AN EXCAVATION OF A MIDDEN COMPLEX AT THE TOULKERRIE OYSTERMENS LEASE, MORETON ISLAND, S.E. QUEENSLAND

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INTRODUCTION

In 1988, the Queensland Government proposed the granting of an Oystermen's Reserve at Toulkerrie on the south west coast of Moreton Island (Figure 1), under the trusteeship of the Fisheries Division, Department of Primary Industries. The lease consists of some 11 Lots within a wedge-shaped tract some 400m long (N-S) by between 100m (in north) and 50m wide (south) (Figure 2). As a consequence of this proposal the National Parks and Wildlife Service decided to alter the route of a stretch of road running through the lease area and called for a prior archaeological inspection of the new route. This work revealed numerous middens within the proposed lease proper (Hall 1988a) and subsequent discussions between D.P.I. and the (then) Archaeology Branch, Department of Community Services, led to a cultural resource management study (Hall 1988b). On the basis of an assessment of the surface manifestation of cultural material this area was deemed a significant Aboriginal midden-camp complex. Accordingly, a management plan was proposed which included limited archaeological excavation.

In March, 1989, The University of Queensland Archaeological Services Unit (UQASU) was engaged by D.P.I., Fisheries Division, to carry out such investigations. The aim of this limited excavation was essentially to gather a representative sample of cultural and matrix material sufficient to provide a more comprehensive assessment of the entire midden complex in respect of its human occupation and its spatial and temporal dimensions. Furthermore, and in light of the proposed management plan (Hall 1988b), The D.P.I wished to use the results to guide their final decisions as to which of the 15 lots were to be leased for oystering activities. As the latter aspec of the study has been dealt with elsewhere (Bowen and Hall 1990 in prep.), this paper concerns only the excavation results and their implications for the prehistory of Moreton Island.

A significant proportion of the data presented herein was worked up by one of the authors as part of his B.A. Honours thesis research (see Bowen 1989). That research utilized the results gained by preliminary analysis of the excavated material. Subsequent follow-up analysis has resulted in some modification of those earlier results (esp. re: stone analysis). However, these largely concern detailed data and do not change the overall results of the excavation.

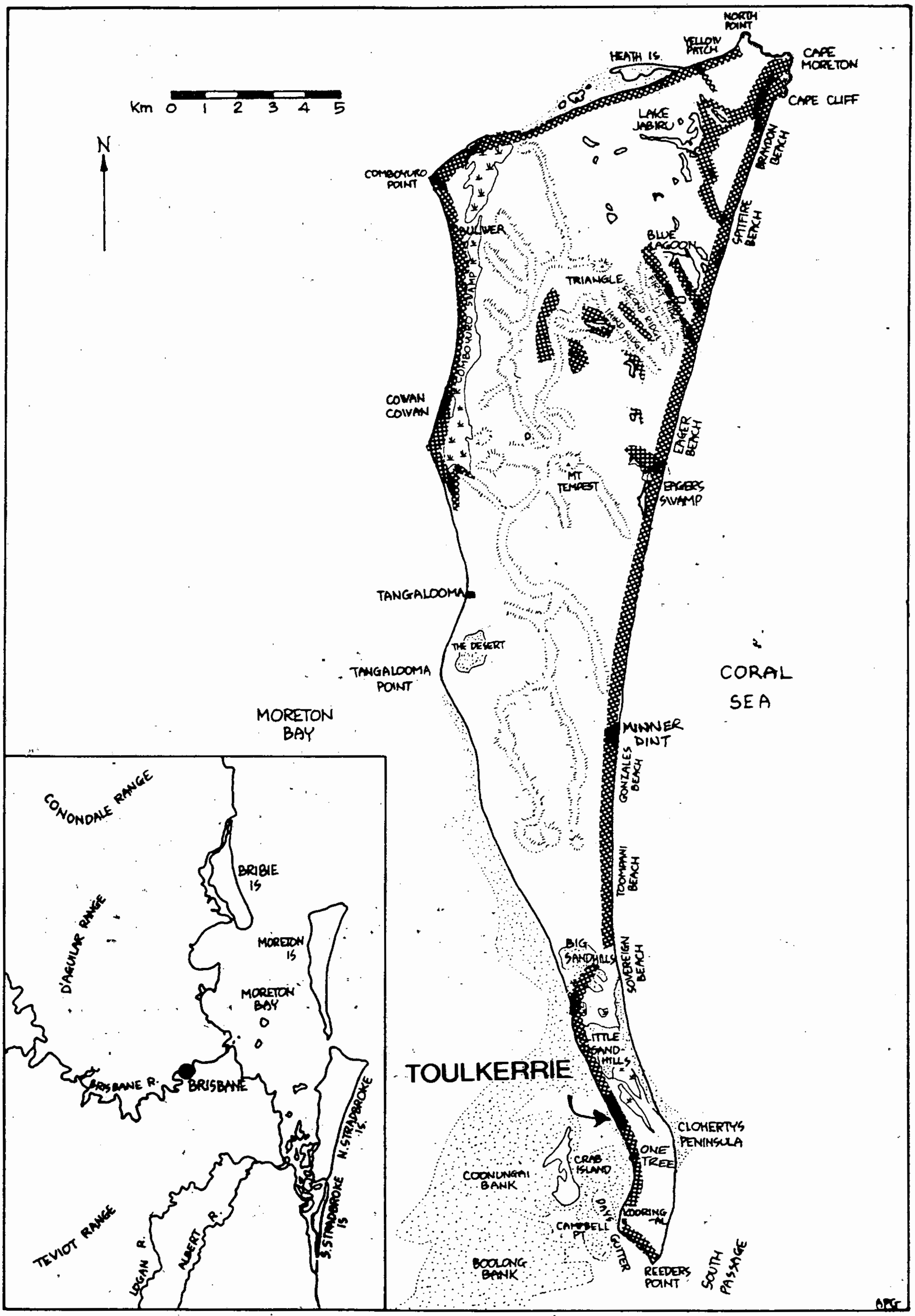

Figure 1. Map of Moreton Island showing Toulkerrie study area (hatching shows general site distribution) (after Hall & Robins 1984:86).

