ECHIDNA'S REST, CHILLAGOE: A SITE REPORT

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INTRODUCTION

Archaeological excavation of the Echidna's Rest site was undertaken in 1985 as part of an M.A. thesis research project at the Australian National University (David 1987). The project concerned patterns of cultural change and stability during the Holocene in the Chillagoe region of Northern Queensland and included an investigation of past foraging behaviour. When this research began very little was known of the prehistory of the region (see Campbell 1982, David 1984). Echidna's Rest was therefore excavated primarily to obtain information about the human antiquity and paleoevironment of the region.

Echidna's Rest is a large rockshelter at the base of the Queens-lander Tower, a large limestone bluff located 20km NW of Chillagoe (144^{o} 26'E 81^{o} 01'N). It exhibits a large, skylit opening in an above-ground limestone karst formation with near-vertical walls up to 30m in height. The rockshelter created by the skylit chamber can be reached by a small opening in the rock wall at ground level (Figure 1).

The shelter floor is generally flat, with 208m^2 lying beyond the dripline and 94m^2 within it. The area outside the dripline has some grass cover and occasional trees. Cultural deposits occur only within the main chamber of the rockshelter complex, with fine, ashey sediments found only in a localised area within the dripline. No excavation was attempted outside the dripline, although all surface artefacts were plotted and collected (David 1987).

THE EXCAVATION

Twelve 50cm x 50cm squares were excavated, 11 of which were aligned to form a trench, the other placed 1.0m south and 1.5m west of the trench. The trench was located in an area devoid of macropod surface disturbance, and oriented to span the width of the shelter from dripline to the rear wall (Figures 1 & 2).

Excavation was undertaken in 5cm (max.) Excavation Units (XU) within natural strata or Stratigraphic Units (SU). All bones over 2cm long (max.) and all <u>in situ</u> artefacts were recorded in three dimensions and bagged separately. Relatively few artefacts were found towards the base of the excavation and, as these were not observed whilst excavation was in progress, SU3 (the basal SU) was originally thought to be culturally sterile, and excavation was terminated. The failure to observe SU3 artefacts <u>in situ</u> was largely due to their small size (mean = 0.5g), most being retrieved from the 1mm mesh sieve. All excavated sediments (except for bulk sediment samples) were sieved through 1.0mm wire mesh and subsequently sorted in the laboratory.

