A shell midden at Clybucca, near Kempsey, New South Wales

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This paper reports on Graham Connah's 1972 excavations at Clybucca, near Kempsey in northern New South Wales (Fig. 1). This has involved bringing together aspects of three unpublished B.A.(Hons) theses that resulted from those excavations, as well as re-examining the field records and reanalysing aspects of the excavated data. Analysis of Clybucca 3 suggests a shift in the subsistence strategy of the prehistoric inhabitants away from an economy based on shellfish toward one based on a broader range of resources available from an estuarine and a terrestrial environment. In addition, this paper looks at why subsistence strategies might have changed and discusses the Clybucca 3 data in light of two explanations for mid-Holocene changes of this sort currently found in the literature.

Since McCarthy (1943a, 1943b) a number of papers have been published concerning the human prehistory of the north coast of New South Wales. Campbell (1972) published a series of radiocarbon dates generated by field research in the Macleay River Valley (Campbell 1969), Bailey (1975) reported on studies carried out along the Richmond River to the north at Ballina in the mid-1970s and Connah (1975, 1976) reported that the University of New England was following up on Campbell's initial unpublished work. Coleman (1980, 1982) produced two papers discussing human subsistence strategies from a series of sites on the north coast, including Clybucca 3. In the early 1980s McBryde (1982) produced a monograph on sites in the Clarence River Valley, to the north-east of Grafton. Coleman (1978), Callaghan (1980), and Kelly (1980) analysed components of the Clybucca 3 assemblage but most of this research remains unpublished.

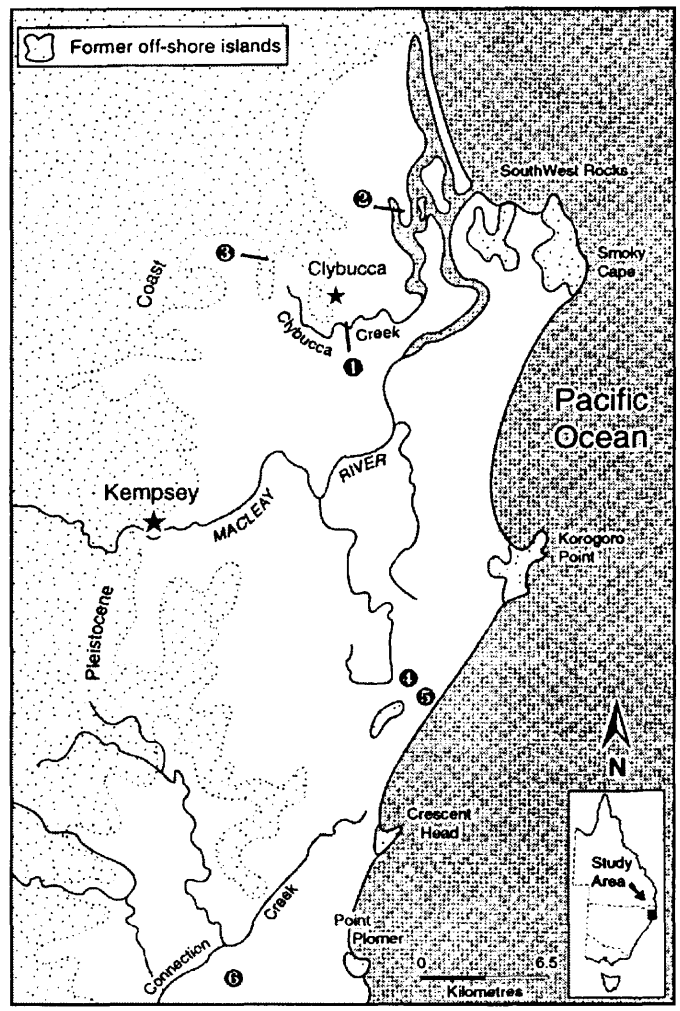

Figure 1 The lower Macleay River, in northern New South Wales. The numerals represent shell middens discussed in the text: 1 = Clybucca 1, 2 = Stuart's Point, 3 = Clybucca 3, 4 = Inner Barrier, 5 = Maguire's Crossing, 6 = Connection Creek.

Background physiography

The Clybucca 3 midden is located in the Macleay River Valley to the north-west of the village of Clybucca, 25 km north of Kempsey (Fig. 1). It lies on a former Pleistocene coastline (Hails 1968) and was the first in a series of shell middens excavated by Connah between 1972 and 1975, who selected it for excavation because of its distance, approximately 14 km inland, from the present coastline.

Geomorphological studies suggest that eustatic fluctuations apparent around the Australian land mass over the last 20,000 years began to stabilise by 6000 BP to within 1 m of present day sea level (Hails 1965; Thom 1974; Thom and Chappell 1975). Approximately 7000 years ago a barrier began to form between Korogoro Point and Smoky Cape (Fig. 1), which at the time would have been offshore islands (Hails 1968). As the barrier dunes developed, so the action of the sea upon the Pleistocene coastline diminished, resulting in the Macleay River forming an estuarine environment between Kempsey and the coast. Thus, despite relatively static sea levels from 6000 years ago, significant changes continued to occur in the Macleay River Valley as the river deposited sediments between Kempsey and its present outfall at Southwest Rocks (Walker 1970).

Thus, at the time of initial occupation, the lower Macleay River Valley was changing from a marine to an estuarine environment. From 5000 years ago Clybucca 3 began to form on the margins of this estuary, though humans were probably present in the area prior to this time (Voisey 1934). Clybucca 3 cannot be used to test this probability, even though Campbell (1969) provided evidence in support of Voisey's idea. In contrast, archaeological work carried out at Stuart's Point (Connah 1976; Callaghan 1980) provides evidence for a change in shellfish species, rather than a shift away from shellfish altogether, and radiocarbon dates indicate occupancy prior to the formation of the estuary. No shift in shellfish exploited appears at Clybucca 3, however the midden's abandonment may indicate when the estuary began to silt up.

When Europeans began visiting the Clybucca area in the 1830s and 40s, an extensive band of rainforest abutted the coastal fringe (Hodgkinson 1845, as quoted by McBryde

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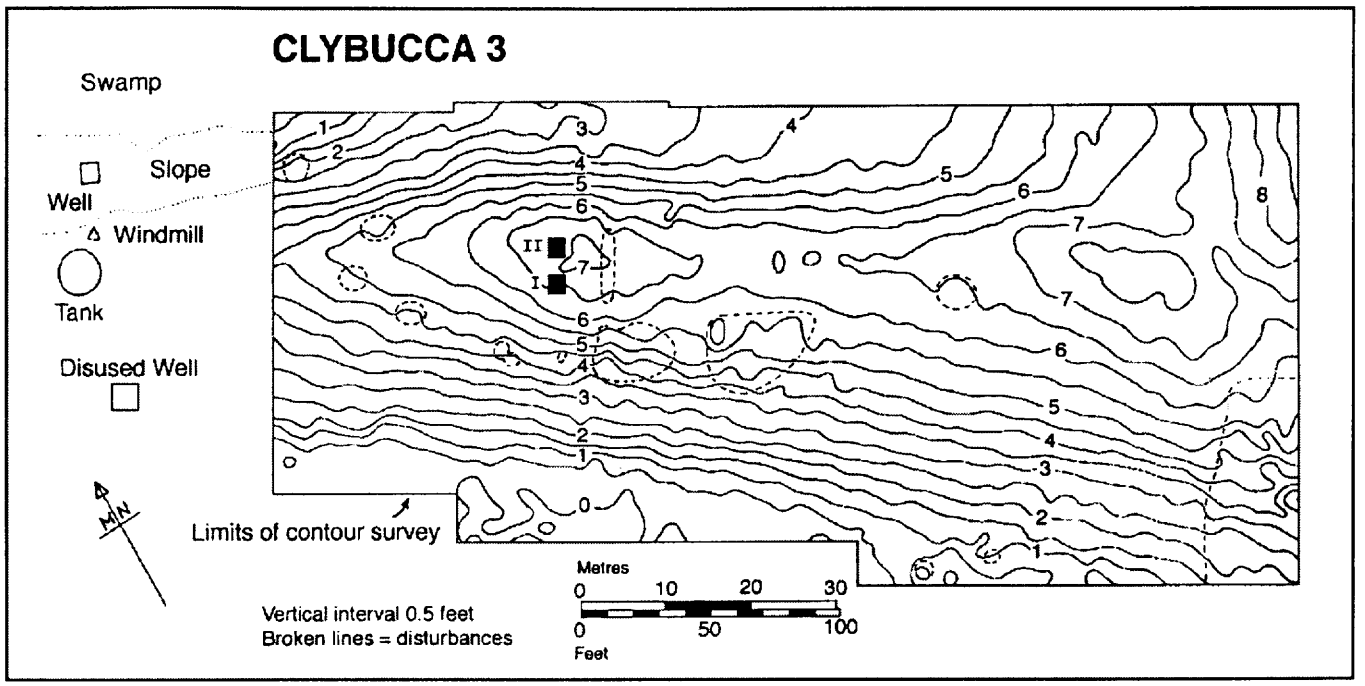

Figure 2 Clybucca 3 site plan. The midden extended further to both north-west and south-east. Contours are arbitrary.