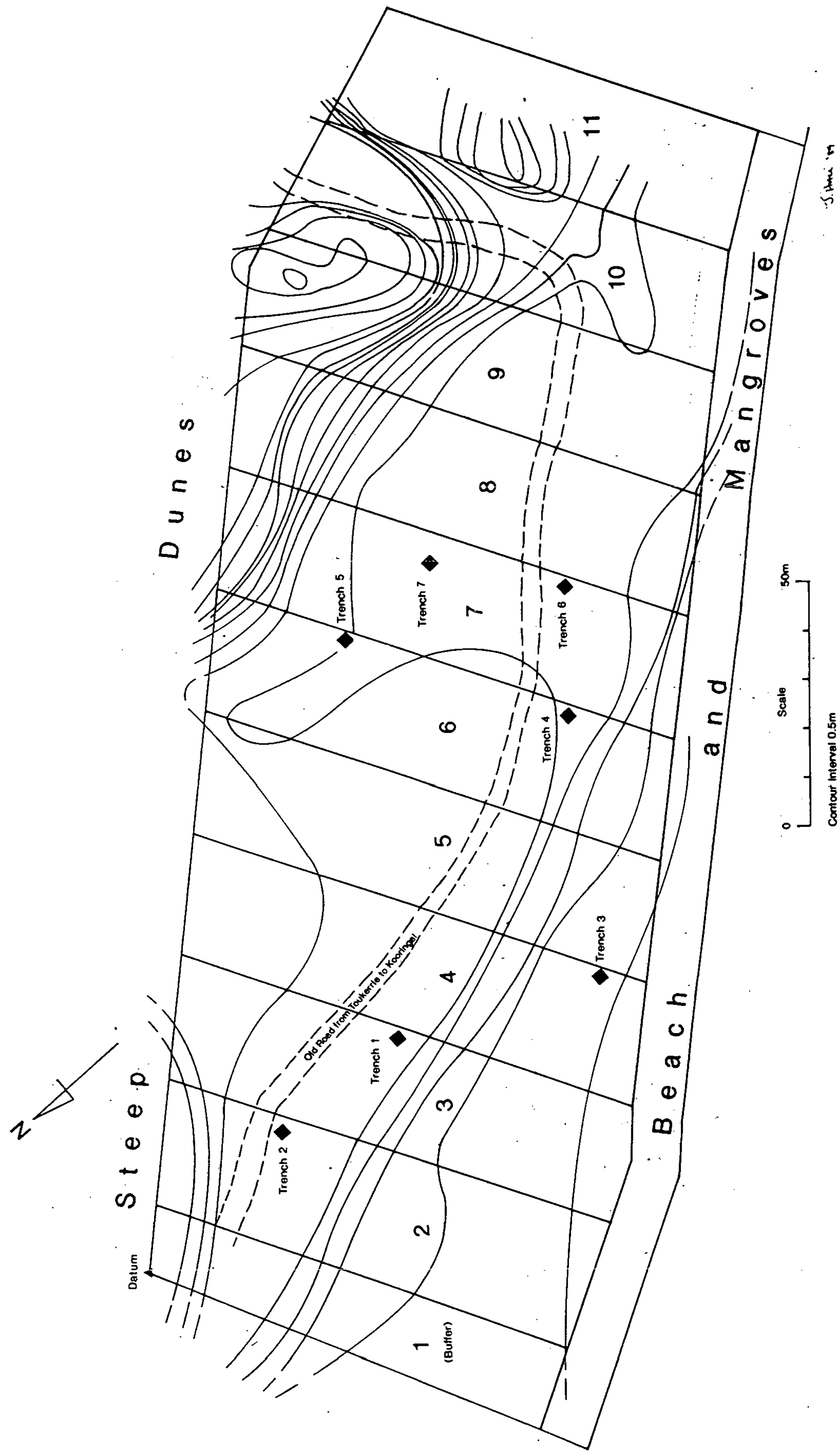

Figure 2. Map of proposed Oystermens Lease showing excavated trenches relative to lot numbers (after Hall 1988b:5).

THE SITE AND ITS SETTING

The Toulkerrie midden complex, listed on the State Site Register as LB:C33, is located at Grid Reference 412776, Kooringal Sheet 1:25,000 Queensland Topographic Series. The midden deposits are situated on level ground between the coastal mudflat-mangrove community and a series of steep sand ridges which lie up to 100m behind the mangroves (Figure 2).

The Toulkerrie locality is situated in typical Wallum country (Coaldrake 1961) with intertidal mudflats and mangrove communities leading up to a low-energy beach. The beach slopes up quickly to a low flat sandy ridge of ca. 1.0m to 2.0m elevation dominated by cypress pine trees (Callitris columellaris) with an understorey of grass and low shrubs. In the northern half of the lease (Lots 1-6 in Figure 2) the flat ridge runs westward approximately 60m where the terrain rises sharply to over 35.0m. This steeper ridge runs westward in the southern half of the lease (Lots 7-11 in Figure 2). These steep hills support a canopy of Banksia sp. and Tristania conferta as well as shrubs and grasses.

Erosion of the site has been largely confined by vegetation to the beachfront (Hall 1984:62). The midden complex has also, however, been partially disturbed by European activity including commercial oyster farming and private residence construction. More substantial damage has been caused by a four-wheel-drive track that traverses the site and cuts into the deposit (Figure 2). Stone artefacts, shell, and bone (largely dugong) are exposed in the track's bed.

PREVIOUS ARCHAEOLOGICAL WORK

During the past decade or so, quite a deal of archaeological research has been focused on Moreton Island (Morwood 1975; Richardson 1979; Walters 1987, 1989; Hall 1980, 1982, 1984; Robins 1983, 1984a, 1984b; Hall and Robins 1984; Lilley & Hall 1988). Surveys by Morwood (1975) and Robins (1983, 1984a) identified a large complex of midden sites on the southwest coast from Toulkerrie to Korringal. Subsequently, the Toulkerrie locality has come to be considered the richest complex of archaeological sites on the island.

Two excavations have been carried out in this part of the island by The University of Queensland, one at Toulkerrie, within 100m north of the present study area, the other at One Tree which is less than 1km to the south (see Hall 1982, 1984). At Toulkerrie six trenches of varying size and depth were excavated along an east-west transect placed across three small sand ridges approximately 30m from the coast. Excavation revealed a multi-component, stratified site with cultural deposit extending to 60-80cm below the surface. The basal deposits were C14-dated to about 400 years ago, suggesting that people only began occupying the site at this time.

The Toulkerrie midden deposit consisted primarily of marine fauna. Invertebrate fauna included Eugarie (Donax deltoides), Rock Oyster (Saccostrea commercialis), Cockle (Anadara trapezia), Sand Snail (Polinices sordidus), Mud Whelk (Pyrazus ebeninus) and Hairy Mussel (Trichomya hirsuta). Ten species of fish were also identified, including Bream (Acanthopagrus australis), Tarwhine (Rhabosargus sarba), Mullet (Mugil cephalus), Whiting (Sillago sp.), Flathead (Platycephalus fuscus), Luderick (Girella tricuspidata), Tailor (Pomatomous saltatrix), Jewfish (Sciaenidae) and two unidentified taxa. Of the above, Bream, Tarwhine and Mullet were most abundantly represented.

Hall attributed the rich suite of resources to the site's proximity to the two coasts and interpreted this midden as representing "a settlement...quite large from time to time, perhaps incorporating upwards of 50 individuals" (1984:79-80). He viewed Toulkerrie as representing a semi-permanent campsite or village from which people made forays to the east coast and other local microenvironments within a short distance (i.e. 2km or so).

The One-Tree site exhibited two stratigraphic levels, the uppermost containing shell midden deposit (plus fish bone and stone artefacts), the lower containing only stone artefacts and charcoal and a very few fragments of degraded shell. The lower stratum yielded a C14 age of 1600 b.p. (Hall 1982), the earliest date recorded for Aboriginal presence on Moreton Island until the present study. The shell midden layer remains undated at this time and although the bulk of midden analysis has now been completed, definitive results are not yet available for comparative purposes.

In general, the data from these two excavations are inferred to represent evidence of occupation by people living a fishing-shellfishing-gathering lifeway from the time of European contact back to some 1,600 years ago (Hall 1982). Following a sketchy model posited by Hall (1982:92) for the prehistory of Moreton Bay, Hall and Robins (1984) offered a working explanatory model of Moreton Island settlement which held that people abandoned the island after it was created by rising post-Pleistocene seas about 6,500 B.P., not to return to colonize it until ca. 2,000 years ago. This paper will further develop and refine this model.

To avoid confusion in this paper, the earlier Toulkerrie excavation will be referred to as Toulkerrie 1 and the excavation reported herein as Toulkerrie 2.

EXCAVATION

Prior to this Toulkerrie 2 excavation, the area had been surveyed by the D.P.I.- Fisheries Division, for the purpose of demarcating the oyster lease lots (Figure 2). Consequently, it was only necessary to add contours (0.5m intervals) along lot boundaries to gain a working site plan. These boundaries eventually were selected as transects along which excavation took place (Figure 2).

A sample of seven trenches, each measuring 50cm x 50cm in area, was chosen for excavation. These were located across the site in such a way as to obtain a representative sample of the entire complex. In short, this selection was based on judgment relating to site spatial variability (as seen from surface and subsurface probes) rather than based upon randomized selection techniques.

Excavation followed the system devised by Johnson (1979, 1980) whereby one 10-litre bucket filled from the deposit was designated one excavation unit. Each bucket was weighed on a tared spring balance and the deposit was wet-sieved through 3mm wire mesh, bagged and sent to the laboratory for analysis.

Of the seven trenches excavated, three (1, 2 & 3) were selected for laboratory analysis for the purposes of this study. This sample restriction was deemed appropriate in the face of both time constraints and minimal observed spatial variation of the cultural deposit.

Stratigraphy

Of the three trenches analysed, Trenches 1 and 2 demonstrated two distinct Stratigraphic Units (SU) on the basis of colour and texture during excavation (Figures 3 & 4) while Trench 3 exhibited three such units (Figure 5). Stratigraphic description is given below.

Stratification of Trenches 1 and 2

SUI A midden deposit characterised by an organic, "greasy" sediment. This layer extends to a maximum depth of 50cm in Trench 1 and 52cm in Trench 2. A feature worthy of note was an increasing degradation of shell in the lowest 10cm of the deposit in both trenches.

SUII A white sand below SUI which extends beyond excavation which was terminated at a depth of 80cm in both trenches after sand auger testing (to 1.5m) had revealed no further cultural material.