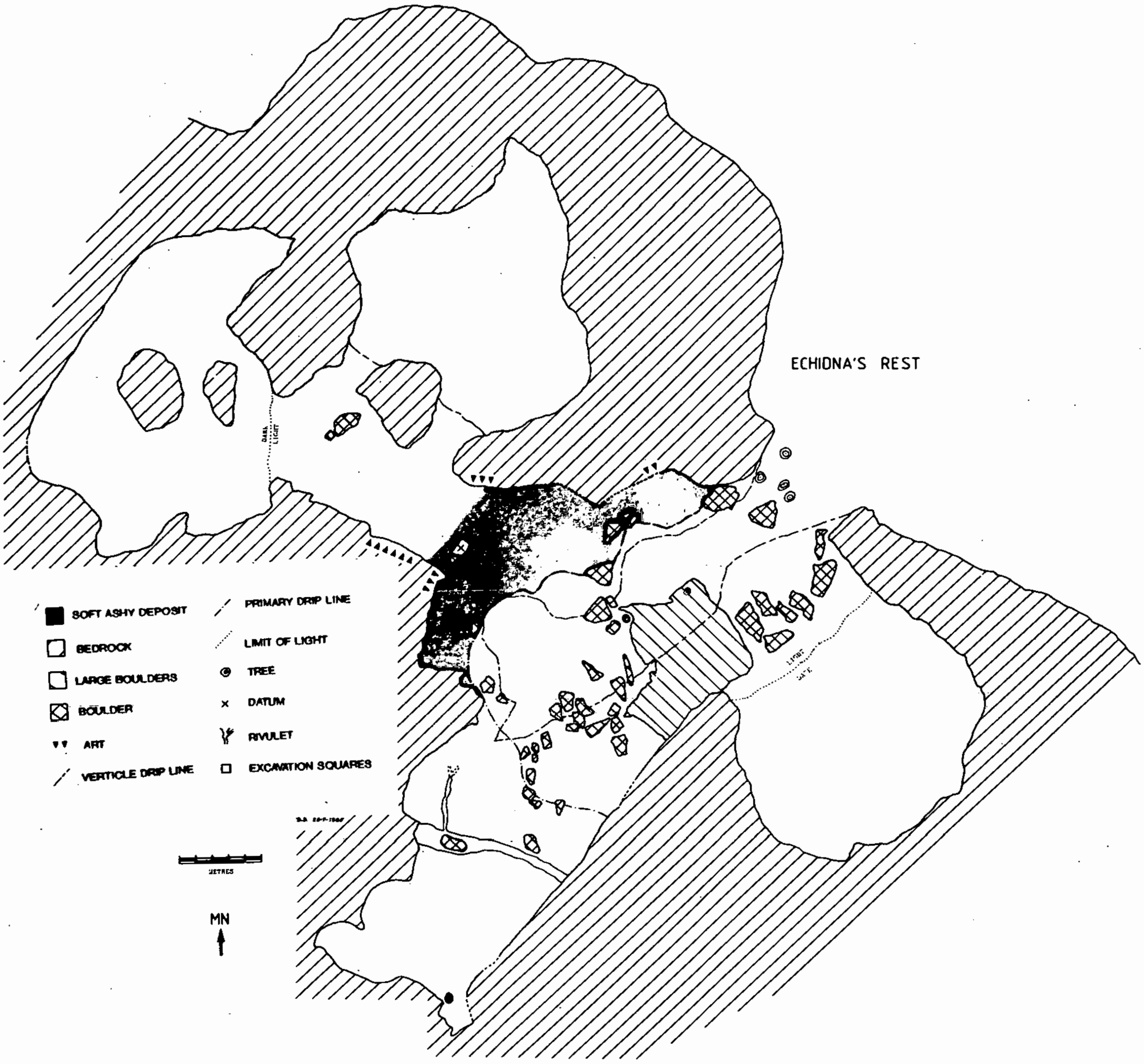

Figure 1. Site Plan of Echidna's rest

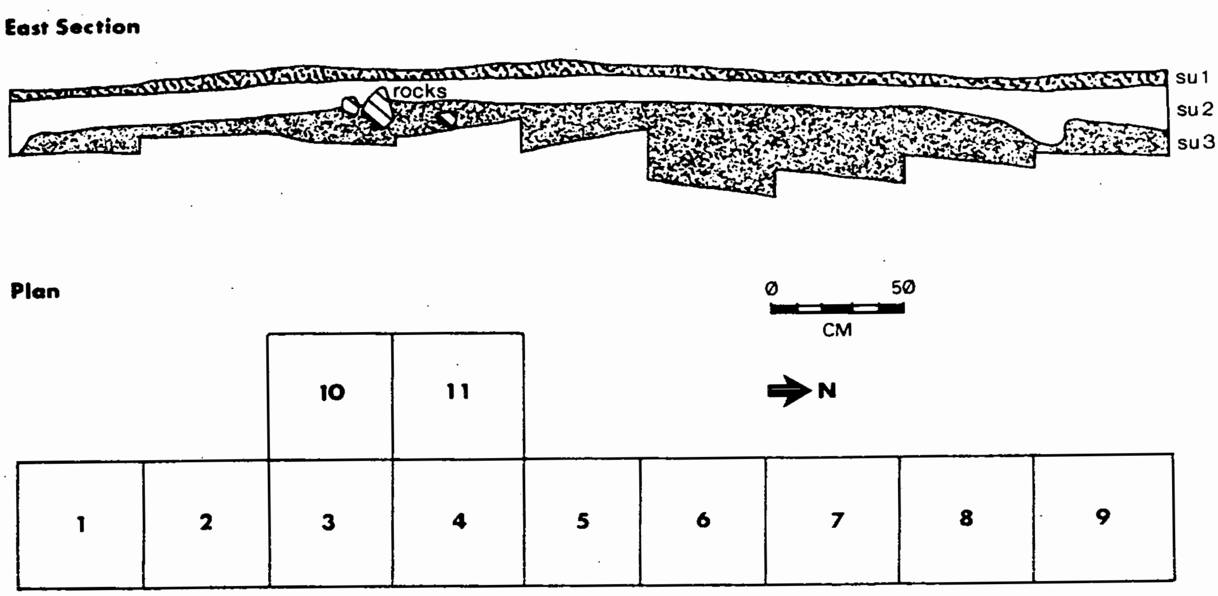

Figure 2. Excavation squares and East section.

STRATIGRAPHY

Square 12, the isolated pit away from the trench, exhibited three major Stratigraphic Units (SUs) as follows (see also Table 1):

Table 1. Square 12 stratigraphic details.

SU	WET MUNSELL	DRY MUNSELL	pH	MAX.THICKNESS
1	10YR 4/3	10YR 6/2	8	4.1cm
2a	10YR 6/1	10YR 7/1	8	5.0cm
2b	10YR 5/2	10YR 6/2	8	10.0cm
3	2.5YR 3/6	2.5YR 3/6	8	40.0cm

SU1: a dry, loose, fine ashey surface sediment. This unit appears disturbed, probably in part at least by the macropods (Petrogale sp. and Macropus robustus) that currently inhabit the site. Bone, stone artefacts and glass are present.

SU2a: a distinctive lens appearing in the southern half of the square only. It consists of a relatively loose ash concentration with well-marked boundaries. Cultural materials are common.

SU2b: a fine, ashey sediment of moderate compaction. Distinct in colour and compaction from overlying SUs 1 and 2a. Cultural materials are common.

SU3: Stone artefacts are present but in low numbers. There are some small cracks at the top of SU3 (snail and/or insect disturbance ?) where it meets with SU2. In spite of this fact, the boundary between SU2 and SU3 is very well defined. A number of angular limestone roof-fall blocks appear at the base of this unit, inhibiting further excavation. This also marks the base of SU3.

The basic stratigraphy in the main trench is the same as that found in Square 12 above except that SU2 could not be sub-divided (Figure 2). Mean pH readings ranged from 8.0 to 9.0 in all SUs (see Table 5). Sediment samples were taken from each spit.

SEDIMENT ANALYSIS

Some 0.59m^3 of sediment was excavated from the main trench. When combined with that from Square 12 the total amounts to 3m^2, or 4.0% of the soft ashey surface area of the site. The sediment analysis was conducted on all of the excavated material except for a number of spits which were lost in transit from the field to the laboratory (Tables 2 & 3). All calculations presented below take into account the missing samples.

The carbonate content of each spit was calculated in a volumetric calcimeter. Samples were decomposed in a sealed apparatus using hydrochloric acid. The volume of fluid displaced by evolved carbon dioxide was measured and related to standard calcium carbonate (CaCO3) and to the sample size (J. Caldwell, Dept. Biogeography and Geomorphology, R.S.Pac.S., Aust. Nat. Uni., Pers. Comm.). Calcium carbonate enters the soil through percolating water, and therefore it is not surprising that a direct correlation exists between humidity and carbonate levels (Table 4, Figure 3).

Table 2. Excavated spits not analysed.

SQUARE	STRATIGRAPHIC UNIT	SPIT
5	1	1
5	3	1
10	2	1
10	3	1
10	3	4
11	1	1
12	3	1

Table 3. Volumes (in m3) of excavated sediments.

	SPIT			
SU	1	2	3	4
1	0.09			
2	0.18	0.07		
3	0.16	0.08	0.03	<0.01

Table 4. Percentage humidity, carbonate and organic carbon.

SU	HUMIDITY	CARBONATE	ORGANIC CARBON
SU1	1.6%	3.0%	61.5%
SU2	0.2%	5.3%	49.1%
SU3 SPIT 1	0.2%	2.1%	48.2%
SU3 SPIT 2	0.0%	0.9%	18.1%

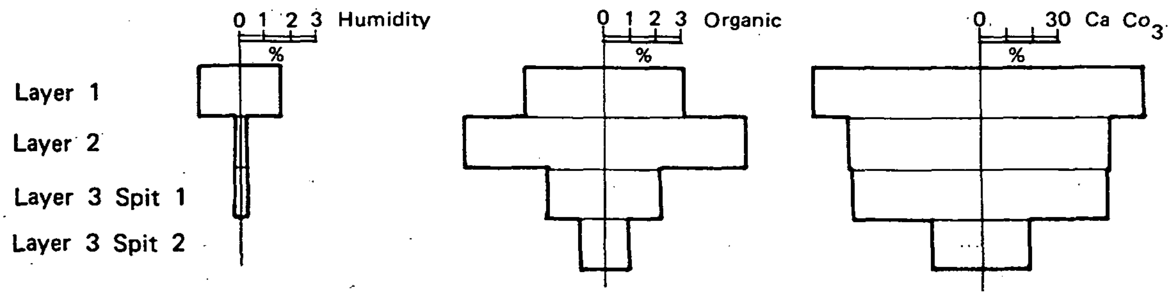

Figure 3. Humidity, organic Carbon and Calcium Carbonate Curves.

The amount of organic carbon was calculated by the Schollenberger wet oxidation technique. The carbon in the sample is quantitatively oxidized by chromic acid in the presence of silver sulphate/sulphuric acid. Unreacted chromate is back-titrated with ferrous sulphate and related to a standard and to the sample size (J. Caldwell, Pers. Comm.).

A loss-on-ignition technique was initially applied to calculate amounts of organic carbon but, due to the high clay content (the particles of which emit water at the treatment temperature of 500°C), the procedure was abandoned.

Both SU1 and SU2 contain high levels of organic carbon (present mainly as ash and charcoal). This supports their interpretation as rich cultural layers, unlike the underlying SU3 (see below).

Particle Size Analysis

A two-fold pattern emerges from the particle size analysis. First, SU1 yielded a high proportion of fine sediments, with small amounts of coarse sediments. The middle-sized particles are represented by similar proportions throughout the deposit (Figure 4). The high proportion of fine sediment can be best explained by the presence of a relatively large amount of ash and calcium carbonate.

Second, there is a trend towards decreasing coarseness with depth. This may be due, in part, to the higher proportion of ant bed material and hearth stones in SU2 (see below). The high percentage of coarse materials in SU2 also reflects the abundant shell and bone in this unit.