1982:31). Henderson (1851) records the presence of a large lake to the south of the Macleay River mouth, and Pierce (1971) mentions what became known after European settlement as Clybucca Swamp, in the large embayment south of where Clybucca 3 is situated. These landform features no longer exist subsequent to European logging activity along the river and land clearing that followed the decline of logging (Thorpe 1968). Flood damage became a serious problem in the lower Macleay River Valley (Thorpe and Lewins 1953) and following bad flooding in the 1950s, Clybucca Swamp was drained as part of a larger flood mitigation program which continued into the 1960s (McDonald 1967; Lee 1969).

The excavation

The midden is situated on a former beach sand ridge at the head of a small bay (Connah 1978; Connah and Jones 1983). To the east of this sand ridge a long narrow peninsula projected southward. The midden measures 120 m E-W and 30 m N-S; two trenches (Cuttings I and II) were excavated, both toward the apex of the midden (Fig. 2). Initially material was removed from an area 2 x 2 m but due to time constraints and inclement weather the area of each trench was subsequently reduced to 2 x 1 m. The trenches were excavated in a series of arbitrary 10 cm spits. In Cutting I, Spit 1 was 2 x 2 m, Spits 2-11 were 2 x 1 m. In Cutting II Spits 1-3 were 2 x 2 m, Spits 4-13 were 2 x 1 m. A column sample was removed from the south-eastern baulk of Cutting II, marked 'Z' in Figure 3 (see Stratigraphy section). This was also recorded in arbitrary 10 cm spits.

Weights were not recorded for the material removed from each spit, making comparison between the upper (larger area) and lower (smaller area) spits difficult. This is not a significant problem in Cutting I but does present a problem in Cutting II where a considerable amount of material was removed from

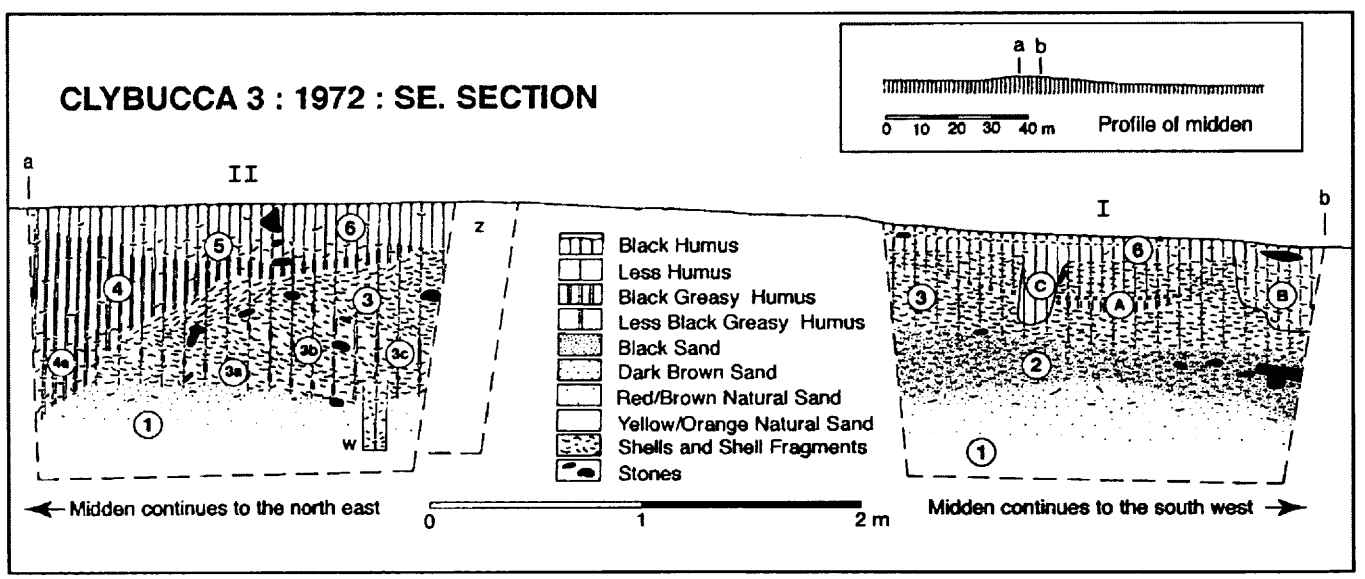

Figure 3 South-east section drawings from both cuttings. The letters represent: a-b = location of the cuttings on the midden profile; w = Campbell's auger hole; z = Column sample. Cutting walls were battered, that is, excavated sloping inward to minimise collapse.

Spits 1-3. To deal with this problem the archaeological components obtained from Spits 1-3 in Cutting II have been halved, in an attempt to reflect the reduced area excavated from Spits 4-13. This is discussed further below.

Stratigraphy

The section diagrams (Fig. 3) show a complex stratification of six units, or layers, indicating human activity. Figure 3 shows each unit represented by Arabic numerals and each is described below.

Cutting I

Unit 1 at the base of this cutting consists of sand, ranging in colour from yellow at the base, through red to dark brown at the upper margin. It contains no archaeological material. Unit 1 represents the Pleistocene beach sand ridge upon which the midden developed and this unit coincides with Spits 9-11.

Unit 2 consists of a matrix of humus and blackened sand mixed with shells and shell fragments. The unit coincides with Spits 7-8 and the north-east part of Spit 6. This unit has a high stone artefact content.

Unit 3 includes a number of features and appears to represent the most consistent period of human use in the midden. Shells and shell fragments make up almost the entire matrix and there have been three pits excavated into the unit at different times. Feature A contains a burial at the base of a shallow, bowl-shaped pit, which extends from the margin of Feature B across to the north-east side of the cutting, with the burial resting at its base. Feature B is more difficult to interpret, but it appears to have been excavated some time before Feature C. The purpose of Feature C is not known, though it has the characteristics of an old post-hole and, coincidentally, the remains of a fence were present in the vicinity of the midden at the time of excavation. The material found in this pit originates from the younger Unit 6 above and the feature cuts through and therefore postdates Feature A. Unit 3 coincides with Spits 2-5 and the south-west portion of Spit 6.

Units 4 and 5 do not appear in Cutting 1.

Unit 6 at the surface of the cutting consists mainly of black humus and sandy soil, with a low shell content. There are stone artefacts and human and faunal bones present in this unit which precedes the site's abandonment at approximately 2400 BP. Unit 6 corresponds to Spit 1 in this cutting.

Cutting II

Unit 1 corresponds to Unit 1 in Cutting I, this unit coincides with Spits 10-13.

Unit 2 does not appear in this cutting.

Unit 3 also resembles the matrix found in Unit 3 of Cutting I, but in Cutting II it contains sub-units very different to those in Cutting I (Units 3a, 3b and 3c). These may represent specific occupation events or even short breaks in occupation. This unit coincides with Spits 4-9 (Fig. 3).

Unit 4 consists of black, greasy humus with sparse occurrences of shells and shell fragments. This unit corresponds with Spits 2-10, increasing where Unit 3 decreases (Fig. 3). Cultural material occurs throughout, though it is sparse through Spits 4-5. Scattered and fragmentary human remains occur particularly in Spits 2-3 and also in Spits 7-9. Within Unit 4 there is a denser area of shell; Unit 4a has a matrix similar to Unit 3a and may have formed at the same time.

Unit 5 rests in a depression at the upper contact between Units 4 and 6. It consists of a matrix of humus and shell with some bone and stone artefacts. This unit coincides with Spit 3 but does not comprise the entire spit – it only occurs toward the centre of the section as a lens of cultural deposit.

Unit 6 correlates with Unit 6 in Cutting I and coincides with Spits 1-2 of Cutting II. The matrix consists of a sandy, clayey soil through black humus with associated cultural material (stone artefacts, human and animal bone). Shell content is low compared to the total amount of material removed during archaeological excavation.