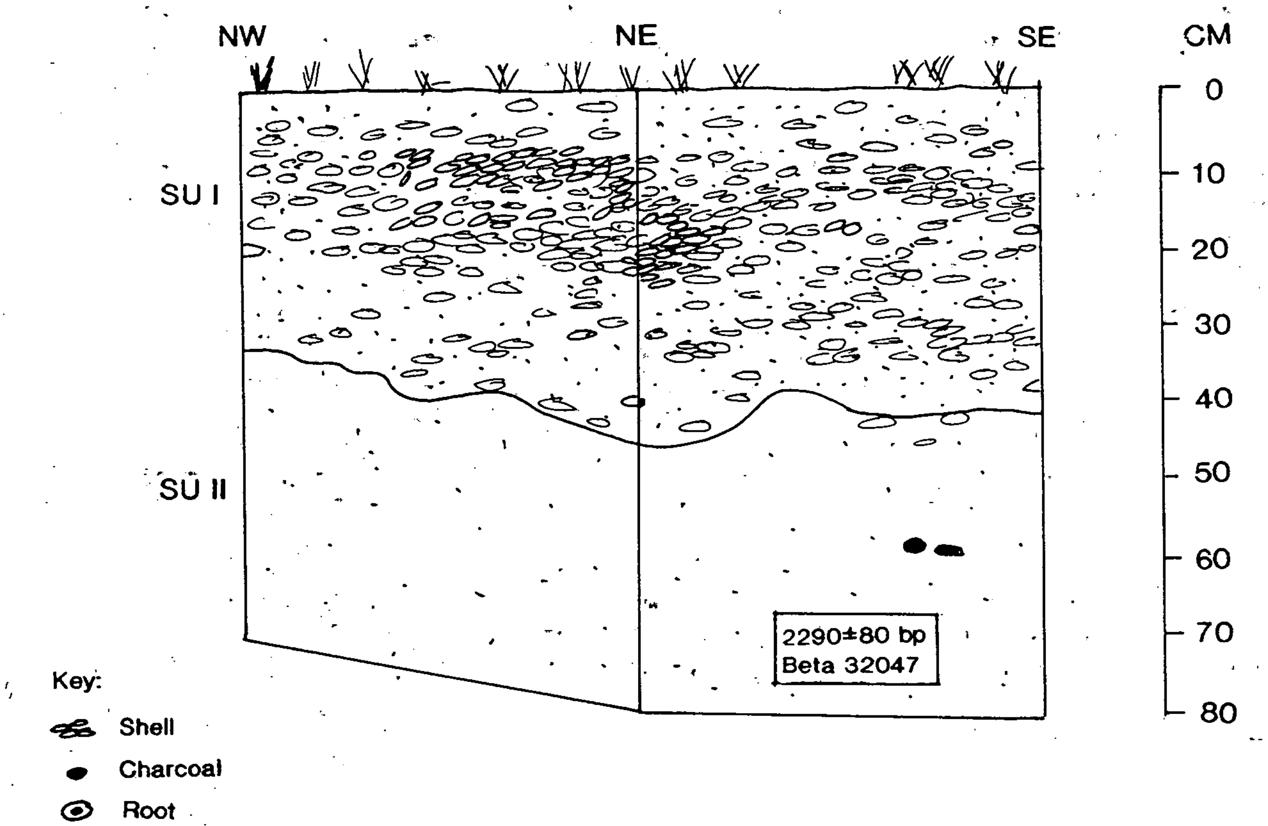

Figure 3. Profile of Trench 1.

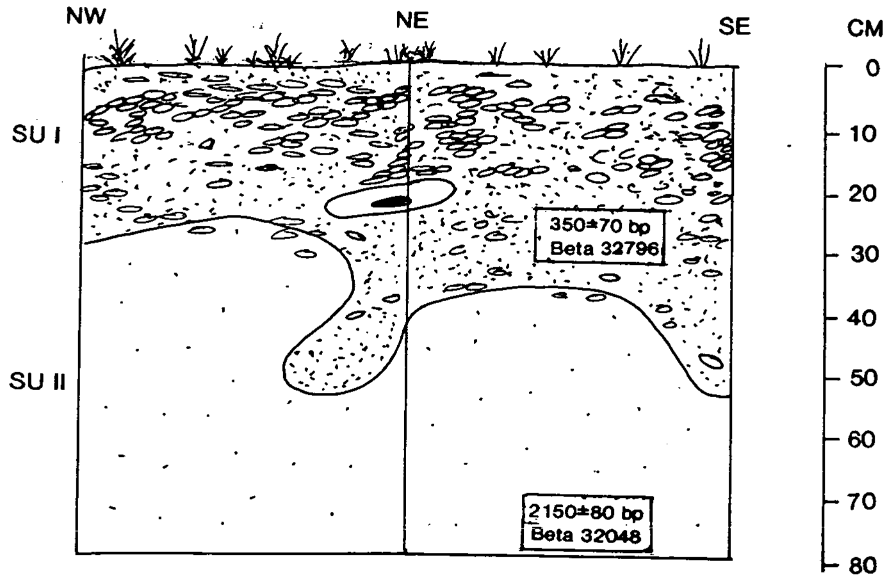

Figure 4. Profile of Trench 2.

Stratification of Trench 3

SUI - White sand intermixed with small quantities of shell (mainly oyster) and fragments of rusted iron extending to a depth of 44cm.

SUII - Shell midden deposit, characterised by a "greasy" organic sediment. This layer is 13cm thick and stops 57cm below the surface.

SUIII - A white sand extending at least 1m below excavation's end at 65cm (checked by sand-auger) which appeared to be culturally sterile (but see below).

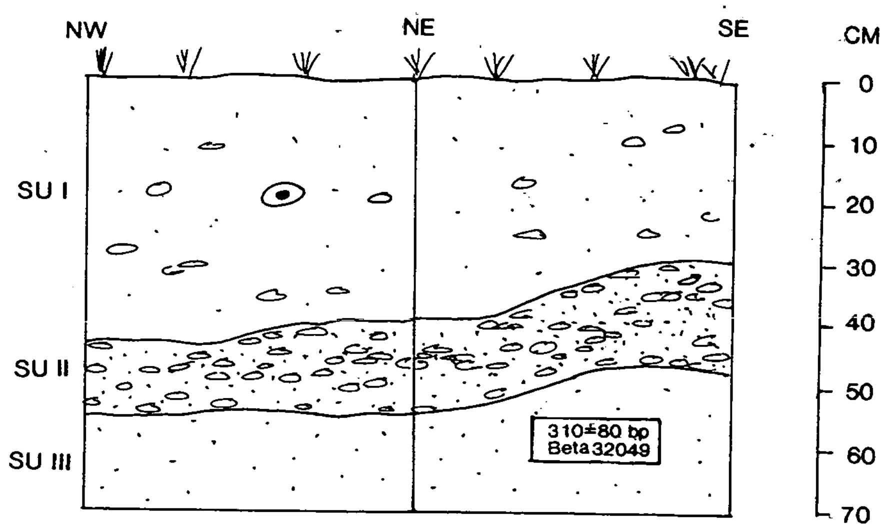

Figure 5. Profile of Trench 3.

Summary

The stratigraphic changes observed in the field on the basis of colour and texture appear to result from organic midden material staining the surrounding sandy matrix. White sand is found below the midden deposit in Trenches 1 and 2, and above and below the midden deposits in Trench 3. However, while the lower white sand layers exhibited no cultural material during excavation, they did yield stone artefacts, fragmentary charcoal and a few fish bones during subsequent laboratory sieving. Thus, as we shall demonstrate, the observed stratigraphic break serves to differentiate heavy shell midden deposits from other cultural deposition rather than to differentiate cultural from non-cultural strata. This feature was also noted during the excavation of the One-Tree site and we discuss this point later in the paper.

Although the midden deposition was probably episodic in nature, the cultural strata representing an unknown number of discard events, it was not possible to differentiate such events by reference to the trench sections. This stands in contrast to the Toulkerrie 1 midden where a number of interfingering midden deposits were discernible in the trench profiles (Hall 1984). The difference is likely the result of differential aeolian activity between the two areas. At Toulkerrie 1 periods of human occupation were quickly covered by sands which moved downslope from immediately adjacent dunes. At Toulkerrie 2 however, the high dunes which flank the middens to the east appear not to have been as active as those at Toulkerrie 1. This inference is based on the fact that the ca. 400-year-old shell midden deposit is still exposed on the surface between the low ridge and the dunes. Below the ridge however, the stratification and chronology of Trench 3 leads to the inference that the sands of the small ridge have been moving downslope, thus providing the matrix for SUI and covering the midden deposits (SUII) which are coeval with the SUI layers in Trenches 1 and 2 on the ridge top (see Figure 2).