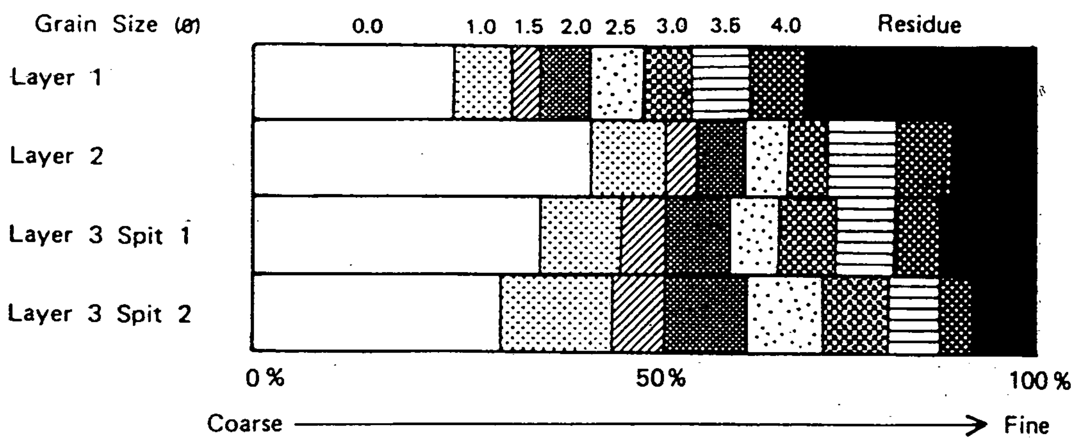

Figure 4. Distribution of sediment particle sizes.

Cave Pearls

Cave pearls are inorganic calcite formations which form in the vadose (above ground-water) zone with the influx of fresh water. They are created under low energy environments in the process of soil formation in humid tropical and sub-tropical climates, and are characterised by composite nuclei formed chemically by evaporation (Fluglel, 1982:128, 149). Stable conditions within the limestone environment are critical to their formation (Wallensky pers. comm.).

The Echidna's Rest sediments contain large numbers of small cave pearls (<1cm diam.). Their abundance in each spit was estimated by allocating a rating of 1 for low abundance, 2 for medium, and 3 for high. The mean abundance rating was then calculated for each spit of each stratigraphic unit (Table 5, Figure 5). The rich cultural units (SU1 and SU2) contain large amounts of cave pearls, whilst very low numbers were found in SU3. This implies stable environmental conditions during SU1 and 2 times, conditions conducive to the formation of cave pearls. As noted below, this pattern is believed to reflect greater rainfall levels during SU3 times, dated to pre-3000 BP.

Table 5. Mean cave pearl ratings and acidity levels.

SU	XU	CAVE PEARLS	pH
SU1		1.9	8.27
SU2	XU1	2.2	8.25
SU2	XU2	2.1	8.29
SU3	XU1	1.2	8.27
SU3	XU2	1.2	8.56
SU3	XU3	1.2	8.00
SU3	XU4	?	8.50

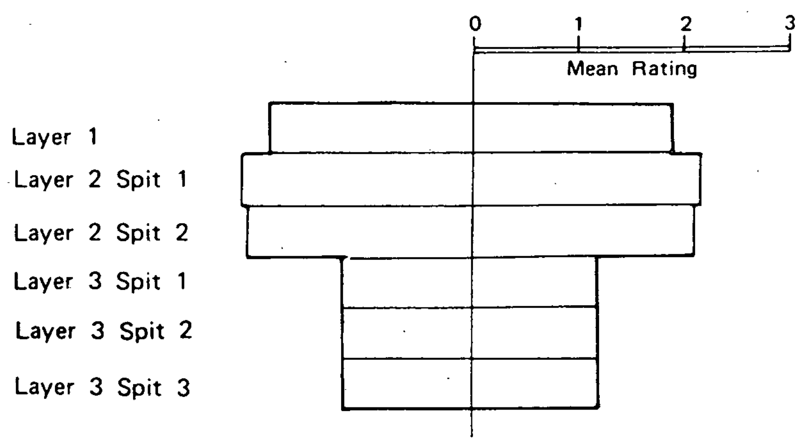

Figure 5. Distribution of Cave Pearls.

RADIOCARBON DATES

Seven radiocarbon dates were obtained (Table 6). All are from wood charcoal samples and all were collected <u>in situ</u>. There is general agreement between the dates obtained. Dates of 690 ± 90 bp.(ANU 4812) for the base of SU1, and dates of 710 ± 120 bp. (ANU 4809) and 730 ± 200 (ANU 4815) for the top of SU2 suggest a change-over from SU2 to SU1 around 700 bp. If this is the case, ANU 4811 (490 ± 80 bp.) is slightly anomalous.

Table 6. Radiocarbon dates.

ANU LAB #	SQUARE	LOCATION	AGE (bp)
SU1 XU1 4812	4	0.2cm above base of SU1	690±90
SU2 XU1 4811	6	4.0cm below ground surface	490±80
SU2 XU1 4809	12	6.7cm below ground surface	710±120
SU2 XU2 4815	2	10.2cm below ground surface*	730±200
SU2 XU2 5154	3	9.5cm below ground surface*	1470±170
SU2 XU2 4810	3	5.3cm below ground surface	2120±150
SU2 XU2 5155	3	7.9cm below ground surface	2440±150

* This sample was collected from a localised area where SUs were of unusual depth.

ANU 5155 (2440±150) dates the sediments immediately above the base of SU2, and is supported by ANU 4810 (2120±150) immediately above it. ANU 4815 (730±200) and ANU 5154 (1470±170) come from localised areas where SUs in Squares 2 and 3 are unusually deep, the latter coming from an area adjacent to a stratigraphic depression. Given these problems, the absolute depths of these two samples can not be used to calculate sedimentation rates. By extrapolation from a depth-age curve, the following sequence is thus derived:

SU1: 0 - 720 BP
SU2: 720 - 3020 BP
SU3: 3020 - ? BP.

By extrapolation, the base of the excavated sediments (and therefore the base of SU3) may date to 7770 BP. This figure is speculative as sedimentation rates are likely to have been very different during SU3 compared to later times.

If the SU2/SU3 interface reflects a change in environmental conditions, then its inferred timing (approx. 3000 BP) accords well with palaeoclimatic reconstructions obtained from nearby areas (e.g. Kershaw 1975; David 1987). Kershaw's (1970, 1975) work points to an increase in rainfall during the early Holocene followed by a decrease around 3000 BP. This age is also supported by the low density of cave pearls recovered from SU3, implying dynamic environmental conditions at that time.

LAND SNAILS

Because the sediments were sieved through 1mm mesh, numerous tiny land snails were retrieved (N=573). They are currently being identified by J. Stanisic (Queensland Museum) for palaeoenvironmental reconstruction.

Also common is the large Camaenidae, Xanthomelon pachystylum (Coleman pers. comm.). This species is abundant on the floors of most rockshelters in the region and has been recovered in excavations at Walkunder Arch Cave (Campbell 1982), Fern Cave, Hearth Cave and Mitchell River Cave (pers. obs.). Because these snails are found in both cultural and non-cultural contexts, it is unknown whether or not their presence is related to human activity in the site. A significant number the shells from Echidna's Rest are burnt and some have small, circular holes in them which may have been caused by humans or by natural factors. I have observed birds such as Pitta spp. and white-winged chuffs (Corcorax melanorhamphos) breaking snails against stones to extract the flesh; thus, it is possible that birds are responsible for the holes. I have also seen many examples of land snails with holes in them in the bowers of Bower-birds.