Chronology

The antiquity of human activity in the Clybucca district has been of continuing interest since Voisey (1934). Campbell's (1972) proposition that the lower Macleay River shell middens could be as old as 30,000 years echoed Voisey and the hypothesis put forward by McCarthy (1943b), who argued for similarities between stone artefacts at Clybucca and those of the Kartan industry found on Kangaroo Island in South Australia. Table 1 lists the dates mentioned in the text.

Radiocarbon samples taken in the late 1960s from middens in the area of Clybucca 3 (Fig. 1) provided a number of dates for the lower Macleay River valley (Table 1). At Connection Creek, south of Clybucca, dates of 4850±160 BP and 3460±120 BP (GaK 2458 and GaK 2459) were obtained from samples of shell taken from test auger cores and a date of 1210±90 BP (GaK 2456) was obtained from a charcoal sample taken from a shell midden in eroding sand dunes at Maguire's Crossing (Campbell 1972). A sample of charcoal collected by Campbell (1972) from an old cutting through the Clybucca 1 shell midden, returned an age of 3850±140 BP (GaK 2457).

In the early to mid-1970s, Connah (1975, 1976) extended the range of dates available for the lower Macleay River

Date	Sample #	Location	Reference
1210±90	GaK 2456	Connection Creek	Campbell 1972
3460±120	GaK 2459	Connection Creek	Campbell 1972
4850±160	GaK 2458	Connection Creek	Campbell 1972
3850±140	GaK 2457	Clybucca 1	Campbell 1972
3360±120	SUA 274	Clybucca 3	Connah 1975
4260±120	SUA 275	Clybucca 3	Connah 1975
5120±150	SUA 276	Clybucca 3	Connah 1975
3340±100	SUA 395/2	Connection Creek	Connah 1975
3380±100	SUA 396/2	Connection Creek	Connah 1975
3400±100	SUA 396/1	Connection Creek	Connah 1975
3720±100	SUA 395/1	Connection Creek	Connah 1975
3790±130	SUA 397	Connection Creek	Connah 1975
915±105	SUA 486	Maguire's Crossing	Connah 1976
925±105	SUA 485	Maguire's Crossing	Connah 1976
1060±100	SUA 483	Inner Barrier 4	Connah 1976
2550±105	SUA 487	Inner Barrier 4	Connah 1976
3750±280	SUA 482	Stuart's Point	Connah 1976
9320±160	SUA 484	Stuart's Point	Connah 1976

Table 1 Dates from the Lower Macleay River Valley.

valley. Samples of charcoal taken from Cutting I of Clybucca 3 during the excavations in 1972 returned dates of 3360±120 BP (SUA 274) at a depth of 30-40 cm, 4260±120 BP (SUA 275) at a depth of 60-70 cm, and a maximum age of 5120±150 BP (SUA 276) at a depth of 90-110 cm, immediately above the beach sand ridge (Connah 1975). The excavation was extended into the beach sand ridge to establish whether cultural material occurred below the midden; none was found. The base of the sand ridge was not located.

In 1973 Connah (1975) excavated a shell midden at Connection Creek (Connection Creek 1), 4 km inland from the present shoreline, in an area which was possibly an estuary at some time in the past. Five dates were obtained from both shell and charcoal material and were compared by Connah to Campbell's (1972) dates. The dates returned were as follows; 3720±100 BP (SUA 395/1) from a charcoal sample at a depth of 50-60 cm; 3340±100 BP (SUA 395/2) from an oyster (*Crassostrea commercialis*) shell sample at a depth of 50-60 cm; 3400±100 BP (SUA 396/1) from a charcoal sample at a depth of 100-110 cm; 3380±100 BP (SUA 396/2) from a cockle (*Anadara trapezia*) shell sample at a depth of 100-110 cm; and, 3790±130 BP (SUA 397) from a charcoal sample at a depth of 130-140 cm (Connah 1975).

In 1974 excavations were conducted at Maguire's Crossing (Fig. 1) and charcoal samples tested returned dates of 925±105 BP (SUA 485) from Layer 4a and 915±105 BP (SUA 486) from Layer 6. These dates were compared with Campbell's (1972) dates for the same midden and Connah (1976) comments on the differences apparent. Inner Barrier 4 (Fig. 1) was also excavated in 1974 and dates returned on charcoal from this midden were 1060±100 BP (SUA 483) at Layer 2 and 2550±105 BP (SUA 487) at Layer 3a (Connah 1976).

In 1974 and 1975 Connah also excavated at Stuart's Point (Fig. 1), a large midden to the north-east of Clybucca. Charcoal obtained from this midden returned dates of 9320±160 BP (SUA 484) from Layer 2 (Spit 13) and 3750±280 BP (SUA 482) from Layer 2 (Spits 8-9) (Connah 1976). The Stuart's Point midden exhibits clearly a transition in resource exploitation by humans and is at present, the oldest midden dated on the north coast of New South Wales.

This range of dates (Table 1) indicates humans were occupying the region at least as long ago as 5000 years, possibly as far back as the terminal Pleistocene. Figure 4 shows a deposition rate for Clybucca 3 that seems to have been constant and stable. Assuming a constant deposition rate it can be argued this midden was abandoned at approximately 2300 years bp, thus having been occupied for approximately 2700 years.

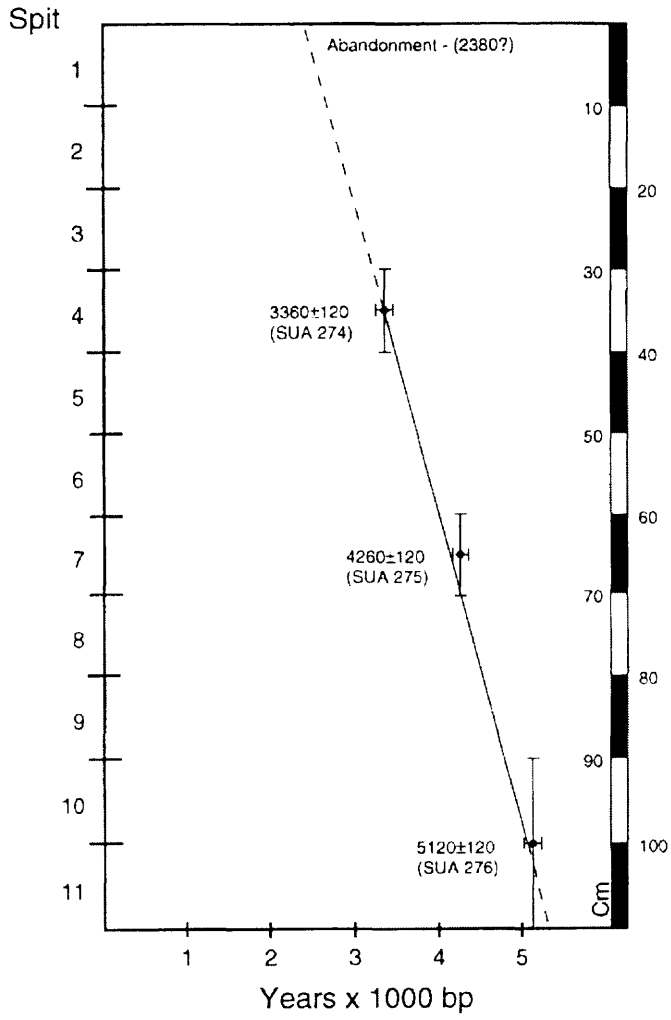

Figure 4 Clybucca 3: age/depth curve. Radiocarbon dates obtained from charcoal samples from Cutting I.

Archaeological material

Human

Human skeletal material was excavated from both trenches at Clybucca 3. One actual burial was found in Cutting I (Fig. 3). No formal study beyond the identification of elements has been carried out; the majority of the material present was fragmented and few bones were well preserved. A total of 461 human bones and bone fragments were identifiable to element. Many phalanges were identifiable to left or right side.

Cutting I A burial pit was located in Spit 4 at a depth of approximately 30-40 cm. A large portion of the burial pit extended back into the south-eastern wall of the cutting. Removal of the entire burial was not carried out. The recovered portion included elements of the appendicular skeleton of two adults. None of the bone material was burnt. Most human material in this cutting was located in Spits 1 through 4.

Cutting II Human skeletal remains were found in every spit to a depth of 1 m at Spit 9. Bone elements removed from Cutting II were comparable to those found in Cutting I though no burial was located in this trench. None of this material was burnt.

