EXPLORATORY EXCAVATION AT TOULKERRIE MIDDEN (LB:B175), MORETON ISLAND, S.E. QUEENSLAND

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INTRODUCTION

A systematic archaeological investigation of Moreton Island commenced in 1978 as the offshore component of the First Stage of The Moreton Region Archaeological Project (MRAP) (see Hall 1980a). Although two previous archaeological surveys had been undertaken on the island (Ponosov 1964, Morwood n.d.), neither had attempted to cover it in a systematic and comprehensive manner. Both had essentially recorded sites close to the shores. Consequently, in order to achieve initial aims of MRAP concerning the variability of the archaeological record across the whole of the island's landscape, it was necessary to carry out a systematic survey. This was accomplished by Richard Robins as part of his M.A. degree research (Robins 1983 and 1984a this volume). However, during the initial reconnaissance which preceded this survey, a small number of sites were noted as having potential for answering basic questions outlined by MRAP's research design. The first of these concerned chronology; just how long have people been exploiting the offshore islands of Moreton Bay? It was also important to know the relative contemporaneity of various types of sites on the island. Hence, sites which exhibited stratigraphic integrity were sought. A second question at that time concerned the nature of the subsistence aspect of the prehistoric economy. Hence,it was important to choose sites in differing localities and which exhibited different faunal and artefactual components. Consequently, exploratory excavations were undertaken at roughly the same time as the survey.

The first site chosen was Minner Dint, a shell midden on the east coast, interpreted as a place where people collected pipis, fish and pandanus fruits during short visits to the site (probably during late winter into the summer months) which dates to about 500 years ago (Hall 1980b). The second was a midden complex located at Toulkerrie, on the southwestern coast. Excavation took place during three short field trips designed as training exercises for University of Queensland archaeology students between 1978 and 1980. This paper presents the results of this work as they relate to original MRAP questions.

In accordance with the overall research design for Moreton Island the exploratory digging at Toulkerrie sought to answer a few general and basic questions. Simply, does the site exhibit integrity and clarity sufficient to:

1. Determine the age of the site?
2. Determine the past subsistence regime?
3. Determine the past local environment?
4. Determine site formation processess?
5. Allow inter-site comparison of the above on the island?

THE SITE AND ITS SETTING

The site is named after Toulkerrie, a locality some 3.5 kms north along the west coast from the village of Kooringal (Figure 1). The site datum lies at Grid Reference 413785, Kooringal Sheet, 1:25,000 Queensland Topographic Series. Although on Crown Land, the site falls within Mining Lease No.1017 held in 1978 by Dillingham Construction.

Toulkerrie is actually a complex of several surface shell midden exposures occurring on crests and seaward slopes of three small sand ridges or dunes which lie within ca.30m of the bay shore. The complex was originally recorded by Morwood (1975) as three separate sites which were allocated state numbers LL:B175, LL:B176 and LL:B177 (from south to north). I have chosen to designate the entire complex by the first of these (LL:B175). The number allocated to the site's contents by the Queensland Museum is S180.

At present, tidal mud flats extend some 800m from the beach. Behind the midden-sand-ridge complex is an extensive Melaleuca swamp which drains via small intermittent streams to the north and south of the site. Thus the site falls between the swamp and the beach, running parallel to the beach for at least 150m. A sand track (for 4-W-D traffic) also runs parallel to the beach and wheel ruts intrude into some quite dense midden deposits. On the surface, shells occur as the dominant component of a heavy midden scatter which also includes occasional bones (esp. dugong) and stone artefacts. The site is quite well vegetated, a factor which has largely confined erosion of the archaeological deposits to the beach, the sand track, and the crest of Ridge C where a hut has been constructed. Trees include a number of Bribie Pines (Callitris columellaris) and some old and large specimens of Banksia serrata. Mangroves grow quite thickly along the beachfront and extend on to the mudflats. The shrub layer below the 8-10m canopy provided by the pines includes Dodonia viscosa, Acacia leiocalyx and Monocota scoparia. Ground cover is sparse to mid-dense and is dominated by Impereta cylindrica and the fern, Pteridium esculentum.

EXCAVATION PROCEDURE

While most of the surficial archaeological material suggested downslope movement from a ridge crest origin, shell in the roadbed offered a hint of in situ deposits at the western foot of Ridge A. A thin steel rod (1/4" dia.), employed as a subsurface probe, indicated at least shallow midden material in both locations, with the ridge-foot deposits extending at least 10m east of the sandtrack. Consequently, a number of 50cm x 50cm trenches were placed along a baseline extending from the crest of Ridge A downslope to the sandtrack (Figure 1). In this way it