DATING

Four wood charcoal samples from Trenches 1-3 and associated with cultural material were submitted to Beta Analytic Inc. (via the N.W.G. MacIntosh Centre for Quaternary Dating) for C14 determination. The resultant ages are presented in Table 1.

Table 1. C14 dates for Toulkerrie 2

Trench No	Stratigraphic Unit	Depth	Radiocarbon Age b.p.	Calibrated Age B.P.*	Laboratory Sample No.
1	II	70cm	2,290±80	2340	Beta-32047
2	I	25cm	350±80	407	Beta-32796
2	II	72cm	2,150±80	2188	Beta-32048
3	III	56cm	310±80	394	Beta-32049

* Calculated using CALIB program (Stuiver & Becker 1986)

These dates demonstrate a greater antiquity for the Island than was previously gained (Hall 1982:91). It is noteworthy that the basal dates (Beta 32047, 32048) from SU's II and III in Trenches 1 and 2, do not represent the antiquity of the shell midden deposit itself; rather they date the earliest deposition of other cultural material which is devoid of shellfish remains. The actual shell midden deposit dates to within the past 400 years or so (Beta 32049, 32796).

ANALYSIS

This section outlines data generated by analysis of the cultural material and a number of salient points are summarized from these data. In the laboratory the excavated material was re-sieved in clean water and air-dried. All material was sorted into four categories: Invertebrate Fauna, Vertebrate Fauna (subdivided into Fish and Other Fauna), Stone Artefacts and Charcoal.

Invertebrate Fauna

Five species of invertebrate fauna, all shellfish, were identified. They include Eugarie (*Donax deltoides*), large Sand Snail (*Polinices sordidus*), Rock Oyster (*Saccostrea commercialis*), Cockle (*Anadara trapezia*) and Mud Whelk (*Pyrazus ebeninus*). From this shellfish suite we infer that resources of the east and west coasts were being equally harvested (Tables 2-4). Sand Snail, Oyster, Cockle and Mud Whelk are all indigenous to mangroves/mudflats typical of the west coast in this locality while Eugarie is indigenous to east coast high energy beaches.

Minimum numbers for bi-valves were generated by counting left and right valves or hinge fragments and taking the highest number (after Bowdler 1983:140). All shell material was also weighed. Shell MNI's for Trenches 1-3 show variation in the spatial distribution of shell. In Trenches 1 and 2, shell takes on its highest density between depths of 11cm and 30cm below the surface. Below about 30cm shell diminishes significantly. Trench 3 differs in that it exhibits two shell concentrations, one at the surface, the other between 30cm and 40cm below surface. The upper layer, because it was dominated by oyster shell and associated with iron fragments but not with stone artefacts, is considered to have derived from very recent non-Aboriginal oystering activities. This is reflected in Figure 6 which shows an emphasis on eugarie and sand snail in Trenches 1 and 2 but a greater proportion of oyster in Trench 3.

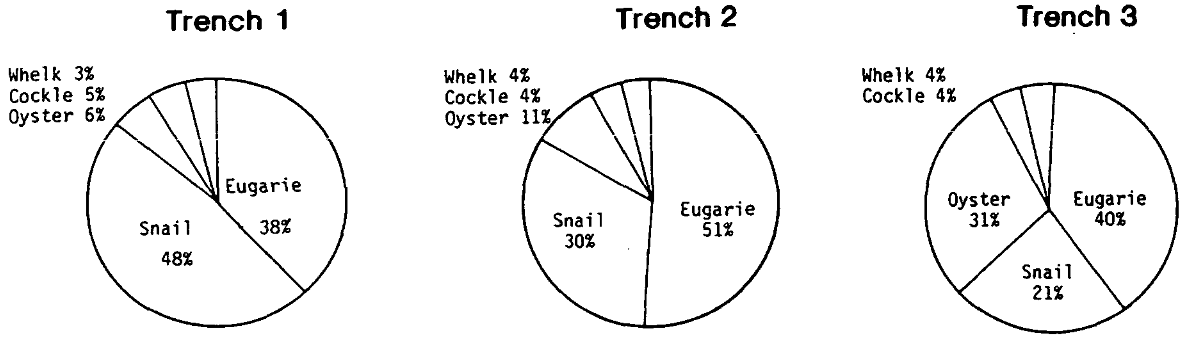

Figure 6. Proportions of shell taxa across Trenches 1, 2 and 3.

Table 2. Shell MNI and weight for Toulkerrie 2: Trench 1

DEPTH (Cm)	EUGARIE MNI	SNAIL MNI	OYSTER MNI	COCKLE MNI	WHELK MNI	ALL SHELL WT. (g.) WHOLE	FRAG.	TOTAL
0-10	2	2	-	-	-	16	-	16
11-20	129	165	17	12	10	1040	868	1908
21-30	45	66	10	8	3	561	266	827
31-40	10	7	5	2	-	97	41	138
41-50	3	1	-	1	-	43	26	69
51-60	-	1	-	1	-	9	59	68
61-70	-	-	-	-	-	-	1	1
71-80	-	-	-	-	-	-	0.24	0.24
Total	189	242	32	24	13			

Table 3. Shell MNI for Toulkerrie 2: Trench 2.

DEPTH (Cm)	EUGARIE MNI	SNAIL MNI	OYSTER MNI	COCKLE MNI	WHELK MNI	ALL SHELL WT. (g.) WHOLE	FRAG.	TOTAL
0-10	120	8	59	10	3	837	1464	2301
11-20	190	146	19	8	7	1479	1690	3169
21-30	75	67	5	13	15	889	229	1118
31-40	9	5	-	2	5	55	73	128
41-50	2	2	-	-	-	12	12	24
51-60	-	-	-	-	-	-	1	1
61-70	-	1	-	-	-	1	2	3
Total	396	229	83	33	30			

Table 4. Shell MNI for Toulkerrie 2: Trench 3.

DEPTH (Cm)	EUGARIE MNI	SNAIL MNI	OYSTER MNI	COCKLE MNI	WHELK MNI	ALL SHELL WT. (g.) WHOLE	FRAG.	TOTAL
1-10	-	-	49	-	11	385	53	438
11-20	1	-	-	-	1	17	5	22
21-30	3	2	-	1	-	35	22	57
31-40	225	126	127	22	11	2789	1265	4054
41-50	2	2	2	1	-	44	22	66
51-60	-	-	-	-	-	-	2	2
Total	231	130	178	24	23			

Vertebrate Fauna

Vertebrates were divided into two categories, Fish and Other Vertebrates. Preliminary identification (parts most easily identified) of bone has been completed but we caution the reader that fine-grained identification of the fish remains is incomplete and may eventually result in minor changes to the data below (esp. in MNI counts). Nevertheless, the vertebrate faunal data sufficient to the purpose of this paper which is to provide information for general comparison with other sites.

Fish

The four species of fish so far identified at Toulkerrie 2 included Yellowfin Bream (Acanthopagrus australis) Tarwhine (Rhabosargus sarba), Snapper (Chrysophrys auratus) and Whiting (Sillago sp.). Bream and Tarwhine are co-dominant, these sparids together comprising some 93% of the catch (Table 5). These four taxa stand opposed to the 10 identified at Toulkerrie 1 (Hall 1984:71) (and the seven taxa recorded by Walters [1987:345] from a subsequent excavation). Particularly surprising is the lack of Mullet which was a major component at Toulkerrie 1 (Hall 1984; Walters 1980, 1987). However, this lower range of diversity at Toulkerrie 2 is likely the result of fewer criteria being used for identification than was used by the abovementioned studies; only cranial elements such as teeth, skulls and otoliths were considered in Bowen's (1989) preliminary analysis. When work is completed on the more laborious task of identifying taxa from postcranial fragments (see Walters 1987), this apparent difference may be shown to be less distinct. Nevertheless, fewer fish taxa at Toulkerrie 2 does not rule out the possibility that the site actually exhibits a lower diversity than Toulkerrie 1.

Significant vertical concentrations of fish bone occurred in all trenches (Figure 7; Table 5). In Trench 1 fish bone was concentrated at a depth of ca. 11-30cm, in Trench 2 from the surface to ca. 30cm and in Trench 3 at ca. 30-40cm beneath the surface. Fish bone abundance diminishes markedly below these depths in all trenches.