Vertebrate fauna

Coleman (1978) recorded a total of 781.53 g of faunal bone, 313.36 g from Cutting I and 468.17 g from Cutting II. Both cuttings contained terrestrial (514.64 g of the total weight) and non-terrestrial (266.89 g of the total) species, bird bone comprised 4.11 g (1.3%) of the material from Cutting I, 5.2 g (1.1%) from Cutting II. Bird bone is not considered further here.

The most frequently occurring identifiable elements were dentaries, pre-maxillae, isolated teeth, and phalanges. Less

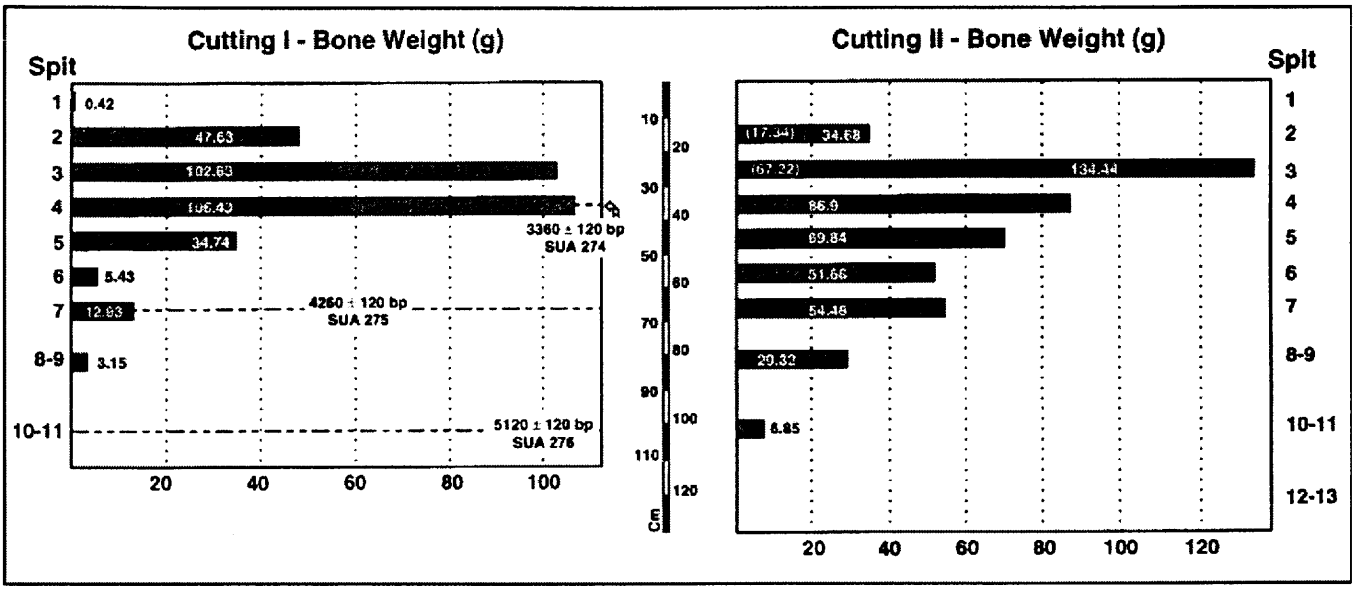

Figure 5 Clybucca 3: faunal material in both cuttings. Weight in g.

common were calcaneae, innominate fragments, four femur fragments and three metatarsal bones. The non-terrestrial component was made up of the bones of fish, from which Coleman (1978) was able to identify 102 individual teleost fishes. Fish bone first appears in the archaeological sequence in Spits 8-9 (1.6 g or 0.87% of the faunal bone total) in Cutting I and Spits 10-11 (1.2 g or 1.46% of the total) in Cutting II. It becomes more common however, in Spits 3 and 4 of both Cuttings, (135.84 g, or 73.64% of the faunal bone total in Cutting I and 47.49 g, or 57.59% of the total in Cutting II). Figure 5 shows the bones weights in each spit of both cuttings. See Discussion for species breakdown.

Invertebrate fauna

The shell component of Clybucca 3 was recovered from Cutting II - no records were kept of the shell material removed from Cutting I. Shellfish species were present in such high proportions relative to other archaeological components, they were considered separately (Callaghan 1980). Figure 6 presents the weight of shell excavated from Cutting II. Crustacean remains were also found (1.87 g, 0.24% of the total fauna assemblage of 781.53 g). Crustaceans are not considered further here.

Apart from the two main 'economic' species present, *Anadara trapezia* and *Crassostrea commercialis* (also placed in the genera *Ostrea* and *Saccostrea* by Robinson and Gibbs 1982), the invertebrate study and analysis of the column sample found the following species present: *Pyrazus ebeninus* (Hercules' Club Shell; Sydney Mud-whelk), *Velacumantis australis*, and *Plebidonax deltoides* (Pipi). Table 2 lists the shell content of Cutting II.

Stone assemblage

The stone component from Clybucca 3 (Kelly 1980) was reanalysed for this paper. Developments in technological analysis since 1980 made this reanalysis essential. Consequently 39 'artefacts' were reclassified as non-artefactual, two artefacts were found to be unprovenanced, leading to the removal of all 41 of these items from further study. A total of 1488 stone artefacts were thus analysed in contrast to 1529 in Kelly (1980), with raw material types including basalt, chert, siltstone, greywacke, sandstone, conglomerate and quartz. Also included with the artefacts were a number of stones attached to oyster shells. The implications of these are discussed below.

A total of 489 artefacts were identified from Cutting I, including 296 (60.5%) flakes and 55 (11.3%) retouched flakes, and 1919 g of non-artefactual stones with shells attached. A total of 998 artefacts were removed from Cutting II including 580 (58.1%) flakes and 139 (13.9%) retouched flakes and 9735 g of non-artefactual stones with shells attached. Backed

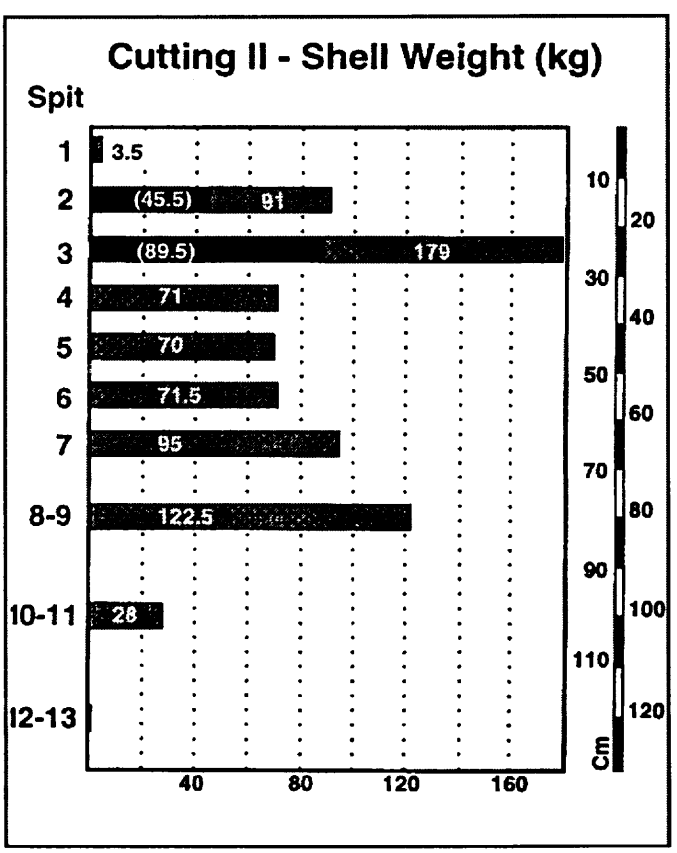

Figure 6 Clybucca 3: shell material in Cutting II. Weight in kg.

Spit	Species1	Species2	Other	Unidentified	Total	%
1	1.5	0.5	0.0	1.5	3.5	0.5
2	41.5	2.0	0.5	47.0	91.0	12.4
3	78.5	3.0	1.0	96.5	179.0	24.5
4	31.5	2.0	0.5	37.0	71.0	9.7
5	30.0	2.0	0.5	37.5	70.0	9.6
6	28.0	2.5	1.0	40.0	71.5	9.8
7	43.5	2.5	0.5	48.5	95.0	12.9
8-9	51.0	6.0	0.5	65.0	122.5	16.7
10-11	12.0	1.0	0.5	14.5	28.0	3.8
12-13	0.5	0.0	0.0	0.5	1.0	0.2
Total	318.0	21.5	5.0	388.0	732.5	
%	43.4	2.9	0.7	53.0		

Table 2 Shell content (in kg) from Cutting II with percentage of total. Adapted from Callaghan (1980:102). Species 1=*Crassostrea commercialis*, Species 2=*Anadara trapezia*. These figures do not include column samples.

artefacts first appear in Spit 7 of Cutting I (n=7 or 4.32% of the total artefacts in the spit) and in Spit 8-9 of Cutting II (n=8 or 5.8% of the total). Table 3 provides the breakdown of all artefacts identified from the excavation; backed artefacts are included in the 'RF' column. Figure 7 shows the artefact density in each spit of both cuttings.