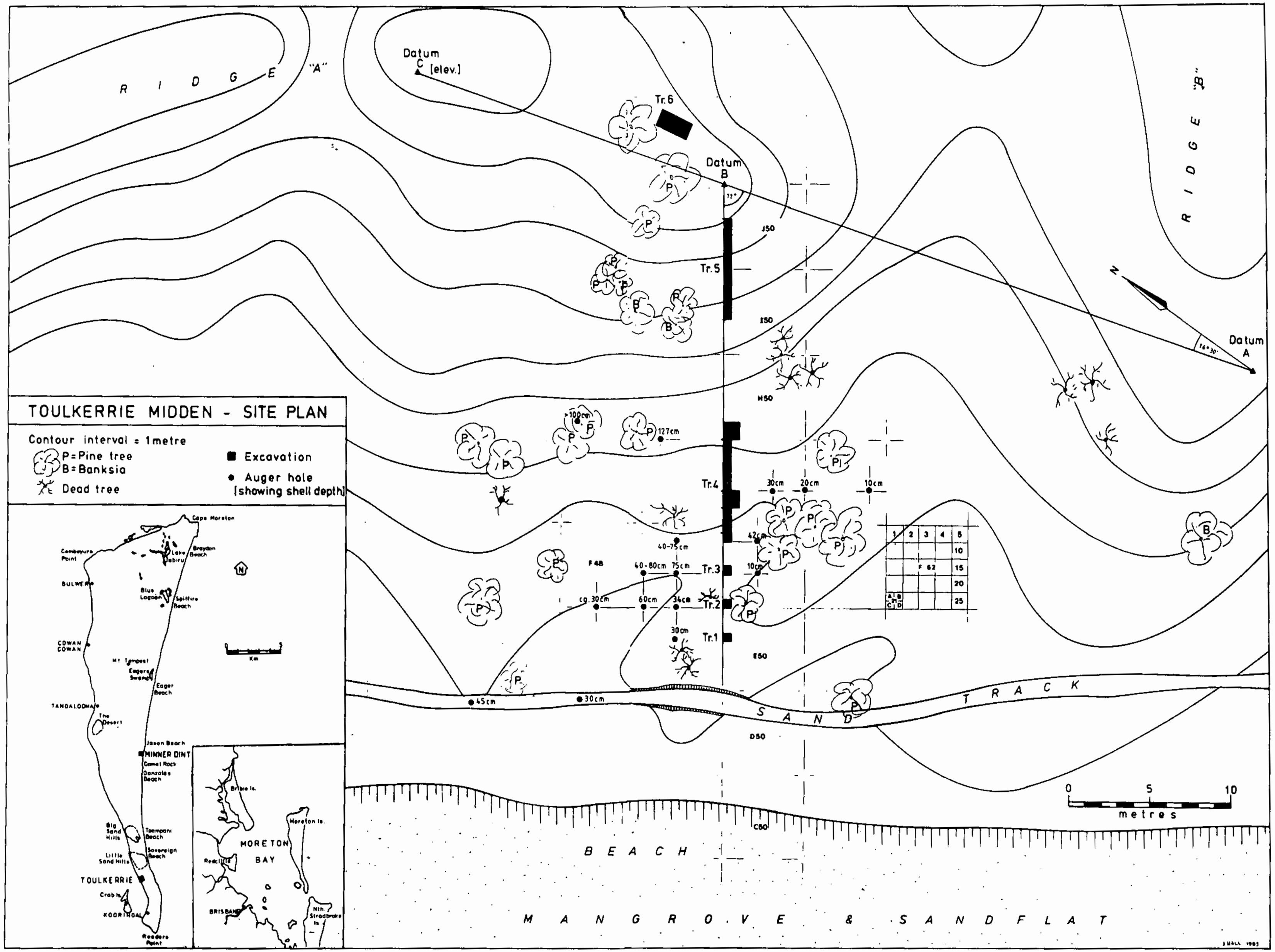

Figure 1. Site plan and location map of Toulkerrie Midden.

was thought to gain some understanding of the site's stratification and depositional history.

The baseline was placed roughly perpendicular to the sandtrack and intersected the southern edge of the crest of Ridge A. Subsequently, this has been tied into the Site Grid (Figure 1). A deeply driven steel post in the southern slope of Ridge B (a survey marker for ML1017), was chosen as Datum A . A line between this point and the Elevation Datum (C), set on the highest point of Ridge A, intersected the excavation baseline at a point designated Datum B. This line through Data A,B,& C ran 16 degrees 30 minutes West of Magnetic North (Sept.,1978). The excavation baseline intersected this at at angle of 72 degrees (Figure 1). The distance between Datum A and Datum B is 96m.

The Site Grid is an alphanumeric system comprising a 5m x 5m primary grid, each unit of which is subdivided into 25 1m x 1m squares. These are further subdivided into quadrants (A,B,C,D,) measuring 50cm x 50cm (see Grid Square F52 example in Figure 1).

Initially, six 50cm x 50cm trenches were excavated at intervals along the Datum B baseline (Grid Coordinates E50/6/C (Tr1), F50/21/C (Tr2), F50/11/C (Tr3), F50/1/C, G50/16/C and H50/21/C). Another trench (Tr6), measuring 1m x 2m, was excavated on the top of Ridge A some 3m north of Datum B. Due to problem of encountering massive tree root systems, it was placed at an angle to the site grid (see Figure 1). Subsequent excavation included an enlargment of trenches in G/50/16C and H50/21/C to 1m x 1m, followed by a 50cm-wide trench linking these with F/50/1/C to form Tr4 and a new 6m x 50cm trench in the upper slopes of the dune (Tr 5) in order to secure stratigraphic control (Figure 1). Finally, a series of 10cm [dia.] sand auger probes were carried out at the seaward foot of Ridge A in order to aid the estimation of subsurface extent and depth of the midden (Figure 1).

Trenches were excavated in 5cm units. Fill was wet-sieved through a short nest of 8mm and 3mm mesh screens with the exceptions of bulk sediment samples and selected fill from Tr4 and Tr5.

STRATIGRAPHY

A brief stratigraphic description of each trench is given below followed by a composite stratigraphy for the site.

Trench 1 (E50/6/C),located 27m downslope of Datum B, exhibits two strata (Figure 3). The upper stratum (Tr1a) extends from the surface to a maximum depth of 15cm and is comprised of dark organic sand and shell. This gives way fairly abruptly to a clean yellow sand stratum (Tr1b). It was excavated to 90cm below ground surface.

Trench 2 (F50/21/C), located 2m upslope of Tr1, also exhibits two strata (Figure 3). The top 14cm (Tr2a) is comprised of dark organic sand, grass roots and shell, the latter becoming slightly more dense towards the base of this layer. As in Tr1, the lower stratum (Tr2b) is a clean yellowish sand. It was dug to a depth of 90cm.

Trench 3 (F50/11/C),located 2m upslope (east) of Tr2, also exhibits two strata (Figure 3). The upper stratum (Tr3a) is a dark sandy deposit containing an abundance of shell (esp. pipi) to a depth of 15cm. It gives way to a yellow sandy layer without shell (Tr3b). This trench was excavated to a depth of 90cm.

Trench 4, is a long trench beginning 2m upslope of Tr3 and extending some 7m. It is 50cm wide except in two places where it was extended to 1m wide (Figure 1). It exhibits 9 strata as outlined below (Figure 2).

Stratum 1 - A culturally sterile clean basal yellow sand underlying all cultural deposits at the foot of Ridge A. Dug to a depth of 1.5m.

Stratum 2 - A dense compact layer of midden material largely comprised of pipi (Donax deltoides) shell which is in an excellent state of preservation. It varies in thickness from 1cm to 25cm. It diminishes in thickness and disappears towards the eastern part of the section.

Stratum 3 - A fine light greyish brown sand layer which appeared comparatively devoid of cultural material in profile but which actually contained some shell,bone and charcoal in low densities. It is about 5-20cm thick where it lies above Stratum 2 but gets thicker in the eastern part of the profile where it eventually merges with Stratum 1 (Figure 2).

Stratum 4 - A thin (av.5cm) dark grey sandy layer exhibiting a concentration of shell, bone and charcoal in the western half of the trench but gradually disappears to a thin line in the eastern half (Figure 2). In the extreme western portion it merges with or becomes indistinguishable from Stratum 6.

Stratum 5 - A thicker (up to 30cm) light brownish grey sand layer which exhibits only sparse cultural material. It begins near the middle of the section where it separates Stratum 4 from Stratum 6, and gradually thickens and merges with Stratum 7 (Figure 2).

Stratum 6 - A brownish grey sand layer containing a concentration of shell,charcoal and bone. It is thickest in the western third of the section (7-17cm) but thins out gradually until it disappears in the centre (Figure 2).

Stratum 7 - A light brownish grey sand layer which begins in the western end of the trench and thickens (ca.15cm) towards the east where it eventually merges with Stratum 5 (Figure 2).

Stratum 8 - A thin (ca. 6cm) layer of fairly dense shell plus charcoal and bone in a dark sand matrix. It peters out towards the eastern end of the profile (Figure 2).

Stratum 9 - A surface layer of dark sand of varying thickness (4 - 20cm) which comprises root systems of grasses, leaf litter and other organic material including sparsely scattered shell and other midden material. It gets lighter in colour and less dense in the eastern half of the section (Figure 2).