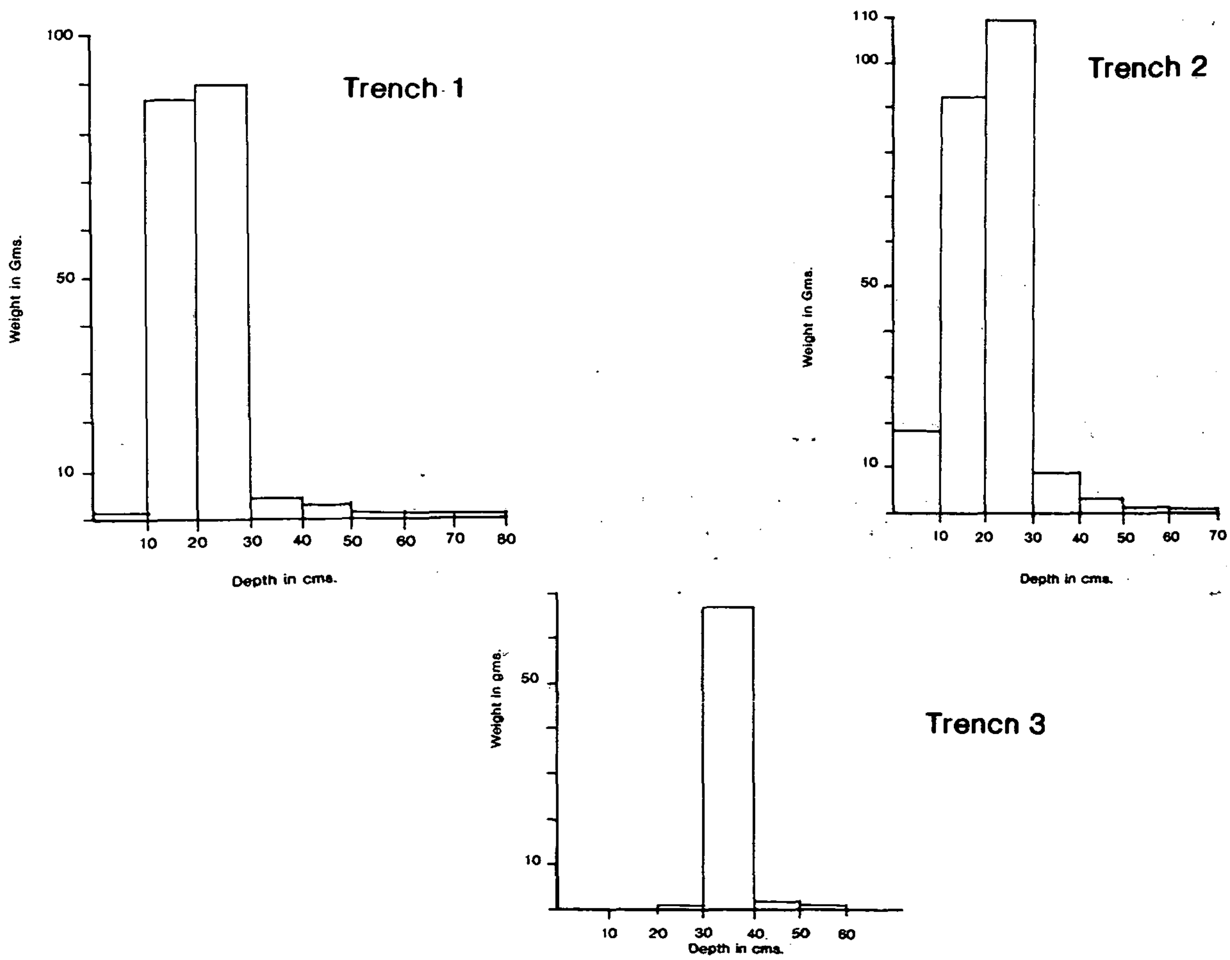

Figure 7. Comparative Weight of fish bone in Trenches 1, 2 and 3

As shown in Table 5, the total MNI count for the three trenches combined is 57 fish, not a large score considering the many thousands of fish parts recovered in the sieves. However, these numbers prove significant when compared with those from Toulkerrie 1 (Hall 1984:70). For example, Trench 6(N) at Toulkerrie 1, which is roughly the same thickness (and the same age) as the Toulkerrie 2 midden deposit, yielded a total of 52 fish MNI's. Taking account of the fact that Trench 6(N) has larger area ($1m^2$) that of the three Toulkerrie 2 trenches combined ($0.75m^2$) the Toulkerrie 2 midden MNI yield is significantly greater (i.e. 1.33 x 57 = 76 or 1.5 times greater than Tr6N). If one takes the mean fish MNI for the three Toulkerrie trenches ($\bar{X}$ MNI = 48.33), the result is still slightly greater (i.e. 48.33 x 1.33 = 64.3 or 1.28 times the Toulkerrie Tr6 MNI count). Given the fairly low sample numbers involved, we infer from this comparison that the numbers of fish discarded at each site are roughly comparable.

Table 5. Fish MNI for Toulkerrie 2: Trenches 1, 2 AND 3.

DEPTH	TRENCH 1					TRENCH 2			TRENCH 3				TOTAL
(Cm)	BRM	TAR	WH	SN		BRM	TAR		BRM	TAR	SN		N
0-10	-	-	-	-		-	-		-	-	-		-
11-20	3	3	-	1		3	3		-	-	-		13
21-30	3	2	1	-		3	3		1	-	-		13
31-40	1	1	-	-		5	8		6	2	3		26
41-50	-	-	-	-		1	1		1	-	-		3
51-60	-	-	-	-		1	1		-	-	-		-
61-70	-	-	-	-		-	-		-	-	-		-
71-80	-	-	-	-		-	-		-	-	-		-
TOTALS	7	6	1	1	(15)	13	16	(29)	8	2	3	(13)	57

KEY: BRM=Bream TAR=Tarwhine WH=Whiting SN=Snapper

In the course of researching the development of the prehistoric Aboriginal fishery of Moreton Bay, Walters (1987:230) postulated that fish MNI's might be estimated by counting vertebrae and employing the formula: 1 vertebra = 1 individual fish. This formula is hypothetical but founded in actualistic taphonomic research in a central Australian Aboriginal camp (Walters 1984). This study found that six months after initial discard of whole small lizard skeletons, only 1.25 vertebrae per individual were recovered archaeologically. This gives a "mean rate of survival of 1.25 vertebrae per animal" (Walters 1987:231). Arguing on the grounds that fish are morphologically related to lizards and seem to have "a similar archaeological survival potential", Walters (1987:230) conservatively suggests a ratio of 1:1 for fish.

Employment of this ratio to the Toulkerrie fish vertebrae provides a significantly larger MNI number than derived through other means (Table 6). Trench 1 yielded only 15 MNI's derived from cranial parts as opposed to 442 using vertebrae counts - a 30-fold increase. For Trench 2 the result (N=469) is 16-fold difference. If these numbers even roughly approach reality in terms of fish discarded, it may then be possible to speculatively estimate the entire population of fish discarded over the Toulkerrie 2 complex. For example, take the average number of vertebrae from Trenches 1 and 2 (n=455.5), multiply it by 4 to arrive at the number per square metre (n=1882) and then multiply by A (= estimated area in M^2 of entire midden). The shell middens of the Toulkerrie 2 complex cover an estimated area of $7,500m^2$. Thus: 455.5 x 4 x 7,500 = 13,650,000! To further speculate, as the shell middens are considered to have been laid down over some 250 years (between ca. 400 and 150 years ago), the calculation: 13,650,000/250 estimates that some 54,660 fish were discarded per year (ca. 150 fish per day). Although this method is hypothetical at this stage and requires further research, we concur with Walters' reasoning (1987:230) that given positive results from further taphonomic studies it may have "powerful implications for quantification of fish remains".

Table 6. Numbers of fish vertebrae per XU in Trenches 1 & 2 (calculated after Walters 1987:230).

MEAN DEPTH (Cm)	XU	NO. VERTEBRAE T1	T2
0 to	1	-	-
10	2	-	3
11 to	3	-	17
	4	31	43
	5	90	46
20	6	101	65
21 to	7	92	93
	8	85	130
30	9	27	23
31 to	10	7	12
40	11	2	9
41 to	12	7	3
50	13	-	5
51 to	14	-	7
60	15	-	7
61 to	16	-	1
70	17	-	3
71 to	18	-	2
80	19	-	-
>80	20+	-	-
TOTAL		442	469

As fish bone abundance is critical to our understanding of past Aboriginal subsistence on Australian coasts and to models of cultural change developed from perceived changes in the archaeological record, we consider it important to provide as many measures of abundance as possible so that one or all might be useful to other researchers. For example, Walters (1987, 1989) employed NISP values (Number of Identified Specimens) in the development of his argument for the intensification of fishing by Moreton Bay Aborigines during the past 2000 years or so. For comparative purposes then, we present NISP values for Trenches 1 and 2 (Table 7). Further, since fine-grained taxon identification has yet to be completed, we limit our NISP count to the inclusive broad taxon, Pisces, thus allowing for comparison between fish and other fauna. The fish NISP measure involved simply separating fish fragments from other faunal remains and counting them.

