*	*	*	*	*	*	(12.31)	
U3-L3	*	*	4	1.43	*	*	17	5.10	*	24.28	217.19
%	*	*	(1.14)	(.41)	*	*	(4.88)	(1.46)	*	(6.97)	
U3-L4	*	*	*	*	*	*	*	*	0.01	5.40	35.76
%	*	*	*	*	*	*	*	*	(.01)	(7.74)	
U3-L6	*	*	*	*	*	*	*	*	*	26.58	26.58
%	*	*	*	*	*	*	*	*	*	(100.00)	
U3-L7	*	*	*	*	*	*	*	*	*	13.32	13.32
%	*	*	*	*	*	*	*	*	*	(100.00)	
U4-L1	1	0.30	5	0.60	*	*	1	0.09	43.70	16.48	116.56
%	(.51)	(.15)	(2.58)	(.31)	*	*	(.55)	(.04)	(22.57)	(8.51)	
U4-L2	*	*	*	*	*	*	*	*	0.50	0.64	4.16
%	*	*	*	*	*	*	*	*	(4.92)	(6.29)	
U4-L3	*	*	4	9.60	*	*	5	1.20	*	70.54	190.94
%	*	*	(1.13)	(2.72)	*	*	(1.41)	(.34)	*	(20.00	
U5-L1	*	*	*	*	*	*	*	*	23.45	3.52	52.95
%	*	*	*	*	*	*	*	*	(26.07)	(3.91)	
U5-L2	*	*	*	*	*	*	*	*	*	*	1.57
%	*	*	*	*	*	*	*	*	*	*	
U5-L3	*	*	3	1.48	*	*	*	*	0.98	64.63	167.90
%	*	*	(1.07)	(.53)	*	*	*	*	(.35)	(23.17)	
U6-LA	1	0.26	9	2.94	*	*	*	*	16.03	33.30	197.57
%	(.30)	(.07)	(2.73)	(.89)	*	*	*	*	(4.87)	(10.13)	
U6-L1	1	0.09	15	6.11	*	*	*	*	18.78	171.80	569.11
%	(.10)	T	(1.64)	(.66)	*	*	*	*	(2.05)	(18.81)	
U6-L1A	*	*	16	4.90	*	*	*	*	1.10	42.70	166.80
%	*	*	(4.77)	(1.46)	*	*	*	*	(.32)	(12.75)	
U6-L2	*	*	*	*	*	*	*	*	*	4.58	39.85
%	*	*	*	*	*	*	*	*	*	(6.85)	
U6-L3	*	*	9	1.73	*	*	*	*	*	182.20	546.80
%	*	*	(.93)	(.17)	*	*	*	*	*	(18.84)	
U6-L4	*	*	16	3.29	*	*	*	*	5.59	232.67	537.77
%	*	*	(1.75)	(.36)	*	*	*	*	(.61)	(25.51)	
U7-LA	2	0.47	4	0.84	*	*	*	*	48.0	58.30	391.76
%	(.23)	(.05)	(.47)	(.09)	*	*	*	*	(5.66)	(6.88)	
U7-L1	*	*	29	6.61	*	*	3	0.70	*	166.20	530.83
%	*	*	(2.97)	(.67)	*	*	(.30)	(.07)	*	(17.04)	
U7-L1A	*	*	8	1.51	*	*	*	*	*	96.60	273.62
%	*	*	(1.56)	(.29)	*	*	*	*	*	(18.91)	
U7-L2	*	*	1	0.20	*	*	*	*	*	8.37	38.37
%	*	*	(1.40)	(.28)	*	*	*	*	*	(11.72)	
U7-L2A	*	*	5	0.59	*	*	*	*	*	6.42	39.80
%	*	*	(6.01)	(.50)	*	*	*	*	*	(6.43)	
U7-L3	1	0.05	39	7.99	*	*	*	*	2.77	227.50	607.74
%	(.10)	T	(3.92)	(.80)	*	*	*	*	(.27)	(22.91)	
U7-L4	*	*	*	*	*	*	*	*	*	*	7.82
%	*	*	*	*	*	*	*	*	*	*	
U8-L1	*	*	*	*	*	*	*	*	1.31	3.34	30.26
%	*	*	*	*	*	*	*	*	(2.00)	(5.11)	
U8-L3	*	*	4	1.10	*	*	*	*	3.41	51.0	150.61
%	*	*	(1.47)	(.40)	*	*	*	*	(1.26)	(18.84)	
U9-L1	*	*	3	0.45	*	*	*	*	1.23	9.01	68.12
%	*	*	(1.92)	(.28)	*	*	*	*	(.78)	(5.77)	
Total	37	4.25	253	69.94	12	3.63	9	16.32	269.98	1958.21	7002.96
%		.03		.53		.02		.12		14.85	92.74
%			1.06				.28		31.83		92.74

Fragmentation of the bone was generally high. The fragmentation patterns suggest that all large mammal long bones have been broken at both ends, probably for removal of marrow. Smaller bones too, however, are well fragmented and the presence of dogs at the site during occupation is suspected.