Having said this, a number of researchers have stressed the importance of Xanthomelon in the diet of northern Australian Aborigines. Whilst their dietary status varies in different regions, its food potential should not be neglected. For instance, Coleman (pers. comm.) has observed Aborigines collecting Xanthomelon in the Blackstone Ranges of Western Australia, where it is an important food source. On the other hand, Meehan (National Museum of Australia, pers. comm.) has suggested that in the better watered regions such as Arnhem Land, where food resources are more freely available, Xanthomelon may have been a lower ranked resource, and utilised during particular times. In addition to its potential as food, Meehan (pers. comm.) has recorded its use in the making of rattles, decoration, and yam peelers.

Nevertheless, Xanthomelon pachystylum, like other Camaenidae, is commonly found in the limestone zones of northern Australia. The snail is a free-sealer, commonly burying itself under sediment, creating a temporary "dorm" (epiphram). It is usually active for about 25 days of the year, surfacing most commonly around December.

Xanthomelon is most common in the upper levels where cultural materials are also most abundant (SU1 and SU2 XU1). This pattern may reflect their cultural origins; alternatively, it may be a product of differential taphonomic processes. If the shells were introduced by humans as food items and if they were cooked, there should be significantly higher proportions of burnt shells in the rich cultural layers. On the other hand, if the shells have been burnt as a result of fires being lit over snails already present in the ground, then there should be roughly similar proportions of burnt to unburnt shells in the richer cultural layers (SUs 1 & 2) and in the upper spits of SU3.

As the ratios of burnt to unburnt shells are similar throughout SUs 1 and 2 and the upper spits of SU3 (Table 7), I infer that X. pachystylum, if a food item at all, was not an important food at Echidna's Rest. In fact, it has yet to be resolved whether or not its presence is due to cultural (ie. food) or natural agency. Such resolution is beyond the scope of this paper.

Table 7. Xanthomelon pachystylum: burnt and unburnt quantities.

SU XU	BURNT (g)	BURNT (%)	UNBURNT (g)	UNBURNT (%)
SU1	247.0	21	933.4	79
SU2 XU1	397.4	34	762.7	66
SU2 XU2	59.1	34	112.3	66
SU3 XU1	87.8	27	235.5	73
SU3 XU2	46.6	35	87.9	65
SU3 XU3	10.0	43	13.1	57

CULTURAL MATERIAL

Charcoal

The vertical distribution of charcoal parallels the distribution of organic carbon as measured by the Schollenberger wet oxidation technique (see above). Charcoal is concentrated in SUs 1 and 2 (Tables 8 & 9).

Table 8. Charcoal concentrations.

SU	XU	CHARCOAL (g)	SEDIMENTS (m^3)	g/m^3 X 100
SU1		374.2	0.09	0.416
SU2	XU1	244.8	0.18	0.136
SU2	XU2	30.2	0.07	0.043
SU3	XU1	25.8	0.16	0.016
SU3	XU2	7.9	0.08	0.011
SU3	XU3	5.2	0.03	0.017

Table 9. Charcoal concentrations by SU.

SU	$g/100yrs/m^2$
SU1	0.208
SU2	0.028
SU3	0.002

Hearth

The only excavated feature was a hearth located at the intersection of SU2 XU1 and SU2 XU2 (Figures 8 and 9). ANU 4810 (2120 ± 150 bp.) comes from charcoal located in this feature and therefore dates the hearth itself.

The hearth was created in a localised 8cm-deep depression near the base of SU2. It comprised large amounts of charcoal, nine hearth stones organised in a roughly circular fashion and was surrounded by burnt earth. It had a maximum diameter of 45cm.

Burnt Ant Bed, Burnt Earth, Burnt Stone

Although burnt ant bed was not as common as reported by Flood (pers. comm.) for her excavations in the Koolburra Plateau, it was nevertheless represented in consistently small quantities throughout the cultural deposits (Table 10). SU2 XU2 contains more burnt material than any other spit, reflecting the presence of the in situ hearth. During ethnoarchaeological research in the Northern Territory I have often observed that hearths with hearth stones represent cooking hearths rather than sleeping fires. If this is the case at Echidna's Rest, greater amounts of bone debris would be expected in SU2. This expectation is borne out (see below).

Table 10. Concentrations of cultural materials (in g/m^3 x 100).

SU	XU	BURNT EARTH	BURNT STONE	MUSSEL SHELL	BONE	OCHRE	EGG SHELL
SU1		0.55	2.85	0.186	8.67	127	5
SU2	XU1	0.26	11.61	0.062	4.64	38	16
SU2	XU2	1.62	24.13	0.002	2.40	42	-
SU3	XU1	0.06	2.87	0.002	1.41	18	3
SU3	XU2	-	-	0.002	1.23	33	-
SU3	XU3	-	0.66	0.002	0.33	-	-

Ochre

Sixteen ochre fragments were recovered (Table 10). All weigh less than one gram. The ochre included yellow, orange, red and mauve fragments. Most of the ochre comes from XU1 and therefore dates to the last 700 years or so.

Egg Shells and Mussel Shells

Eight pieces of egg shell were present (species unidentified but not emu). Most pieces are unburnt and all weigh 0.1g or less. Mussel shell (*Velesunio* sp.) is also sparsely represented (Table 10). Given the ideal pH of the sediments and the well-preserved nature of the bone and land snails, such low numbers are likely to be real rather than due to preservation factors.

Bone

Bone occurs in all XUs, but increases significantly in SU2 (Table 10). This increase is associated with an increase in proportions of burnt bone, which peak in XU2 (the hearth layer). Burnt bones exhibit extensive calcination which only occurs under high temperatures (conditions rarely reached under natural conditions). Furthermore, a significant proportion has a bluish-grey tinge, obtained when 'green' bone (bone containing fatty oils) is burnt (David, 1990). These factors point to the deliberate burning of food refuse by the occupants of Echidna's Rest.

Faunal identification was generally undertaken on cranial and mandibular fragments only (including teeth). Exceptions included reptile vertebrae and avian long bones. The remainder of the bone was examined for species not otherwise represented.

Twelve faunal categories were identified (Table 11) including rodents, bandicoots (*Isoodon* sp.), rock wallabies (*Petrogale* sp.), wallaroos (*Macropus robustus*), possums (*Trichosurus vulpecula* and *Pseudochirus peregrinus*), lizards (Agamidae, Gekkonidae, Scincidae), snakes (Elapidae, Boidae) and birds. As none of the lizard or rodent bones were burnt they are not treated here as food refuse (lizards and rodents inhabit the local caves today and even minimal cooking would expect to at least partly burn their bones). Similarly, the single avian long bone from SU1 is fresh in appearance (not burnt) and is likely to be a natural introduction into the site.

Table 11. Faunal distributions (MNIs).