The result is interesting when compared with data from two other Moreton Bay shell middens of similar antiquity and similar stratification (Table 7). These middens are at Sandstone Point (SSP), and were considered the richest in terms of fish remains in Moreton Bay (see Nolan 1986) and this site was pivotal to Walters' (1987, 1989) late-Holocene fishery model. SSP1-A dated from between 740 ± 50 bp (at 90cm depth) and an unknown period after 500 ± 50 bp (60cm)(Walters 1987:206). The Toulkerrie 2 sequence, although not showing a sustained high average discard of fish like that of SSP1-A, at times actually demonstrates over twice the fish discard amount per centimetre.

Table 7. Comparison of Pisces NISP/cm for Trenches 1 and 2 at Toulkerrie 2, and Sandstone Point.

DEPTH (Cm)	TRENCH 1	TRENCH 2	AGE BP	SSP1-A*	AGE BP
0-10	0.8	13.3		154.4	
11-20	1102.0	446.2		416.2	
21-30	815.4	1274.7	ca.400	434.3	
31-40	51.9	138.7		517.5	
41-50	19.6	54.0		516.6	
51-60	5.9	42.6		538.7	
61-70	5.6	24.2	ca.2200	443.8	ca.500
71-80	1.1	5.9		343.3	
81-90	-	1.6		90.0	
90-100	n/a	n/a		4.5	
>100	n/a	n/a		0.6	

* Sandstone Point data averaged from Nolan (1986:85-86)

Other Vertebrates

Four non-fish taxa were recovered including Dugong (Dugong dugons), Python (Morelia spilotes), an as yet unidentified cetacean and an unidentified bird (Aves). Large terrestrial mammals, such as macropods, are absent from the deposit. NISP values for each are given in Table 8. Although this suite is represented by fewer numbers than were found in Toulkerrie 1 (Hall 1984), it shares with the latter a predominance of Dugong, suggesting that this general locality was favourable to the hunting of these large marine mammals. Also interesting is the lack of non-fish vertebrates below the shell midden deposits in all trenches.

Table 8. NISP Other Vertebrate for Trenches 1, 2, & 3.

DEPTH	TRENCH 1		TRENCH 2		TRENCH 3	
(Cm)	D	P	D	C	D	A
0 - 5	-	-	-	-	-	-
5 - 10	-	-	23	-	-	-
11 - 20	25	-	9	-	-	-
21 - 30	-	9	2	1	-	-
31 - 40	-	-	2	-	1	1
41 - 50	-	-	-	-	-	-
51 - 60	-	-	-	-	-	-

KEY: D=Dugong P=Python C=Cetacea A=Aves

Artefacts

Stone was recovered from the excavation as well as a surface collection. For the purposes of this paper only the excavated data is presented. Flaked stone artefacts were defined according to categories devloped by Hiscock (1984). Flaked stone artefacts less than 5.0mm in largest dimension were classified as chips. Other non-flaked stone included fragments of sandstone, rounded beach pebbles and numerous pieces of ironstone (locally known as "Coffee Rock"). All were classified as manuports; since the matrix is aeolian it could not have been deposited on the site by other than human action. Non-stone artefacts were found only in Trench 3 and all have been identified as fragments of rusted iron.

A total of 69 flaked stone artefacts were identified from Trenches 1, 2 and 3. Of these, three (4.4%) are cores, 17 (24.6%) are flakes, 21 (30.4%) are flaked pieces and 28 (40.6%) are chips. Six raw materials were flaked including silcrete, andesite, chalcedony, chert, rhyolite and quartz. Basic data for the assemblage is given in Tables 9,10, & 11.

Given such a small sample size little of statistical significance may be posited regarding this assemblage. However, a number of observations are listed here which may be important when the sample is later enlarged by inclusion of data analysed from the other four excavated trenches.

1. Almost half of the flaked stone assemblage is made from silcrete (43.5%), the next most utilized source being andesite (27.5%). The other four sources made up the remaining 29% (chalcedony = 7.3%, chert = 4.4%, rhyolite = 8.7% and quartz = 8.7%).

2. The three cores, all of silcrete, are small and have multiple platforms (i.e. more than 2). This, plus the fact that the flakes are all very small (weigh less than 1.0g) is suggestive of raw material rationing. Based on the raw material sourcing work of Richardson (1979) it is most likely that Cape Moreton was the quarry for this assemblage and that, owing to the long procurement distance (some 35km), raw material would probably have been carefully rationed. The only other source for flaking stone lies on Stradbroke Island or other parts of Moreton Bay.

3. A relatively large proportion (>40%) chips indicative of at least secondary and probably tertiary flaking/reduction suggests that the site was occupied for more than simple food procurement. In short, following Hall (1984) we would argue for an Aboriginal camp here.

4. It was interesting that the flaked stone assemblage exhibited neither formal flaked implement types (e.g. backed blades) nor artefacts exhibiting retouch or usewear. At present this lack is considered a function of small sample size.

Several points were noted of the stone component of Toulkerrie 2. Firstly, like Toulkerrie 1, stone is found in all trenches in low densities (Tables 9-11). However flaked stone artefacts tend to cluster into two distinct discard episodes, the first beginning at about 2300 BP, the second at about 400 years ago (Tables 9, & 10). The first was associated with thick shell midden material (SUI), the second lacked substantial cultural refuse (SUII). They were separated by a 10-20cm stone-free horizon.

Table 9. **Stratigraphic distribution of stone artefacts by raw material in Trench 1.**

DEPTH IN CM.	XU No.	FLAKED STONE S	A	C	Ch	R	Q	TOTAL No.	OTHER STONE (Number) SS	CR	M	P
0 to	1											
10	2											
11 to	3	f						1				
	4	CFFfc						5		1		
	5		c		c		cc	4		16		
20	6	c						1	1	46		
21 to	7	CF	f					3	1	35		1
	8	c	c					2	2	43		
30	9	F		ffc				4		15		
31 to	10				c			1	4	10		
40	11								2	1		
41 to	12								1	1		
50	13								1	1		
51 to	14		F					1				
60	15	F	F					2				
61 to	16	FF	f	F				4	2	1	1	
70	17		Fc			Fccc		6				
71 to	18	c						1				
80	19											
81 plus	20											
	21											
TOTALS		15	8	4	2	4	2	35	14	30	1	1

KEY:
1. RAW MATERIAL: S=Silcrete A=Andesite C=Chalcedony Ch=Chert R=Rhyolite Q=Quartz SS=Sandstone CR=Coffee Rock M=Manuport P=Potlid

2. FLAKED STONE CLASS: C=Core F=Flake f=Flaked Piece c=Chip

Table 10. **Stratigraphic distribution of stone artefacts by raw material in Trench 2.**

DEPTH IN CM.	XU NO.	FLAKED STONE S	A	C	Ch	R	Q	TOTAL No.	OTHER STONE (Number) SS	CR	M	O
0 to	1											
	2											
	3											
10	4	C						1	1	5		
11 to	5								2		1	
	6	f					f	2	1	8		
20	7						f	1	2		1	1
21 to	8	Fc			f			3	1	24		
	9	f						1		12		
	10	c						1		7		
30	11	F						1				2
31 to	12									3		
	13								1	1		
	14											2
40	15											
41 to	16									1	1	
	17									1		
50	18	c	f	f				3				
51 to	19						c	1				
60	20	F	fff			f		5				
61 to	21	c					c	2				
70	22											
TOTALS		10	4	1	1	1	4	21	8	62	3	5

KEY: As for Table 9 except for O=Ochre

Table 11. Stratigraphic distribution of stone artefacts by raw material in Trench 3.