Column sample

A column sample was removed from the south-western end of the south-eastern section of Cutting II (Figs 3 and 8) in arbitrary spits 10 cm deep with an area of 30 x 30 cm. All material in this sample was weighed and retained at the time of excavation. Hungerford's (unpublished) analysis of this sample has shown a paucity of bone and artefacts, however shell remains are well represented.

Spit	F	RF	FP	C	EG	A	Total	%
				CUTTING I				
1	21	6	5	2	1	4	39	7.6
2	0	1	0	0	0	0	1	0.2
3	25	14	3	4	0	7	53	10.8
4	10	6	4	0	1	0	21	4.3
5	8	4	8	0	1	0	21	4.3
6	62	3	14	7	2	20	108	22.0
7	116	19	5	2	2	18	162	33.2
8-9	53	2	6	2	5	13	81	16.5
10-11	1	0	2	0	0	0	3	0.6
Total	296	55	47	17	12	62	489	
%	60.5	11.3	9.6	3.5	2.5	12.6		
				CUTTING II				
1	22	4	4	1	1	0	32	3.2
2	118	38	14	9	5	63	248	24.8
3	182	35	16	9	3	17	262	26.2
4	53	15	19	4	1	0	92	9.2
5	61	61	11	2	1	8	97	9.7
6	57	57	9	2	3	9	91	9.1
7	9	6	2	6	0	6	29	2.9
8-9	75	13	11	6	0	33	138	13.8
10-11	3	3	2	0	1	0	9	1.0
12-13	0	0	0	0	0	0	0	0.0
Total	580	139	89	39	15	136	998	
%	58.1	13.9	8.9	3.9	1.5	13.6		

Table 3 Stone artefacts from both cuttings. F=flake, RF=retouched flake, FP=flaked piece, C=core, EG=edge ground, A=amorphous.

Discussion

Approximately 7.4 m^3 of material was excavated from Clybucca 3, from an approximate total volume of 380 m^3; this represents only 1.94% of the volume of the midden. Problems with midden analysis have been presented by Bowdler (1983), Mackay and White (1987) and Claassen (1991) regarding the 'representativeness' of the area excavated, in the context of the midden as a whole. However, 1.94% may be a representative sample of the shell content because by weight shell is clearly the dominant component (other than soil), shown by the column sample where shell (49.45 kg) represents 34.5% of the total sample (143.175 kg). Moreover, in contrast to the shell is the greater variation within the other archaeological components of both cuttings, so the results obtained here should not be applied across the whole midden. It is clear that any extrapolation of the evidence, or the use of interpretations of the evidence to explain human activity within the midden, should be done with great care. With these concerns in mind it is still possible to determine trends appearing within the Clybucca 3 midden deposit.

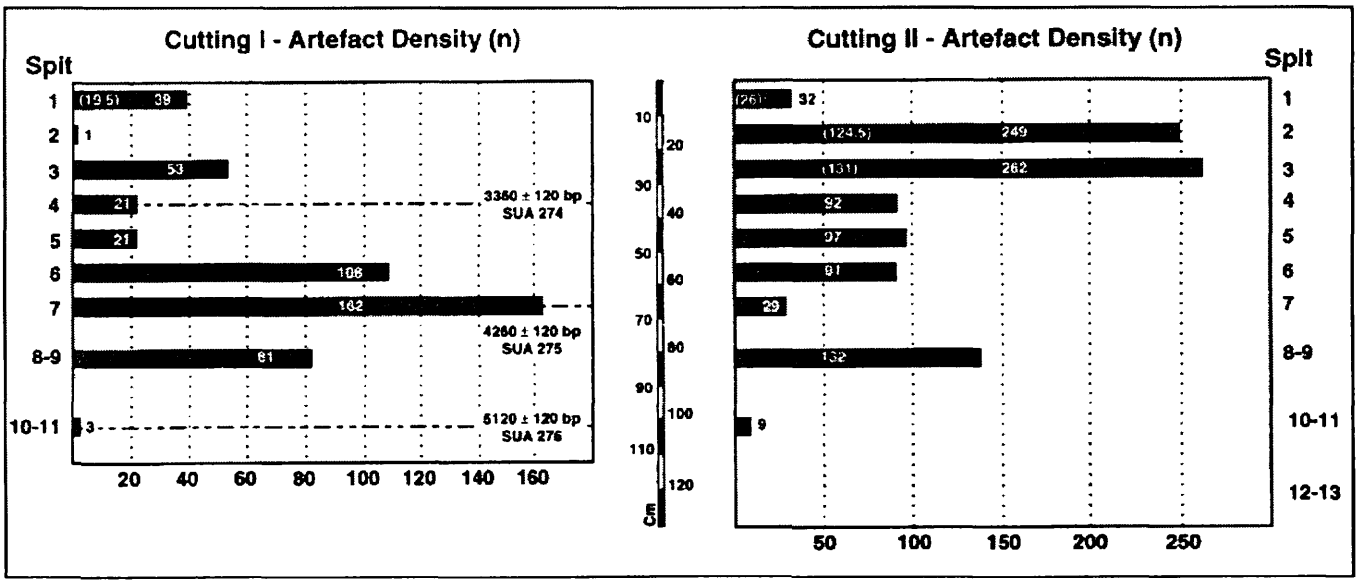

Figure 7 Clybucca 3: artefact density in both cuttings.

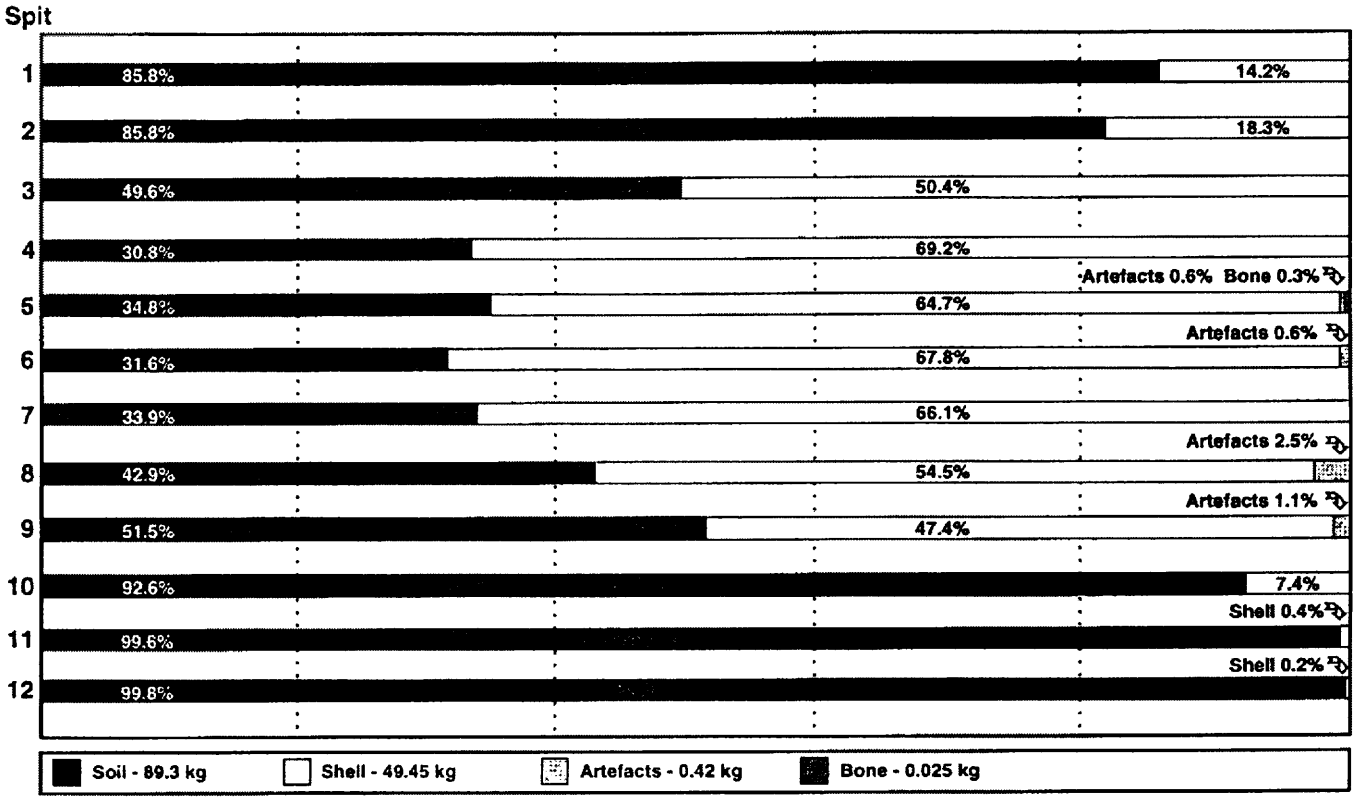

Figure 8 Clybucca 3: column sample from Cutting II (weight in kg). Total weight of each component (inset), percentage in each spit are shown.