	SU1	SU2	SU3
Aves	1	1	0
Rodentia	4	8	26
Scincidae	0	0	1
Gekkonidae	1	0	0
Agamidae	1	0	0
Elapidae	1	1	1
Boidae	0	0	1
Isoodon sp.	2	2	1
Petrogale sp.	4	10	1
Macropus robustus	1	1	0
Unidentified Macropodidae	0	0	4
Trichosurus vulpecula	1	1	1
Pseudocheirus peregrinus	0	1	0

The range of species represented at Echidna's Rest is nearly identical to that from the late Holocene layers at nearby Walkunder Arch Cave (Campbell 1982; David 1984). The latter are dated to the last 3400 years or so (Campbell 1982). In both cases, there is a predominance of Petrogale and Isoodon, with most rock wallabies in the Walkunder Arch Cave assemblage having their fourth molars partially or fully erupted (41 of 43 MNI) (David 1984). In both cases there is also a targetting of fauna from the limestone karst (all species present from Echidna's Rest, and all species except for three specimens of Macropus agilis, one fish and one crab from Walkunder Arch Cave [David 1984]).

Notable are the low numbers of M. robustus and M. agilis from both sites (both of which are common on the surrounding plains), as well as of other species from other nearby environmental zones (such as the plains around the karst, creeks and hills). Coupled with a well defined targetting of limestone karst fauna, the late Holocene foragers of the Chillagoe region appear to have concentrated on older members of the Petrogale wallaby population. Taken together, the Echidna's Rest and Walkunder Arch Cave fauna are inferred to primarily reflect a single continuous hunting strategy from c. 3400 BP to the ethnohistoric present.

Bone Artefacts

Six bone artefacts were found in the excavations. They all come from SU1 and SU2, and consist of four ground uni-points and two ground spatulas made from macropod fibulas.

Stone Artefacts

A total of 3,669 stone artefacts were excavated from Echidna's Rest, 52 (1.4%) of which were modified. Some 96% of all stone artefacts weighed less than 2.0g and these were not examined for secondary modifications. Of the 96 flakes weighing 2.0g or more, 52 (54%) exhibit retouch or use-wear (see Table 12).

There are 13 formal tools, falling into formal types and representing 0.4% of the assemblage. They include two backed flakes, one small fragment of a ground-edge axe (0.4g), one thumbnail scraper, and nine burren adzes. Although backed flakes (geometric and assymetric in shape) are rarely found in northern Australia (but see Hiscock 1985), Campbell (1982) has recently reported them from Walkunder Arch Cave's Pleistocene deposits (but their characteristics remain unpublished). The Echidna's Rest backed flakes appear to be different from the backed blades found in southern Australia, the former having more acute chord angles of around 65^{o}, and extensive step-fracturing along both backed margins.

Table 12. Stone artefacts: weight characteristics.

WEIGHT (g)	1	2	3	4	5	6	7	8
0-1.9	?	3521	?	?	?	?	97	?
2.0-3.9	19	51	37	598	11.7	31.4	1	37
4.0-5.9	10	17	59	283	16.6	28.3	<1	19
6.0-7.9	7	7	100	200	28.6	28.6	<1	13
8.0-9.9	2	4	50	94	23.5	47.0	<1	4
10.0-11.9	6	7	86	247	35.3	41.2	<1	12
12.0-13.9	2	3	67	160	53.3	80.0	<1	4
14.0-15.9	1	1	100	20	20.0	20.0	<1	2
16.0-17.9	1	1	100	45	45.0	45.0	<1	2
318.0	4	5	80	192	38.4	48.0	<1	8

1= # of modified artefacts (tools)
2= # of artefacts
3= % of artefacts modified from that weight range
4= total modified edge (mm)
5= modified edge/artefact (mm)
6= modified edge/tool (mm)
7= % of excavated artefacts
8= % of excavated tools

Rosenfeld et al. (1981) and Flood and Horsfall (1986 & Flood pers. comm.) report the burren adze as the main formal tool type at the Early Man, Green Ant, and Echidna Dreaming rockshelters (located immediately north of Echidna's Rest). This is also the case for Echidna's Rest. Ventral surfaces are characteristically convex, and the modified edges occur laterally to the striking platform. The edge wear in all cases includes deep and extensive step fracturing of the type identified by Kamminga (1982 & Pers. comm.) as created by working hardwood. Edge angles are consistently between 60^{o} and 80^{o}, with scalar retouch and intrusive step fracturing along a large portion of the margin. Artefacts exhibit signs of reduction through both usewear and retouch.

All of the Echidna's Rest burren adzes come from SU1. Their absence from SU2 is intriguing, especially given their presence in 3000 BP contexts in other sites in north Queensland (e.g. Flood & Horsfall 1986). It is possible that when SU2 was being deposited, around 3020 BP to 720 BP, there was a different use of space at Echidna's Rest (see below). There is supporting evidence for this hypothesis in that, one, SU2 has a markedly lower density of stone artefacts than SU1 (see above), two, it has lower proportions of modified artefacts (tools) than SU1, three, tools from SU2 have smaller mean edge lengths than SU1 and four, it has a less efficient use of stone resources than SU1 (in that 0.72cm of edge per gram of flaked stone was used during SU2 times, as opposed to 1.49cm of edge per gram during SU1 times). Taken together, these points may indicate that between about 3020 BP and 720 BP stone working was not as intensive in this part of the site as it was during SU1 times. The major change, however, occurs at the SU3 - SU2 boundary, with a major increase in lithic deposition rates during the last 3000 years or so.

Stone Artefacts: Raw Materials

Whilst quartz (36.9% of assemblage) and indurated mudstone (29.2%) were the most common flaked raw materials, limestone (19.6%), chert (12.2%), chalcedony (1.9%), ironstone (<1.0%), quartzite (<1.0%), conglomerate (<1.0%), and obsidian (<1.0%) were also used (Table 13).

The obsidian is particularly interesting in that it is a true volcanic glass and is believed to be the first such occurrence in a mainland Australian archaeological site. It is currently being analysed and will be more fully reported elsewhere. There are no clear signs of changes in raw materials used during the course of occupation at Echidna's Rest.

Both the cherts and indurated mudstone are high quality fine-grained flaking materials. It is therefore not surprising that they exhibit the greatest tool-to-waste ratios of all raw materials. Whereas 11.2% of chert and 5.2% of indurated mudstone artefacts are modified, only 2.3% of the quartz (white and crystal) and 0.6% of the limestone show signs of retouch or use wear. Preferential use of high-quality flaking material is thus indicated, in spite of a greater availability of quartz and limestone.

The different raw materials also show differences in their flaking characteristics as measured by length:height ratios (Table 14). Length is taken as an artefact's greatest linear dimension, width as perpendicular to the length and constituting its second longest linear dimension, and height as perpendicular to both length and width. Low length:height ratios for quartz reflects differences in flaking properties and perhaps also a different flaking technology.

Only one bi-polar fragment was recovered, implying that bi-polar flaking was not responsible for the differences noted. Further detailed analyses of flaking technologies was not attempted, although a number of surface flaking floors were collected with this intention in mind.

Both the chert and chalcedony artefacts are made from very fine-grained raw materials. The cherts are mainly cream in colour but include black, pink, white, mottled and banded varieties. The indurated mudstone is also fine-grained (and occasionally medium-grained) and it was the material from which all of the burren adzes were made.