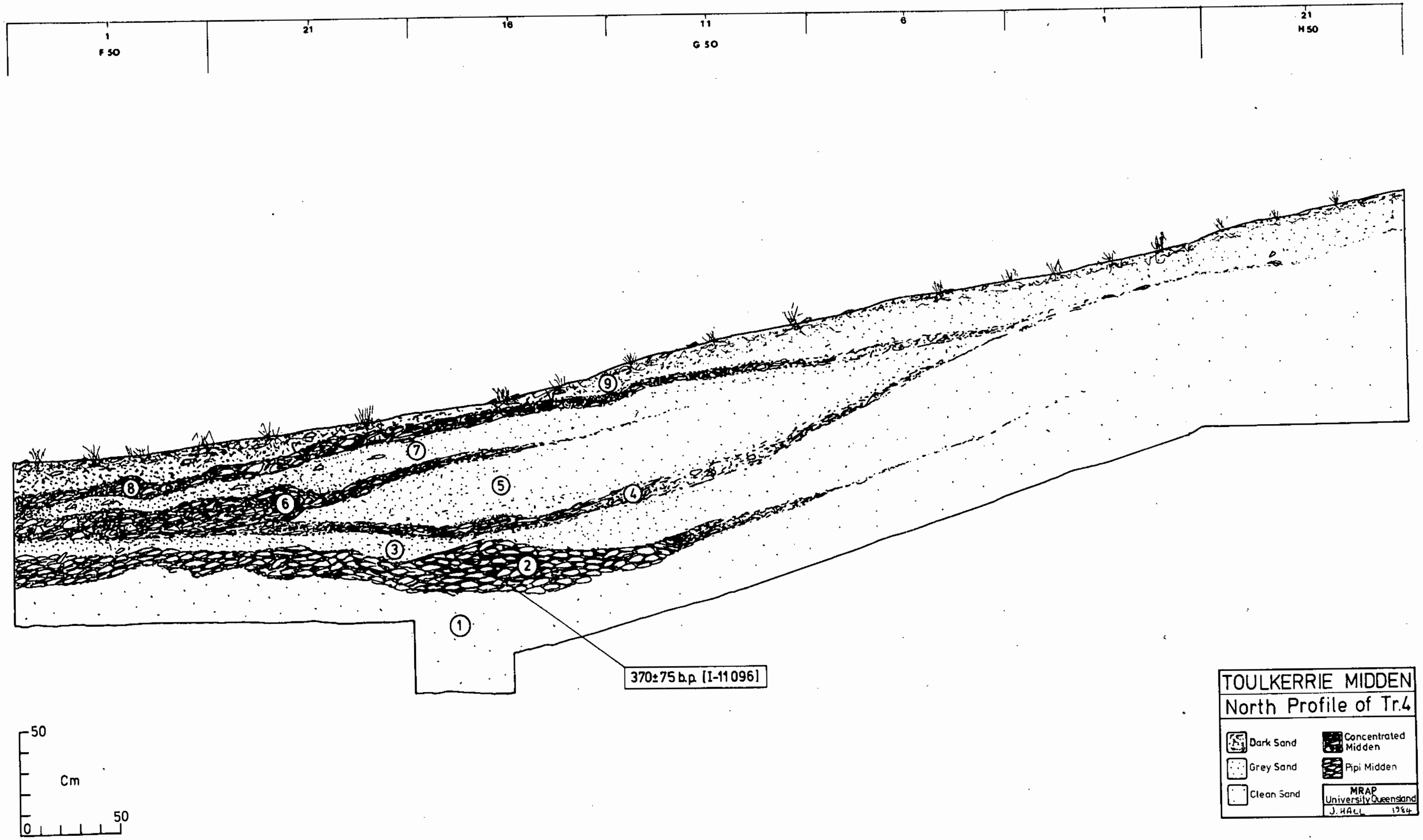

Figure 2. Stratigraphy of Tr4, Toulkerrie Midden.

Trench 5 is 6m long and 50cm wide, beginning 2m west of Datum B and running down the upper slope of Ridge A (Figure 1). It was excavated in order to assess the stratigraphic relationship between Stratum 8, Stratum 9 and Tr6a. Two layers were revealed. The upper layer (Tr5a) is a concentration of shell, charcoal and bone which is ca. 15cm thick at the crest of Ridge A but which thins out and disappears some 4m downslope (Figure 3).

Trench 6 Is a 1m x 2m trench put into the top of Ridge A (Figure 1). It exhibits two discernible strata. The upper stratum (Tr6a) is a ca. 25cm thick layer of concentrated shell, bone and charcoal. This gives way abruptly to a clean yellowish white sand (Tr6b) which is at least 1.5m deep (Figure 3). The northern half is designated Tr6(N), the southern half Tr6(S).

Relationships: As Figures 2 and 3 indicate, the downslope deposits show an interfingering with sands from the dune (Ridge A). Thus, the layers Tr5a and Tr6a are considered to belong to the same midden deposit, the whole of which is considered to be stratigraphically above Stratum 9. It is thus designated Stratum 10 in the sequence.

Downslope midden layers (Strata 4,6,8,) appear to begin to coalesce at the westernmost end of the Tr4 profile. At present this interpretation is put forward to explain the discontinuation of these strata as distinct entities in Tr1, Tr2 and Tr3. That is, unless further evidence proves otherwise, layers Tr1a, Tr2a and Tr3a represent the merging of Stratum 6 and Stratum 8. Similarly, Stratum 2 is thought either to peter out at some point between Tr4 and Tr3 or to merge with Stratum 6 (Figure 2).

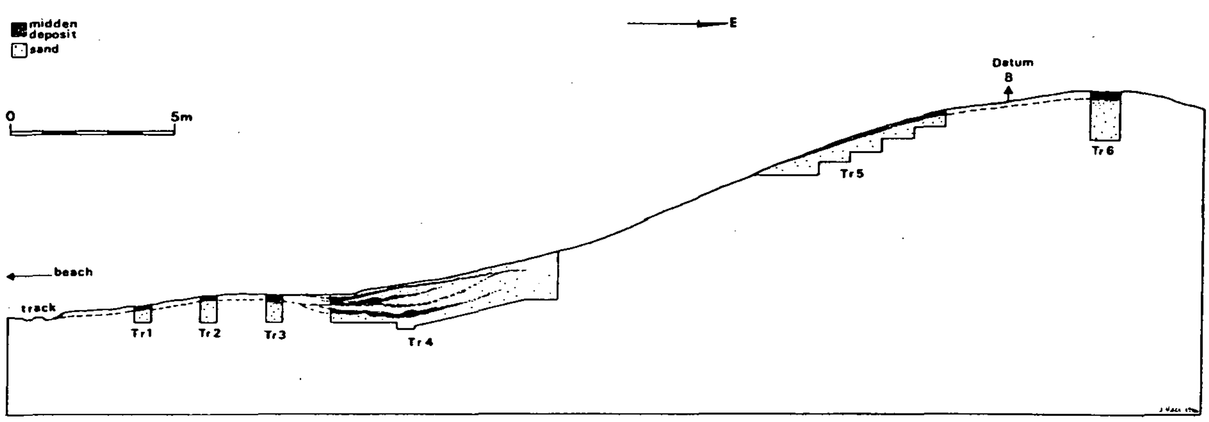

Figure 3. Composite northern profile of Toulkerrie Midden.

CHRONOLOGY

Well-preserved angular and blocky charcoal was collected from Stratum 2 in Grid Square G50/16/C and submitted to Teledyne Isotopes for a radiocarbon determination. The sample (20gms) yielded a date of 370±75 b.p. (I-11096) (using the Libby half-life and not calibrated for changes in atmospheric carbon). Since the surface deposits (top 5cm of

Stratum 10) yielded 19th Century artefacts including a clay pipe bowl, castor oil bottle fragment and an old copper nail, it is assumed that the midden sequence spans some 300 years or so. That is, this part of the Toulkerrie Midden complex was first deposited in the 16th Century and last deposited at some time after the European settlement date of 1824. Although the Moreton Islanders left in 1840 to live at Amity on Stradbroke Island it is well known that people from Stradbroke Island made subsequent forays to Moreton Island at least into the 1890's (Robins 1979,1983). Thus the top of Stratum 10 at Toulkerrie could reasonably date to any time between 1824 and the turn of this century.