One trend immediately identifiable is the large amount of material removed from the first three spits of Cutting II as illustrated in Figures 5, 6 and 7, attributable to the increased area of excavation. In Figures 6 and 7 a bimodal distribution of cultural material appears with peaks in Spits 2-3 and 8-9. Regrettably there is no way of identifying how much of the material in Spits 1-3 of Cutting II is a reflection of the larger excavation area at those levels, or how much is a representation of prehistoric human activity. This problem cannot be addressed effectively without the total weights of material removed from each spit.

Excavating in arbitrary spits also presents problems. Use of the technique was justified because changes in stratigraphic units were difficult to identify during excavation, despite the fact that they appear clearly in the section diagrams. The changing size of the excavation area and the limitations apparent when using arbitrary spits especially for Cutting II where the layers pitch downward (see Fig. 3), may reduce the efficacy of any interpretation of that cutting. For Cutting I however, the stratigraphic layers appear to correlate more closely with the excavation technique used. Consequently Cutting I may provide a more representative view of prehistoric human activity at Clybucca 3.

Stratigraphic integrity

Through time the contents of archaeological sites can move. Matthews (1965) discussed stratigraphic disturbance in sites and other researchers have shown how artefacts can move vertically, as a result of human activity on the midden, succumbing to a sorting effect where smaller artefacts migrate downward and larger ones move upward (Stockton 1973; Siiriäinen 1977). Shell middens appear to be less susceptible to vertical displacement due to a 'bonding' effect (Hughes and Lampert 1977) of the shells where increased compaction through time and the action of water leaching downward lead to the formation of a robust shell 'cap'. This capping effect preserves the stratigraphy of the deposit more effectively than does the unconsolidated matrix found most often in other Australian site types.

Any temporal and/or spatial movement has a direct influence on site interpretation so the primary concern here is to ascertain the integrity of Clybucca 3 relative to such displacement. Taking flake weight as an indicator of artefact size, it appears the pattern of sorting mentioned above, and described by Stockton (1973) and Siiriäinen (1977), does not occur through the Clybucca 3 deposit. Sorting would be manifest as a consistent decrease in flake weight with depth, but as shown in Figure 9 this does not happen. A random distribution of flake weights occurs through both cuttings, though sorting may be argued for Spits 7-11 in Cutting I.

Clybucca 3 shows stratigraphic integrity, to what degree cannot be quantified here. The shell content appears to have bonded the whole deposit post-abandonment, preserving distinct units at least to the point where they do not blend at their borders into an indistinct, mixed unit of material that Stockton (1973) suggests can be up to 16 cm thick, and can represent hundreds or even thousands of years (Hughes and Lampert 1977). This cannot be said for the site at the time of occupation however. The area of Cutting II appears to have undergone some disturbance during midden use and this is discussed further below. Cutting I appears to have been more stable with horizontal units of deposition, a burial that is relatively undisturbed and a series of three dates that occur in sequence.

Archaeological material

Four patellae, two right and two left, indicate the presence of two adult human skeletons in the midden. In Spit 2 of

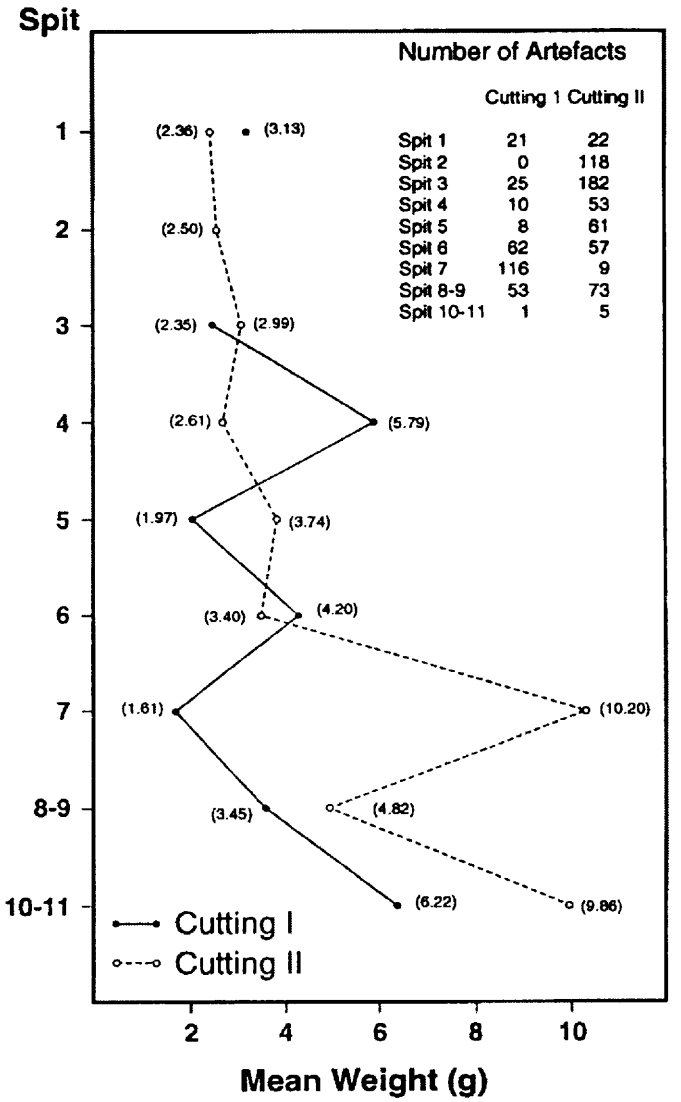

Figure 9 Flake weight means (in g) from each spit in both cuttings. No artefacts were found in Cutting I, Spit 2. Actual mean weight is shown in parentheses.

Scientific Name	Common Name	Spit(s)	MNI
	CUTTING I		
Terrestrial			
Macropus spp.		2	1
Rattus fuscipes	Southern Bush Rat	3	1
Trichosurus vulpecula	Brush-tailed Possum	2, 4-5	2
Thylogale thetis	Red-necked Pademelon	4	1
Wallabia bicolor	Swamp Wallaby	3, 7	2
Non-terrestrial			
Mylio australia	Black Bream	1-5, 7-9	
Platycephalus fusca	Dusky Flathead	2-5	
Sciaenia antarctica	Mulloway	2-3	
	CUTTING II		
Terrestrial			
Aepyprymnus rufescens	Rufus Rat Kangaroo	2, 8-9	2
Dasyurus viverrinus	Eastern Native Cat	3	1
Isoodon obesulus	Short-nosed Bandicoot	7	1
Macropus spp.		3-5, 7	2
Potorus tridactylus	Long-nosed Rat Kangaroo	5	1
Rattus fuscipes	Southern Bush Rat	4	1
Thylogale thetis	Red-necked Pademelon	3-4, 6	2
Wallabia bicolor	Swamp Wallaby	2, 6	2
Non-terrestrial			
Mylio australia	Black Bream	2-9	
Platycephalus fusca	Dusky Flathead	2-9	
Sciaenia antarctica	Mulloway	2-3	

Table 4 Animals identified from both cuttings.

Cutting II three deciduous teeth were recovered (right central incisor, right canine, right first molar), suggesting the presence of a juvenile. No other skeletal evidence of a sub-adult individual was recovered. Young bones have active zones of growth, blood-engorged epiphyses and extensive areas of cartilage so they would not survive long after interment. Determining any relationship between these three individuals, that is whether all three or any two were interred at the same time, was not possible.