Indurated mudstone artefacts also show occasional signs of heat treatment in the form of potlids, which make up 5.9% of these artefacts (N=61 potlids, with 31 from SU1, 20 from SU2, and 10 from SU3). Selective heat treatment of this material may only imply that it was a function-specific material; this notion is supported by its use for adze-making. It is unlikely that the potlids were accidentally formed when camp fires were lit over existing buried artefacts as other raw materials, such as chert, would also be expected to have been affected.

Table 13. stone Artefact raw material data.

MATERIAL: % (for each SU)	SU1	SU2	SU3
QUARTZ: % artefacts	29.2	43.1	32.4
QUARTZ: % tools	21.2	22.6	20.0
QUARTZ: % modified	3.5	2.1	0.9
CHERT: % artefacts	14.8	10.4	11.0
CHERT: % tools	40.9	29.0	30.0
CHERT: % modified	13.6	11.7	3.9
INDURATED MUDSTONE: % artefacts	29.7	28.0	30.9
INDURATED MUDSTONE: % tools	31.8	45.2	40.0
INDURATED MUDSTONE: % modified	5.3	6.7	1.9
LIMESTONE: % artefacts	22.0	15.8	22.8
LIMESTONE: % tools	1.5	3.2	10.0
LIMESTONE: % modified	0.3	0.9	0.6
OTHER: % artefacts	4.2	2.6	2.8
OTHER: % tools	4.5	0.0	0.0
OTHER: % modified	7.1	0.0	0.0

Table 14. Stone Artefact Length:height ratios.

QUARTZ	CHERT	INDURATED MUDSTONE	LIMESTONE	OTHER
2.96:1	3.36:1	3.43:1	3.59:1	3.78:1

Limestone occurs naturally at the site. It is softer than quartz, chert or indurated mudstone, and has a tendency to break along natural fracture planes. Further, because of its friability, it tends to shatter more readily thereby reducing its flaking qulaity and utility. Given its easy availability and poor flaking characteristics, it is not surprising that it was rarely transformed into tools (only 0.6% show evidence of use).

Edge Modification and Edge Angles.

Five general types of use-wear were identified following examination of stone artefact edges under 10x magnification:

1] fine invasive flaking, including hinge, retroflexed hinge, feather and bending scars (Kamminga 1982);
2] fine step fracturing, consisting mainly of multiple fractures, where the fracture floor terminates abruptly, and sometimes continues beyond the detached flake;
3] heavy step fracturing, distinct from Type 2 above in depth and extent only;
4] edge rounding and gloss; and
5] edge grinding, identified by the presence of edge polish and striations.

There appears to be a correlation between type of use wear and edge angle (Tables 15-17). Fine invasive flaking and fine step fractures occur most commonly on edge angles of 11° to 50°, whereas heavy step fractures occur mainly on edge angles of 40° to 90°. This pattern is apparent from all SUs. This correlation may reflect functional, technological or other differences. Loy (Dept. Prehistory, R.S.Pac.S., Aust. Nat. Uni., pers. comm.) has analysed a small number of the artefacts with Type 1 invasive flaking for traces of residue, and he found microscopic plant particles (cellulose) on two artefacts. No blood particles were found. Coupled with the presence of adzes, step fracturing, and edge angles of 41° to 90°, the implications are that wood-working was undertaken at Echidna's Rest. The association of fine invasive flake scars and acute edge angles may reflect finer scraping of wooden objects (cf. Kamminga 1982).

Variations in Stone Artefact Characteristics Between Spits

By far the densest stone artefact concentrations are found in SU1 (Tables 18 and 19). Although artefacts are found in SU3, they are present in very low quantities, with very low mean artefact weights in every spit (ranging = 0.50 - 0.64g). Only 11 artefacts from SU3 weigh more than 1.9g, and all but one weigh less than 6.0g. Given this fact, it is difficult to characterise stone artefacts from SU3 beyond the fact that they are rare. However, there is a contrast in the distribution of stone artefacts of SU1 and SU2 as follows (Tables 20-22):

1] there are three times as many stone artefacts in SU1 than there are in SU2, and seven times as much by weight;
2] the proportion of modified artefacts in SU1 is one and a half times as great as found in SU2;
3] there is a greater intensity of stone use, as measured by edge length per gram of stone and by edge length per number of tools, in SU1. SU1 artefacts show twice as much edge modification as do SU2 artefacts;
4] in SU2 all edge angles are relatively acute (ranging from 8° to 60°) (as they are in SU3), whereas SU1 exhibits a broader range of angles;
5] heavy step fractures and burren adzes are only found in SU1.

Before SU2 times, stone artefact production and use at Echidna's Rest appears to have been of low intensity. A major increase takes place about 3000 years ago, followed by another increase at around 700 BP. Given the nature of stratigraphic units at the site, however, it is possible that this increase in deposition rate was continuous through the course of the late Holocene.

Table 15. Numbers of edge angles and types of use wear - SU1.

EDGE ANGLE (x°)	1	USE 2	WEAR 3	TYPE 4	5	TOTAL
0-10	7					7
11-20	14			1		15
21-30	10	2	1			13
31-40	11					11
41-50	6	1	2			9
51-60	6		1			7
61-70	3		3			6
71-80	4	1	2			7
81-90	1		1			2

Table 16. Numbers of edge angles and types of use wear - SU2.

EDGE ANGLE (x^o)	1	2	3	4	5	TOTAL
0-10	5					5
11-20	18				1	19
21-30	17			1		18
31-40	15	2				17
41-50	9					9
51-60	5					5

Table 17. Numbers of edge angles and types of use wear - SU3.

EDGE	USE WEAR TYPE					
ANGLE (x^o)	1	2	3	4	5	TOTAL
11-20	2					2
21-30	4					4
31-40	2					2
41-50	4					4
51-60	2					2

Table 18. Artefact characteristics.

SU	1	2	3	4	5	6	7
1	0.50	18.04	2.1	50	0.010	1.49	1299
2	0.07	6.30	1.3	57	0.003	0.72	1594
3	?	?	0.3	46	0.001	0.08	776

1 = g/100yrs/m^2 2 = artefacts/100yrs/m^2
3 = % artefacts modified 4 = % artefacts >1.9g modified
5 = g/cm^3 6 = mean edge length (mm)/g of stone
7 = number of artefacts

Table 19. Artefact characteristics by spit.

SU	XU	g/cm^3	MEAN Wt./ARTEFACT (g)
SU1		0.010	1.09
SU2	XU1	0.002	0.71
SU2	XU2	0.003	0.88
SU3	XU1	0.001	0.52
SU3	XU2	0.002	0.64
SU3	XU3	<0.001	0.50

Table 20. Artefactual characteristics - SU1.

WEIGHT (g)	1	2	3	4	5	6
0-1.9	?	?	?	?	93	?
2.0-3.9	4	17	15	89	3	15
4.0-5.9	5	56	17	31	1	19
6.0-7.9	4	100	30	30	<1	15
8.0-9.9	1	50	34	68	<1	4
10.0-11.9	5	83	39	46	1	19
12.0-13.9	2	100	80	80	<1	7
14.0-15.9	1	100	20	20	<1	4
16.0-17.9	1	100	45	45	<1	4
318.0	4	80	38	48	1	15

1 = # modified 2 = % modified
3 = mean edge (mm) artefact 4 = mean edge (mm)/tool
5 = % of artefacts 6 = % of tools

Table 21: Artefact characteristics - SU2.