SITE CONTENTS ANALYSIS

During excavation all material recovered from the coarse screen was sorted in a field laboratory according to the gross categories, shell, bone, charcoal, stone and "miscellaneous". All bone, charcoal and stone was dried and bagged for later analysis in the Brisbane laboratory. Shell, however, was sorted into species, weighed, counted, measured, checked for usewear and any other unusual attributes and finally bagged, labelled, and placed into the trench from whence it came. Thus, it may be recovered if additional information is required. Fine screen residue was bagged for later analysis.

Since this report concerns matters of a coarse-grained and preliminary nature and since intrasite spatial variation of components proved largely unremarkable at this level of analysis, not all recovered information is presented herein. It is sufficient to display data from the G50/16 part of Tr4 and, in order to include Stratum 10 material, from a portion of Tr6. Comprehensive treatment of all excavated material is deferred until a fuller investigation of the Toulkerrie Complex has been undertaken.

The Invertebrate Fauna

Toulkerrie yielded five main species of shellfish including the common pipi (Donax deltoides), rock oyster (Saccostrea commercialis) cockle or tapered ark (Anadara trapezia), mudwhelk (Pyrazus ebeninus, large sand snail (Polinices sordidus) and the hairy mussel (Trichomya hirsuta). All species are common to the island today, and all but the pipi (which comes from the east coast surf beach) inhabit the estuarine sand flats immediately adjacent to the site. Other shell species were recovered (including Velacumantus australis, Pinctada sp. and a few Trochidae); however, these were represented in such minute quantities that they are considered to be incidental to the above and unimportant with respect to current questions. Similarly small amounts of exoskeletal fragments of a crustacean (probably the mudcrab, Scylla serrata) were recovered from Strata 2 and 10.

Figure 4, which displays the data stratigraphically, allows a number of observations concerning the shell component. These will be referred to in later discussion. The Tr4 sample comes from G50/16/A while the Tr6 sample is a fourth of Tr6(N) (ie. 50cm x 50cm).

1. The most striking fact is that pipi shell overwhelmingly predominates in the column at all levels save for the 45-50cm spit. It is noteworthy that this species (Donax deltoides) originates from the east coast of the island.

2. Two estuarine bivalves, rock oysters and cockles, are found throughout the sequence but neither represents more than 30% by weight in any level (save for cockle at 45-50cm). Prior to the 75cm level (ie. in Stratum 2) only a trace of them is recorded.

3. The mudwhelk, Pyrazus ebeninus, appears in small amounts, in roughly similar proportion as cockles and oysters, but only after 30cm.

4. Sand snails are also found throughout the sequence but usually in very low numbers.

5. The hairy mussel is found first at the 35cm level but is always recorded as only a trace (<2% by wt.).

6. The weight of shell per 5cm unit (ie .0125m^3) ranges from almost 6kg to less than 100gm. The bulk is found in the upper and lower strata (Stratum 10 and Stratum 2) while the 0-80cm levels in Tr4 yielded little in comparison. Stratum 8 shows up as a small bulge on the graph while Strata 4 and 6 are not reflected in terms of shell weight at all.

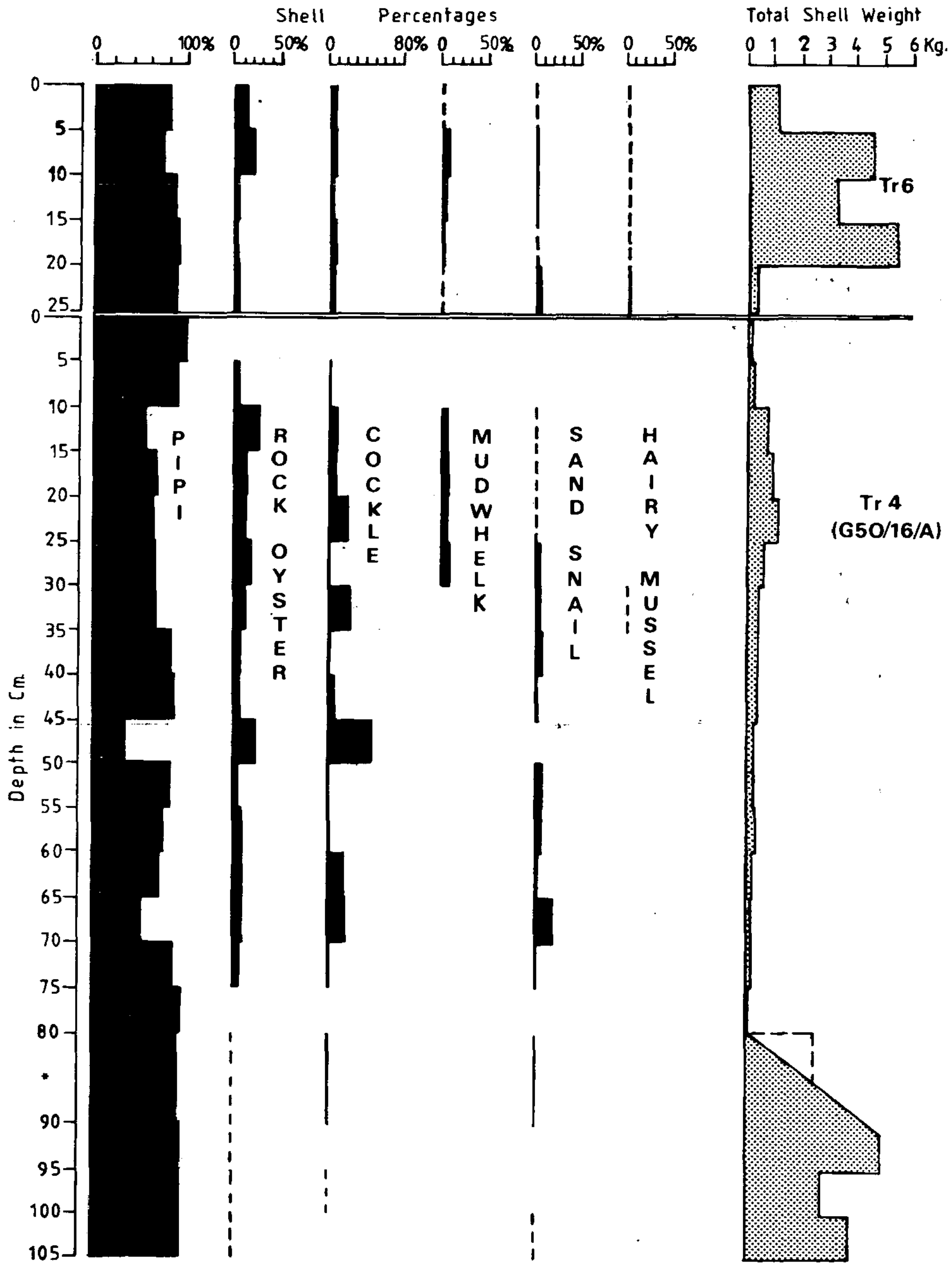

Figure 4. Proportions of shell fish taxa in Tr4 (G50/16/A) and Tr6 (N) at Toulkerrie Midden.