DEPTH IN CM.	XU NO.	FLAKED S	A	C	STONE Ch	R	Q	TOTAL NO.	OTHER ARTEFACTS (Number) IRON	CR
0 to	1								18	
	2								27	
	3								70	
10	4								44	
11 to	5								2	
25	6								1	
26 to 30	7								2	5
31 to	8	F	Fccc					5		
40	9	ff	fcc			F		6		
41 to	10	c						1		
50	11	c						1		
51 to	12									
60	13									
TOTALS		5	7			1		13	164	5

KEY: As for Table 9 except for IRON=European rusted iron fragments

Secondly, there is a general lack of temporal change in the flaked stone artefact component in terms of either raw material range or abundance of artefacts (T1: n=14 to 21, T2:n=11 to 10). However, it is difficult to ascertain the discard rates per unit time for both discard phases. While the upper phase temporal range can reasonably be put at between ca. 400 BP and 150 BP (i.e. 250 years) the lower phase may represent any period(s) between ca. 2300 BP and 400BP. Thus, the similarity in discard abundance of the two clusters of flaked stone artefacts may actually reflect significantly lower discard rates per unit time for the lower phase.

Thirdly, unlike the flaked stone distribution, that of the non-flaked stone component shows an interestingly different pattern (Tables 9 & 10) which may help to illuminate reasons for the temporal changes noted in the shell fish/fish discard pattern. The sandstone discard is largely restricted to the upper phase shell midden deposit. All sandstone was found in the form of small fragments which we source to Moreton Island Sandstone which outcrops at Cape Moreton some 35km to the northeast. We also speculate that the sandstone fragments are remnants of grinding equipment. A muller, a shattered grindstone (in an, as yet, unanalyzed trench) and a complete grindstone plus muller (surface) were also recovered from the site. Two fragments exhibited smoothed facets and microscopic analysis revealed traces of ochre in interstitial cracks and fissures. In this connection, the few ochre fragments found were also restricted to the upper levels of the site (Table 10). This fact leads us to suggest a different function of the site after ca. 400 BP (discussion below).

Another interesting aspect of the non-flaked stone component of the assemblage is that of Coffee Rock, a cemented ironstone formed on the coasts of Moreton Bay including parts of Moreton Island, but not found forming in the general Toulkerrie locality. Its presence in the site is regarded as resulting from human activity. With only two exceptions (in T1, XU16), none of this material was found in the lower non-shell midden phase of the site. We thus speculate that it is associated with activities restricted to the upper phase of occupation. One plausible explanation is that, like other stone (and wood) which lies in intertidal waters in mud-flats, Coffee Rock would attract oyster spat, the young oysters using it as a substrate. One of the writers (J.H) has observed numerous instances of rock oyster clumps attached to Coffee Rock and other lithic substrates in other parts of Moreton Bay. At Sandstone Point, where this phenomenon occurs today, midden excavation yielded hundreds of Coffee Rock fragments associated with oysters. In sum, we argue that the Coffee Rock fragments at Toulkerrie 2 represent discarded debris separated from oyster clumps.

Other non-flaked stone included one potlid and four rolled beach pebbles. The latter exhibited no signs of usewear but, as they could not have originated on the west coast, they are considered manuports brought to the site from the east coast beaches.

Charcoal

Charcoal was also found in all cultural levels of the excavation and for the most part the fragments were angular and blocky, suggesting little post-depositional transport. The exception was the charcoal from the lowest XU's associated with the lower deposition phase. From this evidence we infer that the charcoal derived largely from human activity. Figure 8 shows the proportion of charcoal (by weight) in the Trenches. From these data we infer that charcoal deposition roughly mirrors the sequence as defined by other materials except shellfish remains. In short, the peaks of charcoal deposition are associated with the post-400 BP heavy shell midden.

The charcoal was examined for the presence of Pandanus, identified by Hall (1984:73) at Toulkerrie 1 and Minner Dint Midden as a likely subsistence component. Tiny Pandanus drupe fragments were identified but only in Trench 2 (see "P" in Figure 8), thus prohibiting assessment of this nut as a component of subsistence at Toulkerrie 2.

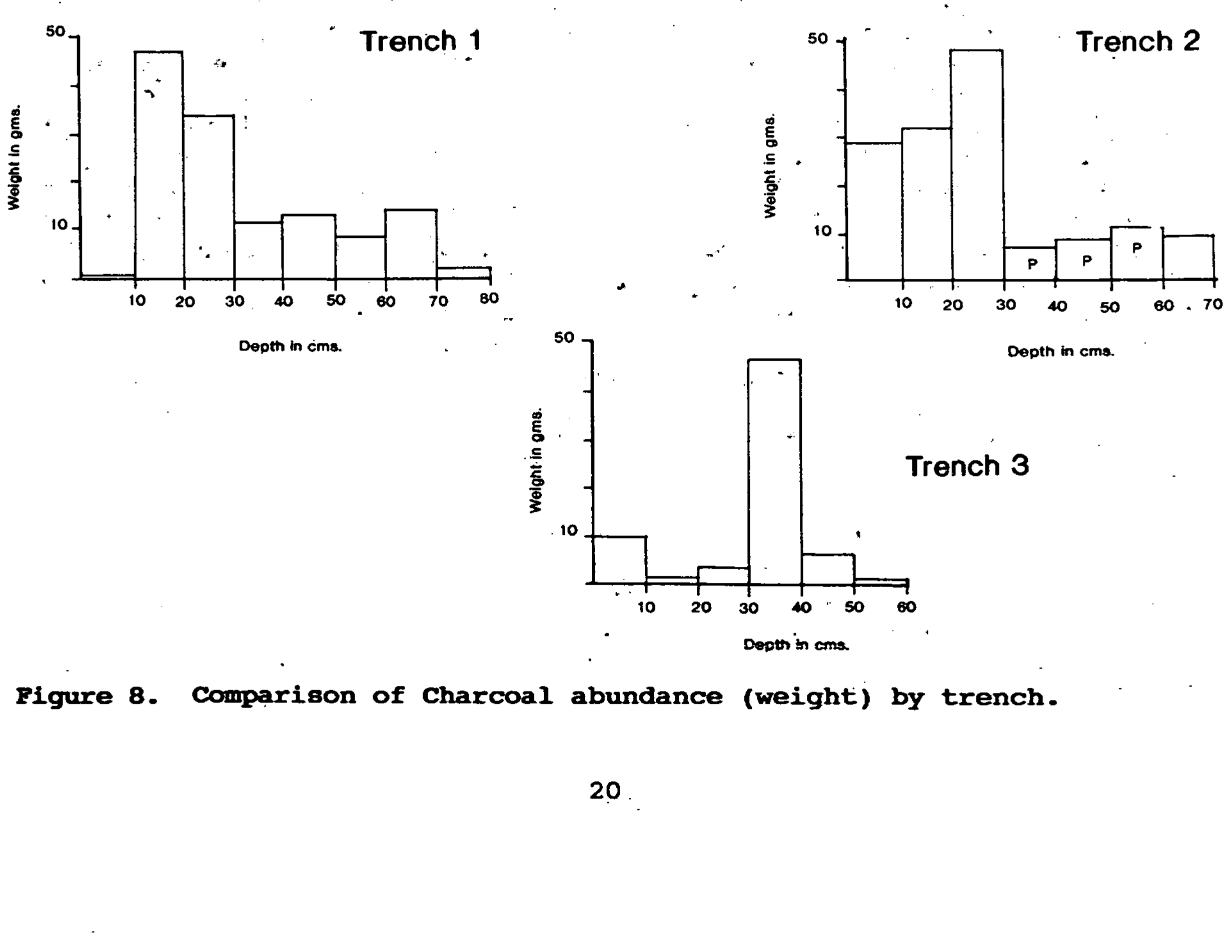

Figure 8. Comparison of Charcoal abundance (weight) by trench.

Summary of Salient Points Yielded by Analysis

The data presented above led us to several general conclusions which aid in the interpretation of this site in the context of Aboriginal culture in Moreton Island's prehistoric past. These are outlined here for the sake of brevity.

1. This midden complex has yielded an age which is some 500 years older than previous excavation has yielded. It demonstrates that people have been occupying this island for at least 2300 years. Thus, the site fits well within the temporal-settlement model posited by Hall and Robins (1984).

2. The material analyzed from this sample of three trenches reveals three episodes of cultural deposition. The first began at least 2300 years ago, the second at about 400 years ago and the third was within the past 150 years or so. The latter is attributed to European oystering activity while the first two are Aboriginal in origin.

3. The evidence points to a significant change in the deposits within the last 400 years or so. At this time and after, the trenches reveal both a significant increase in the density of discarded cultural material and a change in the kind of material discarded (i.e. shellfish, sandstone and Coffee Rock). Explanatory hypotheses for this change are pursued in the following discussion.

4. The distribution of faunal remains in the post-400 BP deposits suggests that harvests of east versus west coast invertebrates were roughly equal. This inference supports the argument (Hall 1984) that the site was used at this time as a base-camp from which people made subsistence forays to other localities beyond the local shore and sand ridges. Further, shellfish remains were limited to this upper phase of occupation; their absence prior to this date requires explanation.