Wt. (g)	1	2	3	4	5	6
0-1.9	?	?	?	?	96	?
2.0-3.9	11	50	11	22	2	55
4.0-5.9	4	57	17	29	1	20
6.0-7.9	3	100	27	27	<1	15
8.0-9.9	1	100	26	26	<1	5
10.0-11.9	1	100	15	15	<1	5
12.0-13.9	0	0	0	-	<1	0

Legend as for Table 20.

Table 22: Artefact characteristics: SU3.

Wt. (g)	1	2	3	4	5	6	7
0-1.9	?	?	?	?	99	?	765
2.0-3.9	4	44	8	15	1	82	9
4.0-5.9	1	100	4	4	<1	9	1
6.0-7.9	0						0
8.0-9.9	0	0	0		<1	9	1

Legend as for Table 20, + 7=number of artefacts.

INTRA-SITE SPATIAL ORGANISATION

Due to the relatively low numbers of stone artefacts from SU3, intra-site spatial analysis has only been attempted for SU1 and SU2. The distribution of bones and stone artefacts excavated is given in Figures 6 to 9 and Table 23. There does not appear to be any distinct concentration of bone in any one part of the excavation in SU2, although there is a slight clustering around the hearth. The distribution of stone artefacts from SU2, however, shows that stone working and stone use was predominantly carried out outside the dripline. Square 1, immediately adjacent to the drip line, has approximately one and a half times as many artefacts and implements (by weight) as the second richest square (Table 23). Progressively fewer stone artefacts are encountered as one approaches the cave wall. Similarly, most cores occur within one metre of the drip line (all excavated cores weigh less than 50g). Coupled with the distribution of surface artefacts at Echidna's Rest, this implies that most stone working and stone use was undertaken away from the main 'living area', outside the drip line, during SU2 times.

Table 23. Distribution of stone and bone per square (g/100 yrs).

SQUARE	1	2	3	4	5	6	7	8
1	0.140	0.219	0.072	0.028	0.034	0.041	0.003	0.003
2	0.098	0.100	0.012	0.011	0.056	0.082	0.002	0.016
3	0.061	0.138	0.043	0.000	0.055	0.083	0.002	0.001
4	0.112	0.154	0.030	0.000	0.038	0.044	0.007	0.000
5	?	?	?	?	0.044	0.059	0.006	0.003
6	0.056	0.120	0.034	0.000	0.009	0.006	0.002	0.000
7	0.141	0.124	0.018	0.000	0.028	0.031	0.009	0.002
8	0.089	0.069	0.003	0.000	0.046	0.027	0.006	0.000
9	0.215	0.038	0.015	0.000	0.023	0.007	0.001	0.000

1=bone (g):SU1 2=artefacts (g):SU1 3=tools (g):SU1 4=cores (g):SU1
5=bone (g):SU2 6=artefacts (g):SU2 7=tools (g):SU2 8=cores (g):SU2

In SU1 bone is concenrtated towards the rear of the cave (Table 23). Given the absence of natural depressions at the site, this is likely due to the human clearance of food debris during the last 700 years or so. This may signify a separation of living and refuse space at Echidna's Rest. This feature of late Holocene life at Echidna's Rest is also reflected in the orderly storage of large surface cores against the back wall (cf. David 1987). As with SU2, there is also a greater concentration of stone artefacts towards the drip line. It may be significant that the only cores found in SU1 were located in the two squares closest to the drip line.

CONCLUSIONS

It is possible that Echidna's Rest was a humid place before 3000 BP and that humans only began to occupy the site intensively after the onset of greater aridity. At c.3000 BP large amounts of cultural material begins to appear including <u>in situ</u> stone artefacts and food debris as well as a hearth. Nevertheless, the onset of relatively humid conditions before 3000BP is unlikely, in itself, to explain the low artefact deposition rates in SU3. On the contrary, the very low rates of deposition of all cultural materials before the late Holocene is in accord with low deposition rates found in other sites at that time (e.g. Rosenfeld <u>et al</u>. 1981) and is more likely to express a demographic change of the type advocated by Lourandos (1983), although the precise nature of this change remains unknown.

If the distribution of surface cultural materials is any indication, only a very restricted area around the centre of the main chamber appears to have been used to any significant degree. Within this area, the organisation of space appears to have been highly structured, and this is so since the earliest signs of intense human occupation. Stone tool manufacturing was undertaken principally in the southern end of the main occupied area, and since this is the area where most of the stone tools were also found, it is likely that most of the tool use occurred here as well (mainly wood working). This pattern is reflected both in the distribution of excavated and surface materials (see David 1987 for discussion of surface materials).

The single hearth excavated from SU2 appears towards the centre of the main charcoal and ash concentration. The surrounding area appears to have been kept clean of bone debris during SU1 times, as most bones are concentrated against the back wall during this time. Elsewhere I have shown that the large cores on the surface of Echidna's Rest are preferentially located against the back wall (David 1987). This is the case despite the fact that almost all other stone artefacts are found away from the wall, near and outside of the drip line. This may imply maintenance of the living space, which in turn may reflect either prolonged use of the site or an anticipated return after initial abandonment, or both.

The Echidna's Rest foragers also targeted a very specific prey range, as did the late Holocene inhabitants of Walkunder Arch Cave. Non-juvenile rock wallabies were hunted to the near-neglect of the abundant wallaroos. The reasons for this are unknown, but similar hunting patterns seem to have been maintained for over 3000 years in the Chillagoe region. What is now needed, however, is more data to determine whether the patterns observed at Echidna's Rest and elsewhere can be attributed to a general late Holocene Chillagoe way of life, or whether they merely represent local, site-specific histories.

In conclusion, the central point emerging from the Echidna's Rest excavations appears to be a major shift in site use after around 3000 years ago. Major late Holocene increases in deposition rates of all cultural materials are paralleled in other north Queensland sites (e.g. Mitchell River Cave, Early Man). This appears to be a distinctly regional rather than site-specific phenomenon and may well express a local variant of the "intensification" process argued by Lourandos (1983), the precise meaning of which still has to be worked out for north Queensland.