In calculating the minimum number of individual (MNI) terrestrial animals, Coleman (1978) used the following procedure: where a gap of one or more spits occurred between bones identified to the same species, the bones were assumed to be from different individuals (Coleman 1978:77). Calculation of MNI for fish involved: 'counting the left or right of the most commonly occurring bone' (Coleman 1978:76). Species identified are presented in Table 4.

Along with calculating MNI, Coleman (1978) used the faunal evidence to assess the possibility of Cutting II representing a zone of redeposition where refuse cleared from the living area had been discarded. She rejected this possibility, however, concluding the supporting evidence was not convincing. The fauna alone may not provide support for this idea but when taken together with the stone artefacts and scattered human remains present, Cutting II may represent a discard zone. The pattern of shell discard in Cutting II supports this view. Large amounts of shell occur low in the trench but quantities decline towards the top of the midden. However, at Spit 3 there is an increase in shell content and this may be a reflection of material being cleared from other areas.

Campbell (1969) took two auger samples from the midden and found in both that *A. trapezia* (Sydney Cockle) was present in the lowest levels, her diagrams (Campbell 1969:27 a-c) show a clear change from *A. trapezia* to *C. commercialis* (Sydney Rock Oyster). Campbell's Auger Hole 2 can be seen in the Cutting II section drawing (Fig. 3) where it was relocated by the 1972 field team. One of Callaghan's (1980) aims was to determine what shellfish species were present in the assemblages he studied, but his analysis of both the excavated shell and Hungerford's unpublished results from the column sample analysis did not replicate the results produced by Campbell's earlier work. Callaghan (1980), however, was unable to establish a clear change from *A. trapezia* to *C. commercialis* in the Clybucca 3 shell component.

Both Coleman (1978) and Callaghan (1980) discuss this problem. Coleman suggests the stratigraphy for the site displayed a high degree of disturbance and that the original auger holes at Clybucca 3 probably entered a concentration of *A. trapezia* that did not represent the midden as a whole. The 1972 excavation provides evidence to suggest it is unwise to extrapolate across a site using the evidence obtained from only two auger samples. Moreover, the use of an auger as a sampling tool is itself a problem because these implements

introduce specific difficulties of their own, including destruction of depositional integrity. In this situation the retention of the shell component from Cutting I would have been an advantage.

Within the shell component Callaghan (1980) argued *P. ebeninus* may have accounted for only 2% of the shellfish in the prehistoric human diet associated with the midden, whilst *V. australis* probably contributed nothing at all. This latter species could indeed have been brought into the site unwittingly, attached to other, larger shells. No indication of the contribution of *P. deltoides* is offered, suggesting its contribution to diet was also negligible, possibly reflecting the distance of suitable littoral environments. However, confusion exists in general regarding what constitutes 'contribution to diet', and for a general discussion of this topic see Rowland (1994).

In addition to the stone artefacts analysed were the non-artefactual stones with *C. commercialis* shells attached to them. At Connection Creek, Connah (1975:29) found that shells often 'had marked grooves on their backs', indicating, most probably, an attachment to mangrove roots. No shells with this 'mangrove root' pattern were retrieved from Clybucca 3 suggesting that even though an estuary existed at Clybucca, it may not have been a low energy (slow flowing), 'quiet' environment. The oyster shells indicate that, at least in parts of the estuary, stony conditions prevailed suggesting moving water and probably a tidal estuarine environment within which both *Crassostrea* and *Anadara* could live (McMichael 1962; Child 1977). The shell remains from Clybucca 3 support this with both species being found throughout the midden sequence, with *C. commercialis* dominant.

Prehistoric subsistence

The main phase of midden development, documented by the 1972 excavations, began at 5000 years BP with the coast gradually moving eastward, an estuary forming in its place. This environmental shift is indicated archaeologically at Clybucca 3 only in the location of the midden itself, and not through the material within the midden deposit. With mound development beginning at approximately 5000 years ago, and ending approximately 2700 years later at 2300 years BP, the midden appears to reflect the exact period of time through which the estuary itself existed. Clybucca 3 develops first as a shell dump, but at some time around 4000 years ago it begins to exhibit a multipurpose use. One shell species (*C. commercialis*) dominates the resource base but there is evidence of activities other than shell deposition at the site.

Fish bones appear early in the archaeological record of this site at approximately 5000 years but do not become common until approximately 3300 years. Intensive fishing appears to have been a later development at Clybucca 3. Coleman (1978, 1980) was able to suggest the time of the year that fishing occurred and the techniques that may have been employed. Her evidence argues the use of both single and multiple pronged spears and nets, which indicates considerable time and effort were invested in the collection of this resource. Coleman (1980) argues cogently that fishing occurred during the summer months (January-March) based on the species represented, but insufficient evidence is available to suggest that fishing expeditions were the only time during which the site was occupied. The species targeted provide not only an indication of the time of year but also the environmental conditions in the vicinity of Clybucca 3. Of the fish bone analysed, Black Bream (*Mylio australis*) and Dusky Flathead (*Platycephalus fusca*) made up 91% of the total, and both these species prefer estuarine conditions.

Coleman (1978) found a greater amount of faunal material in Cutting II but she was unconvinced of its importance in showing that area as a redeposition zone when compared with the bones in Cutting I. Clearly more archaeological material is present in Cutting II than in Cutting I, and if all archaeological components are considered together, the 'clearing' hypothesis is still a possible explanation. The fact that human remains are scattered throughout Cutting II and are almost entirely absent below the burial in Cutting I is strong support for Coleman's original redeposition hypothesis.

Redeposition, however, does not explain why the increase of material in Cutting II occurred. An increase in material would result from more intensive human activity at the midden site, and the appearance of more effective fishing techniques such as spear and/or net fishing (Coleman 1978, 1980) at 3500 years supports this view. The stimulus for this intensive activity may have been attributable to many factors, two of which (population increase and risk reduction) are discussed below.

Analysis of the stone artefact assemblage shows local raw materials to be the most popular, and that retouched artefacts are relatively common (Table 3). The midden lies over the Kempsey Beds which comprise greywacke, siltstone and conglomerates, and is also associated with the Macleay River and its sandstones, silt and gravels. Also found at Clybucca 3, though uncommon, were chalcedony and ochre which may have been introduced. No local source of these raw materials has been found. McQueen (1982) however, mentions a chalcedony source to the north in the Richmond River valley.

When compared to other sites on the north coast, Clybucca 3 shows a high percentage of retouched artefacts. These occur throughout the midden to a depth of 1 m, with the main concentrations occurring from Spit 4 upward in Cutting II. Retouched artefacts occurring at Schnapper Point and Wombah (McBryde 1982) comprise 1.5% and 6.0% of each stone artefact assemblage respectively. At Stuart's Point, Kelly (1980) identified 72 retouched flakes, 4.2% of a total assemblage of 1699 artefacts. The stone assemblage at Clybucca 3 contains 194 retouched flakes, 13% of a total of 1488 stone artefacts.

Conclusion

Archaeological investigations at Clybucca 3 indicate a prehistoric subsistence strategy that at 5000 years bp depended entirely upon the shellfish resources available in a tidal estuary. Later, people at the site began to exploit more the estuarine fish resources available and for environmental and/or cultural reasons the resource base broadened further to include small to medium-sized terrestrial animals. This reflects a trend common in temperate regions around the world during the early- to mid-Holocene period (Waselkov 1987).

Intensive and diverse midden use apparent at Clybucca 3 may have resulted from an increase in the human population and the data illustrated in Figure 5 for Cutting I support this hypothesis. Intensified site use as a response to population

increase has been argued for south-east Queensland (Morwood 1986) not far to the north. The difficulty here is that even though there is some indication from the Clybucca 3 data that improved subsistence techniques (net fishing for example) may have led to an increase in resource exploitation (Coleman 1978, 1980), there is insufficient evidence of this increase in exploitation then leading to an increase in population. Indeed, the reverse may be true; an increase in population, based on dependable estuarine resources, may have been the stimulus that led to technological developments, which then may have led to improved exploitation of the food resources available.

Clybucca 3 also indicates a concentration of local raw material and a relatively high number of small, retouched artefact forms characteristic of the Small Tool Tradition (Gould 1969). This evidence provides some support for aspects of the risk reduction model (Hiscock 1994) where it is hypothesised that people modified their strategies of survival in response to unfamiliar or changing environments. Retouched and backed artefacts occur in the Clybucca sequence from approximately 4200 years, yet this is toward the middle of the most stable period in the mid-Holocene geographical history of the Macleay River Valley. Environmental change appears to have influenced the lives of the prehistoric inhabitants only very late in the midden's development and their response was emphatic; they abandoned the site altogether.