The Vertebrate Fauna

Analysis of this component was undertaken by Walters (1979,1980,1981; Walters and Hall 1980). who noted the preponderance of the fishes even at the field laboratory stage. As these results are essentially reviewed herein with only slight modifications due to subsequent findings, the reader is referred to the above for more detailed information. Fish and non-fish components are described separately below.

The Fish Component: Of the identified bone specimens from all but the fine sieve fractions, fish remains constituted over 95% by weight (Walters 1980:30). This pattern was even enhanced after fine sieve fractions were sorted. It is also noteworthy that preservation was sufficient to allow retrieval of large quantities of fish scales as well as bone (pH was ca. 8.0 - see Table 2).

LEVELS [cm]			MNI				
			Tr6(N) Coarse Fraction				
0-5	B						
5-10	BBBB	TTTT	M				
10-15	BBBBB	TTT	MMMMMMMMMMM				
15-20	BBBBBBBBBBBBBBBB	TTTTTT	MMMMMMMMMMMMMMMMMM	F	L	W	J
20-25	BBB	TT	MM	F			
			Tr4 (G50/16/A,B,C,D,)				
0-5							
5-10							
10-15	B		MM	F			
15-20	BBB		M				
20-25	BBB	T	MM			W	
25-30	BBBBBB	TTT	MMM	F			
30-35	BBBBBBBBBBBBBBBB	TTTTTTTTTT	MMMMMMMMMMMMMMMMMMM	F		WW	
35-40	BB		M	F			
40-50	BB	TT	M			WW	
50-60	BB		MM			WW	
60-65	B						
65-70		TT	MM				
70-75	B	T					
75-85	BBB	TT	M				
85-90							
90-95	B		MMM			W	
95-100	BB	TTT	M			W	
100-105			MMM			WW	

Key: B=Bream T=Tarwhine M=Mullet W=Whiting
F=Flathead L=Luderick J=Jewfish

Figure 5. Minimum numbers of fish per level, Tr4 and Tr6, Toulkerrie (coarse fractions only).

To date, 10 taxa of fish have been identified including the two sparids, bream (Acanthopagrus australis) and tarwhine (Rhabdosargus sarba), mullet (Mugil cf.cephalus), whiting (Sillago sp.), tailor (Pomatomous saltatrix), jewfish (Sciaenidae), flathead (Platycephalus cf. fuscus), luderick (Girella tricuspidata) and two unidentified taxa. Original analysis of sieve material yielded all but the tailor which was found in subsequent fine fraction sorting (of Stratum 10 material). This also yielded a significant increase in minimum number tallies of fish - especially mullet (due to small otoliths) and tarwhine (due to molar teeth) (Walters 1981).

Figure 5 gives minimum number of individual (MNI) counts for fish identified in the coarse fraction of four sectors of Tr4 (G50/16/A,B, C&D)and in Tr6(N&S). As some of the bones from the fine sieves match fragments from the coarse sieve, the results are kept separate. It should be noted that MNI counts for the fine fraction, although comparable for most taxa, are significantly higher for mullet in Stratum 10 (in one case a 150% increase!).

Figure 6 gives the mass of fish bone per level for Tr4 (G50/16/A&C) and Tr6(N). It is noted that despite the disparity in represented volume between the two trenches, the apparent increase in fish in Stratum 10 is significant.

LEVEL	WEIGHT OF FISH BONE
	Tr6(N) (actual wt/4)
0-5	XXXXXX
5-10	XXXX
10-15	XXXXXXXXXXXXXXXXXXXXXXXXXX
15-20	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
20-25	XXXXXXXXX
	Tr4 (G50/16/A)
0-5	
5-10	X
10-15	XXXXXX
15-20	XXXXXXXXXXXXXX
20-25	XXXXXXXXXX
25-30	XXXXXXXXX
30-35	XXXXX
35-40	XXXXXXXX
40-45	XXXXXXXX
45-50	
50-55	XXXX
55-60	XXXXXX
60-65	XXXXXXXXX
65-70	X
70-75	XXXXXXXXXX
75-80	XXXXXXXXX
80-85	XXXXXXXXX
85-90	XXXXXX
90-95	XXXX
95-100	XXXXXX
100-105	XXXX

Figure 6. Comparison of fish bone mass per level in Tr4 (G50/16/A&C) and Tr6(N) (fine and coarse fractions combined). Graph gives mass to nearest whole gram (X = 1g).

From the fish data a number of patterns emerge which may have an important bearing on the interpretation of this site and to Moreton Island as a whole.

1. Bream, Tarwhine and Mullet make up a dominant triad of fish throughout the history of the site.

2. Fish bone abundance per unit volume of deposit increases significantly in Stratum 10.

3. When fine fraction MNI's are counted, Mullet abundance appears to increase significantly in Stratum 10.

4. Flathead, Whiting, Jewfish, Luderick and Tailor are in low frequencies throughout the deposit.

The Non-Fish Component: Nine taxa of higher vertebrates were recovered in the excavation. They include dog, rat, flying fox, dugong, turtle, freshwater tortoise, crow, goanna, and an unidentified reptile (Walters 1980,1981; Table 1). Because of the great discrepancies in S.G. among these bones, no attempt is made to compare their weights. An MNI tally and stratigraphic location for bones in Tr4 and Tr6 is provided in Table 1. From the evidence, the following statements may be made, albeit the small numbers offer no statistical reliability.

1. The combined Non-fish vertebrates numbers are greatly overshadowed by the fishes in abundance.
2. Large terrestrial mammals (esp. Macropods) are conspicuously absent from the record.
3. All taxa but goanna are found in Tr6 (ie.Stratum 10).
4. Dugong are well represented numerically but appear only in the uppermost strata.

Table 1. Minimum numbers for non-fish vertebrates in Tr4 and Tr6, Toulkerrie (data from Walters 1980,1981).

TAXON	MNI	Tr4	Tr6
Dog	1		15-20cm
Dugong	5*	15-20cm	5-10;10-15;15-20cm
Rat	1		10-15cm
Flying Fox	2		10-15;15-20cm
Goanna	2	75-80cm	
Unident. Reptile	2	75-80cm	10-15cm
Turtle	1		15-20cm
Freshwater Tortoise	3		10-15;15-20cm

* Grayson's (1973) intermediate distinction method used whereas maximum distinction method used for others.

THE FLORAL COMPONENT

Apart from the recent litter on the surface of the site and some subsurface grass and tree roots which are considered unimportant to this study,the floral component consists entirely of charcoal or carbonised material. Relative abundance and stratigraphic distribution of charcoal is given in Figure 7.

An attempt to separate the charcoal component into edible plants versus species used as fuel for cooking/camp fires yielded limited results. Initial sorting for charred drupes of Pandanus, using the reference collection from Minner Dint (Hall 1980), resulted in the recovery of a few fragments of this fruit (Figure 7) but due to the highly fragmented nature of most of the charcoal, quantification was not possible.