The picture given by the post-cranial remains is that the large mammals (presumably kangaroos and wallabies) comprise all the bone in the deposit. Large mammal bone, whole or fractured, is of course heavier than the homologous whole or fractured bone from a small mammal, fish, or bird, so one 100g mammal bone will appear in the Table as a high fraction of a level's total bone numbers, relative to say all bird bone. For this reason, simple bone weight is not a very good measure of the meat weight it represents in the deposit, but it is probably a fair measure of the relative contribution of kinds of animals to the diet. Given the limitations of bone weight as an indication of food resources, and without further analysis it is probably fair to state only that the large mammals (kangaroos, wallabies) and small mammals (bandicoots, possums) provided the bulk of food meat at Cathedral Cave. What is also suggested by the Table is that birds contributed significantly to the flesh resources eaten at Cathedral Cave. This is not suggested in the cranial remains, presumably because the thin crania of birds do not survive in midden deposits as well as do the thicker mammal crania. Although no crania of birds have survived, the size of the long-bones (diameters to 75mm) suggests that medium size birds (e.g., ducks, scrub turkey), but not large birds (plains-turkey, emu), provided the bulk of the fowl flesh. Total fish bone in the deposit (approx. 1%) suggests that this food source, and reptiles (>1%) contributed only relatively small amounts to the flesh-food resources, as did freshwater mussel.

Assuming all the mussel shell, burned and unburned post-cranial remains, and the cranial and dentary fragments are by and large the product of Aboriginal meals in Cathedral Cave, a broad exploitation of local microenvironments is suggested. From the bottom of the gorge, small wallabies, bandicoots, possums, lizards, snakes, fish, water birds and freshwater mussels were probably taken. Wallaroo were most likely caught on the plateau tops and several wallabies were probably taken in forests and grassy flats outside the gorge proper.

Flora

The floral remains from Cathedral Cave are overwhelmingly made up of Macrozamia seed shells, although no wet sieving has been done of the occupation horizons.

The Macrozamia seed shells were recovered from all occupation horizons of the site, and from all excavation units. Their abundance was difficult to estimate due to the fragmentation of the shells themselves. A subjective estimate of their abundance would put their numbers at somewhere between the amounts seen at Rainbow and Wanderer's Cave: i.e., about $500/m^3$ (Beaton, 1991 - this volume). The seed shells were burned and fragmented in the manner observed at the other two rockshelters. Many of the seed shells were highly carbonised and the above estimate of the number of seeds must be a low estimate because of the number that must have been burned and fragmented beyond recognition.

One large Macrozamia grows on the dripline, at the west end of the shelter. This old-timer must have witnessed more seed consumption than it contributed to. There are Macrozamia groves at places 5km to 15km downstream from the cave and other patches of Macrozamia grow on the plateaus. Unless there has been a dramatic change in the distribution of living Macrozamia, the seeds must have been carried, unshelled, in large numbers by people some distance to the site. At the site, the evidence suggests that the seeds were roasted, unshelled. There is no direct evidence of leaching, but unlike the situation at Rainbow Cave and Wanderer's Cave, there is ample water for doing so.

CONCLUSION

Cathedral Cave was first occupied about 3,500 years ago. Intermittently, Carnarvon Creek was blocked, probably by massive wasting of the sandstone cliff, not far downstream of Cathedral Cave. During periods when the cave was dry it provided a capacious shelter for people who carried food there from distances where animals such as grey kangaroo and plants such a Macrozamia could be obtained. There is no suggestion from the nature of the deposits that the cave was anything more that a temporary shelter. Certainly, the nature of the stone tool assemblage would suggest that the site was used as more of an outstation than a central camp.

There is no doubt that the collection and likely preparation of the storable Macrozamia played an important role in the occupation episodes at Cathedral Cave. The use of this particular toxic plant has been argued (Beaton 1977, 1982) to have been a possible important link in the evolution of large ceremonial gatherings in prehistoric Aboriginal Australia. The origin of such social events appears to have been roughly co-incident with other developments in Australian prehistory, such as the spread of the microlithic tradition, the introduction of the dingo, and perhaps an expanding population (Beaton 1977, 1983).