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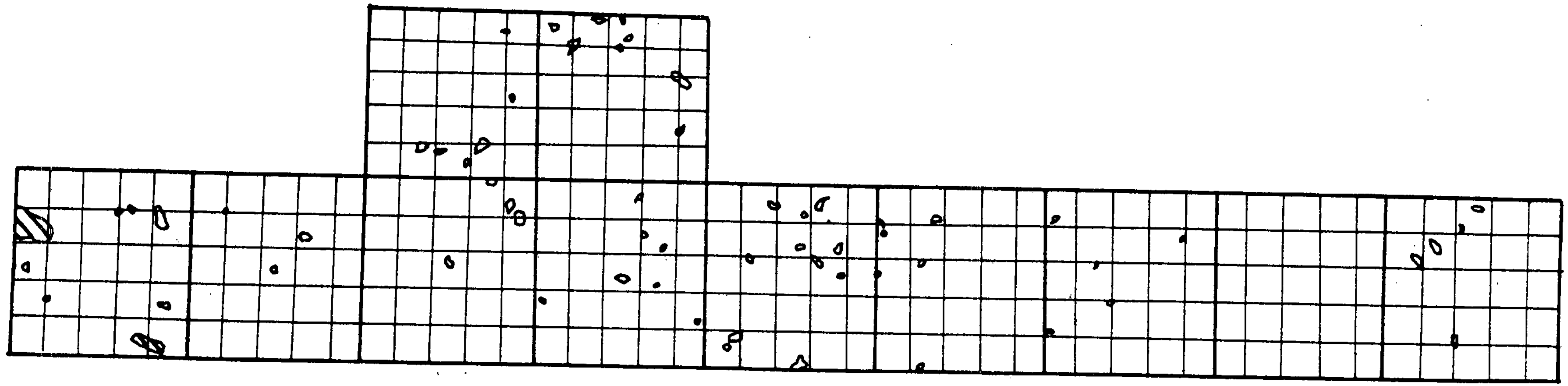

Figure 6. SU1: distribution of in situ artefacts.

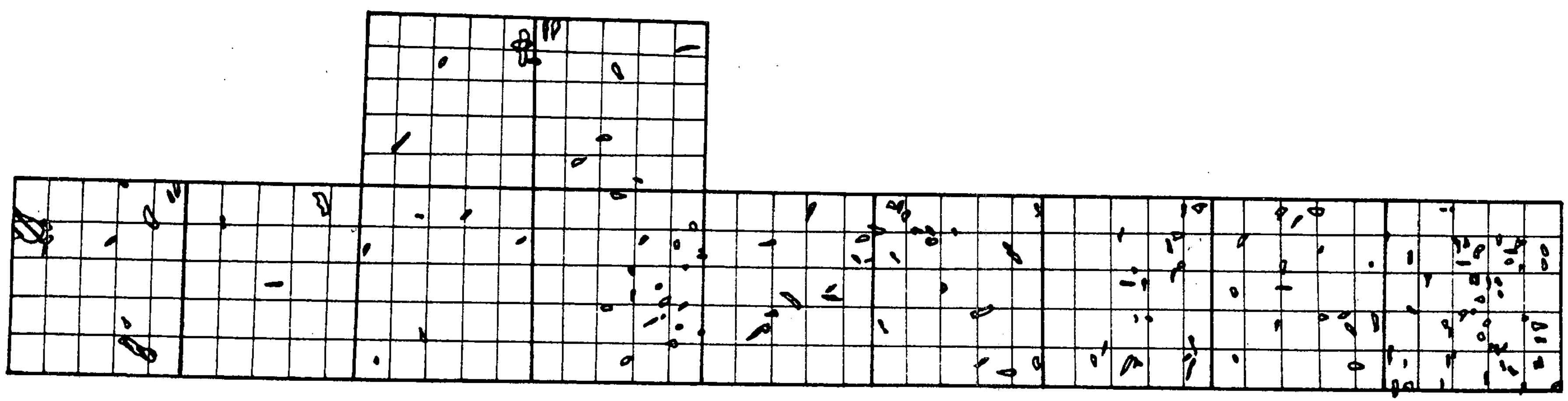

Figure 7. SU1: distribution of in situ bones.

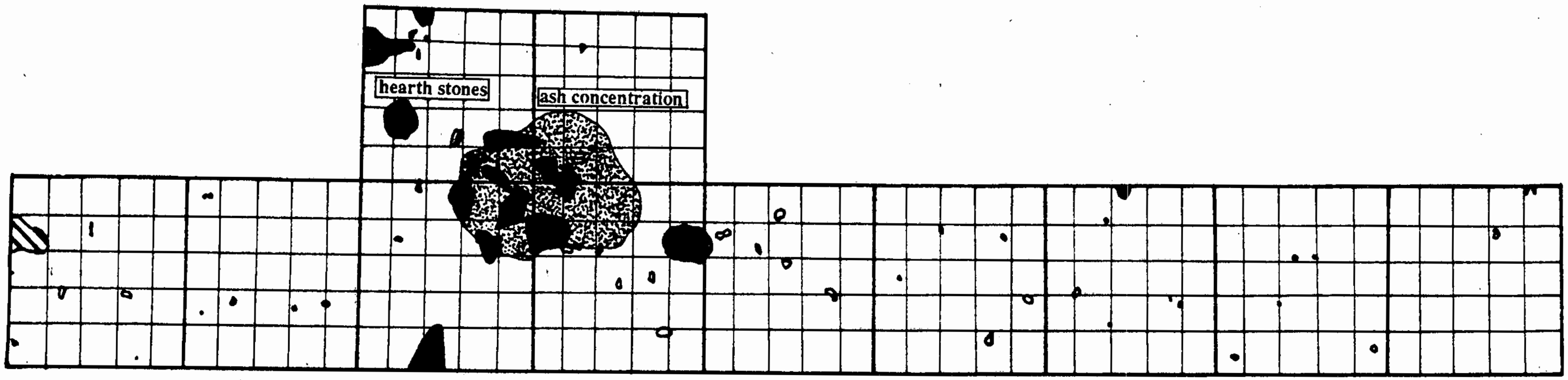

Figure 8. SU2: distribution of in situ artefacts.

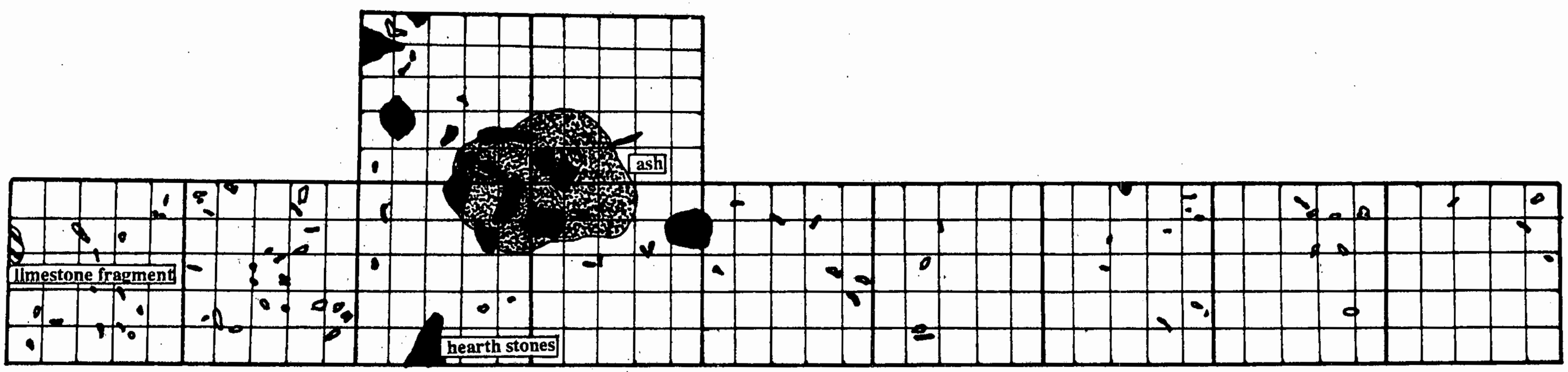

Figure 9. SU2: distribution of in situ bones.

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