LEVEL (cm)	WEIGHT OF CHARCOAL	
	Tr6(N) (actual wt/4)	
0-5	XXXXXXX	
5-10	XXXXXXXXXXX	P
10-15	XXXXXXXXXXXXXXXXXXXXXXXXX	
15-20	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	P
20-25	XXXXXXXXXX	P
25-30	XXX	P
	Tr4 (G50/16/A)	
0-5	XXXXXXXXXXXXXXXXXXXX	
5-10	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	
10-15	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	P
15-20	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
20-25	XXXXXXXXXXXXXXXXXXXXXXXXXXX	
25-30	XXXXXXXXXXXXXXXXXXXXXXXX	P
30-35	XXXXXXX	
35-40	XXXXXXXXXXXX	
40-45	XXXXXXXXXX	
45-50	X	
50-55	XXXXXXX	
55-60	XXXXXXXXXXXXXXXXXX	
60-65	XXXXXXXXX	
65-70	XXXXXXXXXXXXXX	
70-75	XXXXXXXXXXXXXXXXXXXX	
75-80	XXXXXXXXX	
80-85	XXXXXXXX	
85-90	XXXXXXXXXXXXXX	
90-95	XXXXXXXXX	P
95-100	XXXXXX	P
100-105	XXXXX	

Figure 7. Vertical distribution of charcoal (mass) at Toulkerrie - Tr4 (G50/16/A) and Tr6(N) (X = 1g ; P = Pandanus present).

A more sophisticated experimental approach to the problem using incident-light and scanning electron microscopy by Donoghue (1979) resulted in a pilot project which permitted the separation of softwoods from hardwoods. Donoghue chose a sample of 10 well-formed charcoal fragments from Stratum 10 (in Tr6) and another 10 from Stratum 2 . The Stratum 2 sample yielded 8 pieces of softwood (probably Callitris columellaris) and 2 of hardwood (1 of a Proteaceae - possibly Banksia sp., the other unidentified). In Stratum 10, on the other hand, only 2 samples were softwoods (C. columellaris) while the other 8 were hardwoods (4 Banksia sp, 1 Myrtaceae and 3 unidentified hardwood fragments). Donoghue is quick to point out that these identifications were made solely in order to validate her procedures and may not be considered in any way representative of their strata (1979:36). Nevertheless, it is useful to know that hardwood may be separated from softwood and that one of each (a member of the Proteaceae - probably Banksia - and Callitris columellaris) is identified in the top- and bottom-most cultural layers. As Figure 1 shows, these species are still dominant in the upper vegetation storey today. Thus, one may tentatively infer a fairly similar vegetation regime in the general vicinity of the site during its development. Hypotheses concerning which were fuel plants and which were food may be tested even at the level of refinement acheived by Donoghue. Further refinements, coupled with good representative charcoal samples from several localities in the Toulkerrie Complex, could well lead to a productive increase in our knowledge about the floral component of the Moreton Island economy.

The Stone Component

Given the exploratory nature of the excavation, the analysis of the stone material from Toulkerrie sought only to answer rather basic questions relevant to the overall research design. However, first and foremost it was important to gain a sample of artefactual stone from a well-defined stratigraphic context so as to initiate a controlled collection for the island. Most of the stone artefacts collected by pre-MRAP researchers are uncontrolled and unrepresentative samples both spatially and temporally. Thus, it is quite difficult to characterise the Moreton Island stone industry from either an intra-site or inter-site perspective. Since Moreton Island is made of sand, it was assumed by the excavator that all stone found in archaeological sites there is artefactual - ie. it has been brought to the site by people.

Stone was analysed according to the general scheme devised by Peter Hiscock (1981) whereby chipped stone is first separated from manuports and non-artefactual stone, then subdivided into cores, flakes and flaked pieces. These are further subdivided according to secondary attributes such as usewear and retouch.

Given the exploratory nature of the excavation the stone analysis was directed towards the questions below. More detailed inquiry into technological aspects awaits further investigation of the site.

1. What is the general character of the stone assemblage?
2. What is the range of raw material types in the site?
3. Is the stone from the island or was it imported?
4. Does the stone exhibit any temporal patterning?

Although stone was recovered from most trenches, for the purposes outlined above it is sufficient to present data from Tr4 (G50/16/A&D) and Tr6(N) (Figure 8).

The Character of the Stone Assemblage: As Figure 8 indicates, there is a predominance of flakes in the sample. Further, a significant proportion of these (58%) are very tiny (<6.0mm). Cores are rare. No formal types of stone artefacts were found. Sandstone fragments, one or two of which have smoothed facets suggestive of grinding, are commonly found. Another common element includes small rounded and flattish beach pebbles with no trace of usewear (manuports). Small pieces of red ochre, some exhibiting subparallel striations suggestive of grinding, form another element.

Range of Raw Material: Raw material for stone artefacts at Toulkerrie is quite varied. Chipped Stone is represented by 6 rock types including silcrete, chert, chalcedony, quartz, andesite and rhyolite. Non-chipped Stone is comprised of sandstone, quartz and quartzite plus ocherous ironstone. In terms of the representation of each, silcrete predominates in the Chipped Stone category with chert next most abundant.

LEVEL	RAW MATERIAL							
	Silcrete	Chert	Chalced.	Quartz	Andes.	Rhyo.	Sandstone	Ochre
TR6(N&S)								
0-5								
5-10	FFFF ffffff	FFF Fu/w	f	F	F/P	Ff		P
10-15	FFFFFFFFF fff	FFFffff fffffff	FF	FF	FF	FF	PPPPP	PPPPu/w
15-20	FFFFFF fffff	F Fre f	F	fffff				PP
20-25	F						PP	
TR4 (G50/16/A&C)								
0-5				BP			BP	
5-10								
10-15				BP fffff				
15-20	F							
20-25	FFFF C	F					BP P	
25-30	fff			f	f			P
30-35	F/P							
35-40	F	F		BP f				
40-45	FF							
45-50								P
50-55				f				
55-60								Pu/w
60-70				F				
70-75								
75-80				BP				

------no stone below 80cm------

Key: F = flake > 6mm F/P = flaked piece BP = beach pebble
f = flake < 6mm P = piece or fragment re = retouch
C = core u/w = usewear

Figure 8. Diagram showing stratigraphic distribution of stone artefacts by raw material type in Tr4 and Tr6, Toulkerrie Midden.

Source of Stone: Although Moreton Island is almost entirely composed of sand, it does exhibit one outcrop of hard rock which is located at Cape Moreton on the extreme northeastern end of the island. This is made up of two geological units, one volcanic, one sedimentary. A study by Richardson (1979) which surveyed these for rock types and compared the findings with stone artefact collections from the island, concluded that one did not have to leave the island for the archaeological stone. The only rock type found at Toulkerrie but not mentioned by that study is silcrete. However, subsequent reexamination by Richardson (pers.comm 1984) revealed that her category "quartzite" labels the same rock type which I have identified as "silcrete" herein. Thus, one the basis of Richardson's study, the Toulkerrie material did not have to be imported; it was all potentially available from Cape Moreton some 30kms away.

In respect of ochre, the island exhibits several sources of an ironstone concretion which may have provided a source for the material found at Toulkerrie. This hypothesis remains to be tested.