Why was Clybucca 3 abandoned ca. 2300 years BP? McNiven (1989) has argued that a greater diversity of resources available in an estuarine environment would prove a greater attraction for people than resources available on the beach. It is clear from Coleman's (1978) work that, in relation to other sites in the lower Macleay River valley, the inhabitants of Clybucca 3 placed more value on exploiting the resources available in the forests and woodlands to the west of the estuary. So why did they move? At present it is the evidence of an environmental shift that provides reasons for the abandonment of Clybucca 3. As the Macleay River silted up, conditions became unsuitable for oysters, cockles and the estuarine fish present; salt levels in the water fell below those needed for the continued survival of these species. Once these important food resources became scarce, there was little advantage to the people remaining in the region.

Despite the discussion above, it is clear that Clybucca 3 provides indicators of the presence of its prehistoric inhabitants and the resource base they exploited. The archaeological evidence also shows activities apart from the dumping of shells, indicating that these people used the midden for other purposes. The presence of stone artefacts and human skeletal remains indicate the site was at different times the scene of various activities and the presence of these within such a restricted area (2% of the midden) supports the view that the Clybucca 3 midden played an important part in the subsistence strategy of the people present. It also heralds the potential that still lies within this archaeological site.

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References

Bailey, G. 1975 The role of molluscs in coastal economies: The results of midden analysis in Australia. *Journal of Archaeological Science* 2:45-62.

Bowdler, S. 1983 Sieving seashells: Midden analysis in Australian archaeology. In G. Connah (ed.) *Australian Field Archaeology: A Guide to Techniques*, pp.135-44. Canberra: Australian Institute of Aboriginal Studies.

Callaghan, M. 1980 An analysis of the molluscan remains from the Macleay River midden sites. Unpublished Honours thesis, Department of Prehistory and Archaeology, University of New England, Armidale.

Campbell, V. 1969 A field survey of shell middens of the Lower Macleay Valley, with reference to their potential and possible methods of investigation. Unpublished Honours thesis, History Department, University of New England, Armidale.

Campbell, V. 1972 Some radiocarbon dates for Aboriginal shell middens in the Lower Macleay River Valley, New South Wales. *Mankind* 8:283-6.

Child, J. 1977 *Australian Sea Shells*. Dee Why West, New South Wales: Paul Hamlyn Pty Ltd.

Claassen, C. 1991 Normative thinking and shell-bearing sites. In M. Schiffer (ed.) *Archaeological Method and Theory*, Vol. 3, pp.249-98. Tucson: University of Arizona Press.

Coleman, J. 1978 The analysis of vertebrate faunal remains from four shell middens in the Lower Macleay River district. Unpublished Honours thesis, Department of Prehistory and Archaeology, University of New England, Armidale.

Coleman, J. 1980 Fish bones for fun and profit. In I. Johnson (ed.) *Holier Than Thou: Proceedings of the 1978 Kioloa Conference on Australian Prehistory*, pp.61-75. Canberra: Department of Prehistory, Research School of Pacific Studies, The Australian National University. *Occasional Papers in Prehistory*, No. 10.

Coleman, J. 1982 A new look at the north coast. In S. Bowdler (ed.) *Coastal Archaeology in Eastern Australia*, pp.1-10. Canberra: Department of Prehistory, Research School of Pacific Studies, The Australian National University. *Occasional Papers in Prehistory*, No. 11.

Connah, G. 1975 Current research at the Department of Prehistory and Archaeology, University of New England. *Australian Archaeology* 3:28-31.

Connah, G. 1976 Archaeology at the University of New England, 1975-76. *Australian Archaeology* 5:1-6.

Connah, G. 1978 Aborigine and settler: Archaeological air photography. *Antiquity* 52:95-9.

Connah, G. and Jones, A. 1983 Photographing Australian prehistoric sites from the air. In G. Connah (ed.) *Australian Field Archaeology: A Guide to Techniques*, pp.73-81. Canberra: Australian Institute of Aboriginal Studies.

Gould, R. 1969 Puntutjarpa rockshelter: A reply to Messrs Glover and Lampert. *Archaeology and Physical Anthropology in Oceania* 4:229-37.

Hails, J. 1965 The geomorphological history of the Macleay deltaic plain. *Australian Journal of Science* 27(7):214-15.

Hails, J. 1968 The late Quaternary history of part of the mid-north coast, New South Wales, Australia. *Institute of British Geography* 44:133-47.

Henderson, J. 1851 *Excursions and Adventures in New South Wales with Pictures of Squatting and Life in the Bush*, Vol. 1. London.

Hiscock, P. 1994 Technological responses to risk in Holocene Australia. *Journal of World Prehistory* 8(3):267-92.

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

Kelly, M. 1980 Stones ... what use? A functional analysis of two stone assemblages from the Macleay River Valley. Unpublished Honours thesis, Department of Prehistory and Archaeology, University of New England, Armidale.

Lee, K. 1969 *River Improvement Works Above Tidal Influence in the Macleay Valley*. Armidale: Department of Geography, University of New England.

Mackay, R. and White, P. 1987 Musselling in on the NSW coast. *Archaeology in Oceania* 22:107-11.

Matthews, J. 1965 Stratigraphic disturbance: The human element. *Antiquity* 39:295-8.

McBryde, I. 1982 *Coast and Estuary*. Canberra: Australian Institute of Aboriginal Studies.

McCarthy, F. 1943a Two pebble industry sites of Hoabinhian type on the north coast of New South Wales. *Records of the Australian Museum* 21:21-5.

McCarthy, F. 1943b Trimmed pebble implements of Kartan type from ancient kitchen middens at Clybucca, New South Wales. *Records of the Australian Museum* 21:164-7.

McDonald, G. 1967 *A Report on the Hydrological Implications of Flood Mitigation Works on the Floodplain of the Macleay River Below Kempsey*. Armidale: Department of Geography, University of New England.

McMichael, D. 1962 *Some Common Shells of the Australian Sea-Shore*. Brisbane: Jacaranda Press.

McNiven, I. 1989 Aboriginal shell middens at the mouth of the Maroochy River, southeast Queensland. *Queensland Archaeological Research* 6:28-52.

McQueen, K. 1982 Chalcedonies from Schnapper Point and Wombah. In I. McBryde (ed.) *Coast and Estuary*, pp.49-50. Canberra: Australian Institute of Aboriginal Studies.

Morwood, M. 1986 The archaeology of art: Excavations at Maidenwell and Gatton shelters, S.E. Queensland. *Queensland Archaeological Research* 3:88-131.

Pierce, R. 1971 The effects of aquatic foods on the diet and economy of the Aborigines on the north coast of New South Wales at the time of first settlement. Unpublished Honours thesis, Department of History, University of New England, Armidale.

Robinson, K. and Gibbs, P. 1982 *A Field Guide to the Common Shelled Molluscs of New South Wales Estuaries*. Sydney: Coast and Wetlands Society.

Rowland, M. 1994 Size isn't everything. Shells in mounds, middens and natural deposits. *Australian Archaeology* 39(2):118-24.

Siiriäinen, A. 1977 Pieces in vertical movement – a model for rockshelter archaeology. *Proceedings of the Prehistoric Society* 43:349-53.

Stockton, E. 1973 Shaw's Creek Shelter: Human displacement of artefacts and its significance. *Mankind* 9:112-17.

Thom, B. 1974 Coastal erosion in eastern Australia. *Search* 5(5):198-209.

Thom, B. and Chappell, J. 1975 Holocene sea levels relative to Australia. *Search* 6(3):90-3.

Thorpe, E. 1968 *An Historical Survey of the Macleay Valley*. Armidale: Department of Geography, University of New England.

Thorpe, E. and Lewins, N. 1953 *Flood Damage in the Macleay Valley: Interim Report*. Armidale: Department of Geography, New England University College.

Voisey, A. 1934 The physiography of the middle north coast district of New South Wales. *Journal and Proceedings of the Royal Society of New South Wales* 68(2):88-103.

Walker, P. 1970 Depositional and soil history along the lower Macleay River, NSW. *Journal of the Geological Society of Australia* 16(2):683-96.

Waselkov, G. 1987 Shellfish gathering and shell midden archeology. In M. Schiffer (ed.) *Advances in Archaeological Method and Theory*, Vol. 10, pp.93-210. San Diego: Academic Press.