REFERENCES CITED

Bartholomai, A. n.d. Report on fauna collected from Cathedral Cave. Manuscript. Queensland Museum, Brisbane.

Beaton, J.M. 1977. Dangerous Harvest: Investigations in the late prehistoric occupation of upland south-east central Queensland. Unpublished Ph.D. Thesis. The Australian National University.

Beaton, J.M. 1982. Fire and water: Aspects of Aboriginal management of cycads. **Archaeology in Oceania** 17(1):51-58.

Beaton, J. M. 1985. A method for investigating organic matter content in archaeological sediments. **Australian Archaeology** 20:28-31.

Beaton, J.M. 1983. Does "Intensification" account for changes in the Holocene archaeological record? **Archaeology in Oceania** 20:28-31.

Beaton, J.M. 1991. Wanderer's Cave and Rainbow Cave: two rockshelters in the Carnarvon Range of central Queensland. **Queensland Archaeological Research** (this volume).

Beaton, J.M. and Walsh G.L. 1977. Che-Ka-Ra. **Mankind** 11:46-48.

Bowdler, S.E. 1974. An account of and Archaeological Reconnaissance of Hunter's Isles, North-west Tasmania, 1973/4. **Records of the Queen Victoria Museum**, 54:1-22.

Campbell, John. 1982. New radiocarbon dates for north Queensland. **Australian Archaeology** 14:62-66.

Clegg, J.K. n.d. A Preliminary report of the stone artefacts from Cathedral Cave, Carnarvon National Park, Queensland, Dug-up by a party under the leadership of Dr. D.J. Tugby, B.Sc., B.A., Ph.D. Unpublished Ms. Brisbane.

Dortch, C.E. and D. Merrilees, 1973. Human occupation of Devil's Lair, Western Australia, During the Pleistocene. **Archaeology and Physical Anthropology in Oceania** 8:89-115.

Goddard, R.H. 1940/1. Aboriginal rock sculpture, stenciling and paintings in the Carnarvon Ranges. **Queensland Geographic Journal** 47:72-80.

Hall, J. 1982. Sitting on the crop of the Bay: An historical and archaeological sketch of Aboriginal settlement and subsistence in Moreton Bay, Southeast Queensland. In S. Bowdler (ed) **Coastal Archaeology in Eastern Australia**, pp.79-95. Department of Prehistory, RSPacS, ANU, Canberra.

Hall, J. and P. Hiscock. 1988. The Moreton Region Archaeological Project (MRAP) STAGE II: An outline of objectives and methods. **Queensland Archaeological Research** 5:4-24.

Hughes, P.J. and R.L. Lampert. 1977. Occupational Disturbance and types of archaeological deposit. **Journal of Archaeological Science** 4:135-40.

Jennings, J.N. 1971. Sediments in the Lake Embayment at the Burrill Lake Site. Appendix I in R.J. Lampert, Burrill Lake and Currarong. **Terra Australis** I, Department of Prehistory, RSPacS, ANU.

Morwood, M.J. 1979. Art and Stone: Towards a prehistory of central western Queensland. Unpublished Ph.D. Thesis. The Australian National University.

Morwood, M.J. 1980. Time, space and prehistoric art: A principle components analysis. **Archaeology and Physical Anthropology in Oceania** 15:98-109.

Morwood, M.J. 1981. Archaeology of the central Queensland highlands: The stone component. **Archaeology in Oceania** 16:1-52.

Mulvaney, D.J. 1975. **The Prehistory of Australia.** Pelican Dominion Press, Victoria.

Mulvaney, D.J. and E.B. Joyce 1965. Archaeological and Geomorphological Investigations on Mt. Moffat Station, Queensland, Australia. **Proceedings of the Prehistoric Society**, Vol. 31.

O'Brien, D.A. 1939/40. Carnarvon Expedition. **Queensland Geographical Journal** 62:64.

O'Brien, D.A. 1957/8/9. The Carnarvon Ranges. **Queensland Geographical Journal** 58-9:34-6.

O'Brien, D.A. 1963/64. Carnarvon Expedition. **Queensland Geographical Journal** 62:64.

Quinnell, M.C. 1976. Aboriginal Rock Art in Carnarvon Gorge, South Central Queensland. Unpublished MA Thesis. University of New England.

Roth, W.E. 1904. Domestic implements, arts and manufactures. **North Queensland Ethnography Bulletin**, No.7, Government Printer, Brisbane.

* * * *