Patterns through Time: Since the Tr6 sample in Figure 8 represents four times the volume of deposit than that from Tr4, the apparent greater stone density per level in Stratum 10 is considered illusory. It is interesting that concoidally fracturing stone (chert, chalcedony and silcrete) is not present in the Tr4 deposit until the 45-50cm level and sandstone is absent until the 20-25cm level. Quartz occurs throughout the site but in small quantity. Flattish beachrolled pebbles were also found throughout the sequence. Ochre is a consistent find in all levels. No stone at all was found in Stratum 2 in any of the trenches. The other major change in artefacts occurs in the top 10cm throughout the site where European materials enter the record (eg. clay pipe bowl, Castor oil bottle, strap iron, copper nail, piece of rubber). Fuller description of these await a comprehensive site report.

INTERPRETATIONS

Toulkerrie Midden is an excellent model for demonstrating that archaeological sites are not made by people alone; that they are the product of the interplay of both human and environmental agencies (eg. Binford 1980, Butzer 1982, Schiffer 1972). During excavation of Tr4 the interdigitation of cleaner sands with more cultural-organic deposits could be seen clearly. So too was the obvious difference in colour and texture between the Stratum 1 sands and those above it. Its culturally sterile clean yellow profile appeared similar to beach sands found on berms just to the north of Toulkerrie where no tidal mudflats existed and active dunes ran to the water's edge. From these observations a set of interconnected hypotheses were generated concerning the formation of the site.

1. The first midden layer (Stratum 2) was deposited on a clean sandy berm not unlike those found 2km north of Toulkerrie today.

2. Mobile sands from the "Ridge A" dune covered Stratum 1 (fairly rapidly) and subsequent cultural deposits (Strata 4,6,8).

3. The current Mangrove-tidal mudflat regime present at Toulkerrie today is a recent development; it certainly did not become established until some time after the deposition of Stratum 2.

These hypotheses have a number of implications.

1. Sedimentological analysis should show :
a) correspondence between Stratum 1 sands and those from the modern west coast open beach.
b) a lack of correspondence between Stratum 1 sands and those from clean Ridge A sands.

2. Sedimentological analysis should show:
a) a lack of correspondence between Stratum 1 sands and samples from archaeological layers above (Strata 2,3,4,5,6,7,8).
b) correspondence among sands from archaeological sediments above Stratum 1.
c) correspondence among modern dune sands and the sediments above Stratum 1.

3. Estuarine animal food species (eg.shellfish, crustacea and fish) should be represented in the Toulkerrie Midden layers at some time after Stratum 1. They may also be expected to increase in proportion to non-estuarine species.

In order to test these implications, bulk sediment samples were submitted to David Gillieson (then of Geography Dept., The University of Queensland) for sedimentological analysis. Samples from Strata 1,2,3,and 5 were measured for chemical characteristics including pH, organic carbon, soluble salts and phosphorous and were subjected to particle size and S.E.M. surface texture analysis.

Granulometric results showed that all four samples consisted of well sorted sands - a characteristic of dunes. In fact, the samples fell "within the grain size envelope of 32 dune samples obtained by Laycock (1978) on North Stradbroke Island "(Gillieson 1981:6). In short, apart from the silt mode, which reflects the expected organic content of midden deposits, none of the samples can be distinguished by particle size analysis from aeolian dune sand.

However, the S.E.M. examination of surface textures of quartz grains selected from the samples produced a finer resolution to this question. The clean sand from Stratum 1 exhibited features consistent with "turbulent aqueous flow" (Gillieson 1983:45), whereas the sands above exhibited the characteristics of aeolian dune environments.

Table 2. Chemical characteristics of Toulkerrie sediments (after Gillieson 1981:6)

Sample number	Stratum	pH	Soluble salts (g/l)	Phosphorous (ppm)	Organic Carbon %
FS87	8	8.30	0.06	100	0.85
FS88	3	8.15	0.04	19	0.53
FS89	2	8.25	0.10	60	0.98
F10	1	8.05	0.24	3.4	0.33

Further resolution is possible via other lines of evidence. First, the organic carbon content is significantly lower for Stratum 1 than that for samples above (Table 2). According to Gillieson (1981:4), this fact, plus the low phosphorous and high soluble salt content is quite "consistent with the chemical environment of beach facies". Second, Friederich (1978) notes that the local beach sands in this vicinity are comprised of reworked dune sands. Thus, the particle size similarity is to be expected. Finally, the morphology of Stratum 1 is consistent with that of local berms.

Thus, on the basis of Gillieson's study, the site formation hypotheses above were not able to be rejected. In connection with implication 3, estuarine shellfish species appear in the record as a mere trace only up until ca 70cm when oysters, cockles and sand snails begin to be better represented (Figure 4). Mudwhelks do not enter the sequence until the 20cm level. Differential preservation may not be cited as an explanation in this case since the pH is over 8.0 in all levels (Figure 2). In fact the best preserved organic remains were found in the lowest layer. Thus, the evidence may be interpreted as reflecting the build-up of tidal mudflats in the Toulkerrie locality as implied by the berm/dune hypothesis. The fact remains however, that pipi overwhelmingly predominates throughout the sequence of these assumed food remains. This may suggest that the very rich tidal mudflat which exists today had not reached its current production capacity before Toulkerrie ceased to be occupied. A comparative study of modern shellfish production with the archaeological shell is presently under way to check this notion.

A Working Model of Site Formation

The foregoing permits the development of a useful working model of the interplay of humans and landscaping processess which, in the long run, should clarify models about what people were doing at Toulkerrie. It is summarised below. Future investigation of Toulkerrie will be partially directed to putting this model to the test.

1. Some 300-400 years ago the Toulkerrie locality comprised an active dune up against which was formed a clean sandy beach not unlike those just to the north today. This beach may have been associated with a deep gutter fairly close to the shore not unlike those nearby today.
2. People occupied the site, bringing with them foods from the east coast of Moreton Island (ie. pipis and pandanus) and deposited the remains of their meals on the upper part of the beach (the berm).
3. Clean sands from the active dune in the vicinity of Ridge A slumped seaward and covered the midden layer (Stratum 2). On the basis of excellent archaeological integrity and clarity (Dancey 1981:20), this event is inferred to have been rapid.
4. Tidal mudflat development began to affect the Toulkerrie area (perhaps in response to changing sedimentation regimes of the Brisbane River). Dunes may have begun to stabilise and vegetation increase.
5. During three subsequent "visits", people discarded their food remains and artefacts in the same area (on the flat below Ridge A). But with each occupation, while the bulk of the shellfish still came from the east coast, numbers of estuarine invertebrate species were being discarded. While the taxa number increases through time, the estuarine-surfbeach proportion is roughly maintained (Figure 4).

6. Between visits some destabilisation of the dune caused more slumping of sands from the western edge to come down and partially cover the middens. Gillieson suggests that such instability was caused by firing on the basis that very thin concentrations of charcoal appear between midden and dune layers (1983:46). It may also have been caused directly by human clearing of vegetation at the site (cf. Lauer 1978:55). The seaward portions were not so affected and middens were laid upon other middens to form what to the excavator seemed an undifferentiated deposit (Figures 2 and 3). The auger series indicates that another small trench just to the north of Tr3 may clarify this aspect of the problem (see Figure 1).

7. Finally, people began to leave their refuse on top of Ridge A rather than down at the bottom of its slopes (or perhaps in both places). This layer (Stratum 10) built up at least until the time of European contact and was then abandoned, probably late in the last century.

8. In recent times the area has been used by fishers, oyster-getters and campers. The crest of Ridge C (ca. 20m south of Ridge B) contains a wooden hut and the shell of an automobile. This activity has contributed to some downslope erosion of middens on the ridgetop edges, but in the main the area is stabilised by low vegetation. Since controlled burning is not practiced, periodic bushfires serve to further degrade surficial midden material and add to the charcoal content.

What Were the People Doing?

While it is considered very important to unravel the way in which a site has been formed, such models as the one above at best serve to help elucidate more important archaeological questions as to what people were doing and how and why. At worst they become an end in themselves, describing physiogenic processes but largely ignoring the cultural. The following cultural interpretation centres upon subsistence and settlement and should again be considered as a preliminary or working model to be modified as further work in the locality proceeds. In this connection the reader is reminded that the Toulkerrie trenches presented herein are but a fraction of a large site complex located on the southwestern coast of Moreton Island. Although they may be representative of a small part of this complex, they should not be regarded as representative of the whole. Even in respect of this site, the trench baseline appears to be only slicing through one edge of a fairly large and dense midden at the base of Ridge A (see the auger soundings in Figure 1). Until this sector is at least sampled one should treat this "labcatch" (Walters 1979) with due caution in terms of its representativeness.

Versions of a tripartite model of Moreton Island subsistence and settlement are provided elsewhere (Robins and Hall 1981, Hall 1982, Robins 1983, 1984a; Hall and Robins 1984). It generally considers Toulkerrie as a base camp of relatively lengthy duration, in contrast to east coast sites like Minner Dint which is considered a short-term base camp (Hall 1980b).

Toulkerrie fits most of the criteria for a hunter-gatherer base camp as outlined by Jochim (1967). It is located in close proximity to marine and intertidal food resources, not from one but two coasts. The predominance of pipi shell and the presence of pandanus throughout the site points to regular exploitation of east coast beaches. It is, or was close to fresh water; a creek once drained a swamp in the back of the site (R. Day, island resident -pers com.). The swamp and others a little further inland offer an abundance of the historically reported starch staple, the root of the fern Blechnum indicum or "Bungwall" (see Hall 1982:86, Gillieson and Hall 1982). Once the mangroves and mudflats had built up adjacent to the site there would have been the added attraction of estuarine shellfish, mangrove worms, and even the dugong would have come to feed on the sea grass banks near the site.

The site is also a "comfortable" place to live (cf Jochim 1976:50). That is, it is a sandy and fairly flat area raised up off the beach (>1m a.h.w.m) and sheltered under a canopy of Bribie Pines beneath which vegetation growth is comparatively inhibited. In summer it is cool and shaded; in winter it is sheltered. Mosquitoes might be considered the only discomforting aspect of the site (see Meehan 1982:26). However, neither this writer nor large numbers of archaeology students were unduly troubled by these insects during several field camps there.

The only resource not close to the site is stone. Apart from rolled beach pebbles of various rock types (but esp. quartz) which may be picked up from the east coast beach after storms, the only rock source on the island is at Cape Moreton some 30kms away. Stone is also found at Point Lookout, North Stadbroke Island, which would have presented the islanders with a short (<1km) canoe trip. The physical distance was small but one does not know the social distance. Historically, there was much interaction socially between the Gnugi of Moreton Island with the Noonukl of Stradbroke Island (Robins 1979, 1983). Until more detailed analysis of the stone artefacts and their sources from both islands has been completed, parsimony argues for the stone coming from Moreton Island.

Jochim argues, "if settlement can be analyzed in terms of shifting pushes and pulls of resources and other factors, the size of the settlements should reflect the forces of attraction" (1981:155). If Toulkerrie can be considered as part of a large southwestern site complex as argued previously, then the inference is that settlements here were quite large from time to time, perhaps incorporating upwards of 50 individuals. Toulkerrie could well have formed one component of that larger unit. Certainly, the resources are here in the form of fish, shellfish and swamp plant foods to provide the "pull" for such, and also for lengthy community camps. This notion of a longish-term base camp here on the southwest coast in contrast to short-term ones on the east coast can be supported by a number of lines of archaeological evidence.

1. East coast food resources were transported in large amounts to the west coast. Evidence from east coast sites do not show the reverse.

2. This southwestern corner of the island contains a greater density of sites than anywhere else on the island.

3. The site contains a greater density of stone artefacts than east coast sites. For example, Tr6 is the same size as Trench B at Minner Dint (Hall 1980b) but produced 70 times the number of flaked stone pieces and a greater variety of stone artefacts (Figure 8). Further, at Toulkerrie one may observe the products of a stone reduction range from core to flake and and tiny chips. This I infer as indicative of longer term base camp activity than "overnight" industry.

4. The presence of such a relatively large number of fishes in comparison to other Moreton Island sites, especially in upper layers, suggests that Toulkerrie was a well-used fishing ground.

5. The non-fish vertebrates reflect procurement in quite diverse habitats. The tortoises are from freshwater aquatic areas, the bats from arboreal habitats, dugong and turtle from a marine one, and rat, reptile, goanna from terrestrial habitats. The presence of dugong alone would perhaps argue for more than an overnight base camp.

6. Since Tr4 only picks up the edge of four midden strata, the entire middens are considered quite large. They indicate either a very large population over a short time or a smaller group over a lengthy one. This writer opts for the latter given our ethnohistorical knowledge of the island (Robins 1979, 1983).

Seasonality?

It is somewhat easier to argue for the long-term base camp than it is to pinpoint just when people were living at Toulkerrie. This is because seasonal indicators are difficult to find in the subtropics. Was the camp occupied according to a fairly rigid seasonal schedule (eg. Draper 1978) or did people simply move according to food abundance/depletion, weather etc? The presence of pandanus fruits throughout the site points to late winter through summer. Whiting argue for summer if they were taken from near Toulkerrie (Ian Walters pers.com.). Although mullet are found in large numbers during winter, they may be taken throughout the year. Dugong are also most plentiful in winter. I suspect that season had less influence on settlement scheduling than resource depletion and thus hypothesize an all-season campsite. In this connection, a more detailed investigation of the shell component at Toulkerrie is under way to search for signs of overpredation. Similarly, Ian Walters is currently researching ways of getting more information from fish remains at Toulkerrie and other local middens. Results of these studies may help get a finer-grained impression of periodicity and duration of occupation here at Toulkerrie and at other archaeological sites in the region.

SUMMARY

The exploratory excavation at Toulkerrie revealed at least five separate occupations over some 300-400 years in the late Holocene, the last of which indicates European influence. The most striking aspect of the site is its abundance of fish remains, the upper levels appearing to mirror historical claims of Moreton Bay Aborigines as being fisherfolk par excellence (eg. Petrie 1904). The site appears to reflect a changing local environment from a clean beach to estuarine-mudflat conditions. However, the latter is not thought to have equalled the modern mudflat in food production. Occupation is considered to have been influenced by several factors, seasonality being perhaps a minor one. As it forms part of a large complex of sites, Toulkerrie's role in that complex will not be known until further research is undertaken. The excavation of this site has served to answer the original questions asked of it by MRAP and more. As usual, the site has generated more questions than it has answered. It has aided in the generation of a working model of human settlement and subsistence for Moreton Island as a whole and has allowed a glimpse at the nature of past local environmental shifts and their effect upon site formation and human behaviour.

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