5. The flaked stone artefacts found at the site are made from materials not found locally. In accordance with the findings of Richardson (1979), we argue that these materials were brought to the site from Cape Moreton, the rocky headland which provides a source for all identified rock types found at Toulkerrie 2. We also note that neither raw materials or artefact classes differ significantly through time. Discard rates for stone were not assessable for the lower phase due to an hiatus in the flaked stone artefact component at some time between 2300 and 400 BP.

6. The discovery of flaked stone artefacts, fish remains and charcoal in excavation units near the lowest limits of excavation raises some doubt as to whether the basal limit of human occupation was reached by the excavation. Despite the fact that all trenches were core-sampled by sand-auger well below the limit of excavation, it is possible that this procedure was too coarse to permit definitive statements on this matter. In short, further excavation could yield earlier cultural material.

With this brief outline in mind, we now turn to a re-evaluation of the significance of the Toulkerrie midden complex and the implications of these findings for Moreton Island prehistory.

DISCUSSION

The findings from Toulkerrie 2 do not refute the Moreton Island settlement model posited by Hall and Robins (1984). That is, the evidence adds support to the argument that, following abandonment of the newly-formed islands of Moreton Bay as they were created by the post-Pleistocene marine transgression some 6000 years ago, people did not return to exploit the resources of these islands until 2500 BP or so. This model is also supported by Alfredson's (1983, 1984) work on St. Helena Island, which demonstrated initial Holocene occupation just prior to 1900 BP. While evidence from adjacent Stradbroke Island, which Neal and Stock (1986) demonstrate to have been continuously occupied from >22,000 BP, we note that the sea would have presented no barrier to its exploitation at any time during the Holocene (see Hall and Hiscock 1988:14). As the general model appears to hold, we are now interested in investigating the why and the how of this move to the offshore islands, and Moreton Island in particular.

The Toulkerrie 2 sequence presents a suitable starting point for the discussion of the nature of late-Holocene island colonization by Aboriginal peoples. But first, the qualitative and quantitative changes perceived in the deposits over the past 2300 years require explanation. We offer three explanations in the form of working hypotheses. The first hypothesis holds that the differences noted in the sequence may be explained by differential preservation of organic remains. The second posits that the site's function changed after 400 BP and that the change was triggered by a shift in the local availability of food resources. The third hypothesis, advanced by Bowen (1989), argues that the early occupation phase may represent inter-island foraging by Stradbroke Island peoples and that the post-400 BP phase may represent the emergence of a newly-formed socio-political entity - the Ngugi of Moreton Island. We now discuss each of these hypotheses in turn.

Hypothesis 1: Differential Preservation

This hypothesis has a number of implications testable in reference to the archaeological record, two of which are dealt with here. First, if the increasing abundance of organic material from lower to upper phases is the result of preservation factors, then the organic material (i.e. shellfish and fish) should show varying degrees of degradation from top to bottom. Second, organic remains from other sites of the same antiquity and within similar depositional environments should offer similar degrees of preservation.

The shellfish data from all three trenches revealed that the shell abundance decreases with time/depth (Tables 2,3,4), a trend expected if the decrease reflected increased degradation with elapsed time since deposition. However, on two measures, one chemical and qualitative, the other mechanical and quantitative, the results are somewhat equivocal. If chemical degradation increased in proportion to elapsed time since despoition, shell in the lowest levels of the upper phase midden would appeared less fresh in condition (more "chalky" and soft) to shell found in the upper levels. In fact, this was not found to be the case; all shell appeared, in general, qualitaively similar in all XU's. The mechanical measure involved comparing ratios of whole to fragmented shell through tine, the assumption being that the more chemically degraded the shell, the more susceptible it would be to fragmentation.

Table 12 plots whole:fragmented shell ratios (by weight) for 10cm levels for all three trenches (data from Tables 2,3 & 4). It may be seen that while, apart from occasional departures, the trend is for shell to become more fragmented with time. However, although shell below ca. 50cm, tends to exhibit slightly higher ratios of fragments to whole shell, given the minute amounts involved, we consider it unlikely that significantly higher numbers of shell were once present at these levels. We also note that while other organic materials (i.e. fish remains) also decrease in abundance at these levels (cf. Tables 5-7), their observed state of preservation is qualitatively identical to that noted for fish remains above. Finally, as pH levels ranged between 6.5 and 8.0 for all levels in the trenches and showed no trends with depth or age, there is no chemical basis for the degradation argument.

Table 12. Comparison of Whole:Fragmented shell weight ratios per 10cm depth and time for Toulkerrie 2 trenches 1,2 & 3.

TIME (BP)	TRENCH 1 WH:FR	TRENCH 2 WH:FR	TRENCH 3 WH:FR
Present			7.3:1
			3.4:1
ca.150			1.6:1
	16:1	0.6:1	2.2:1
	13:1	0.9:1	2:1
ca.400	2:1	3.9:1	0.2
	2.3:1	0.8:1	
	1.7:1	1:1	
	4.5:1	0:1	
	0:1	1:2	
ca.2200	0:0.2	---	

In a wider perspective, we note that shellfish and fish remains have been found in a well-preserved state in other middens around Moreton Bay which date between 400 BP and 4500 BP (e.g. Alfredson 1983, 1984; Hall 1989, 1990 in prep.; Walters et al 1987). Furthermore, it was emphasized for Toulkerrie 1 that shellfish and fish remains in the lowest levels were in a better state than were those near the top (Hall 1984). In this cases it is considered that the shell midden above served to neutralize acids as they moved with groundwater through the deposits. In sum, we have all but ruled out differential preservation as a significant contributor to the change observed in the abundance of organic remains. However, we do not rule out mitigating factors in this connection which are best discussed in the context of Hypothesis 2.

Hypothesis 2: Change in site function and use

The evidence in support of this hypothesis comes from the introduction of shellfish remains and their association with sandstone, Coffee Rock and a significant increase in fish remains between ca 400BP and 150 BP. A clue to this change comes not from Toulkerrie 2 but Toulkerrie 1 where Hall (1984) was able, via sediment analysis, to argue that the ca. 400 BP initial deposition of shell midden coincided with the development of the extensive adjacent intertidal mud-flat/mangrove environment (this system is still forming in a South-North direction today). Thus, prior to the existence of this regime there would have been few shellfish and other estuarine fauna for human exploitation - at least in this general locality. Since Toulkerrie 2 is in the same locality and the upper phase begins at the same time as the initial occupation of Toulkerrie 1, we offer the same argument for the upper phase shell midden deposition. In short, the complex represents much the same base-camp scenario as posited by Hall (1984) for Toulkerrie 1.

However, if the shell midden phase reflects changing use of the site triggered by the development of adjacent mudflats and a concomitant increase in the range and biomass of exploitable food resources, what was the nature of occupation prior to this time? On present evidence we infer that from ca 2300 BP until some 400 BP, Toulkerrie 2 was infrequently visited by small groups of people for camps of short duration. The occupants fished, flaked stone for artefacts and built fires but did not gather many shellfish locally (most of the few fragments found in this phase are identifiable as Eugarie from the east coast). We consider that such a scenario would best account for the low densities of organic material and the general lack of grinding equipment (or fragments thereof) or Coffee Rock pieces.

In connection with Hypothesis 1 above, if such a scenario obtained one <u>would</u> expect differential preservation to play a role in the archaeological recovery. Small episodes of organic discard would be more susceptible to natural agents of site disturbance and degradation than would those of concentrated discard. In short, archaeological recovery may be proportionately less for such sites than for sites like Toulkerrie 1. Although no supporting granulometric work has yet been undertaken for Toulkerrie 2 it is possible that if no mudflats/mangroves existed in front of the site, the shore environment may well have resembled that of a few kilometres to the north at the Little Sandhills. Here active dunes, largely devoid of vegetation, come to an abrupt halt at the sea. In this area Robins (1984b) has studied the remains of small (<10m^2 in area), isolated short-term camps dating to the last 200 years or so. The cultural material included small discrete scatters of shellfish (>90% Eugarie), bone, stone artefacts and charcoal. Similarly, in the northeastern part of Moreton Island numerous small open sites dating to within the past 500 years have yielded stone and very degraded shell fish remains (Lilley and Hall 1987). In sum, the archaeological record in such places is patchy and comprises a few degrading shells, a few bones and some stone artefacts.

We thus hypothesize that the early phase at Toulkerrie 2 may represent such small infrequent short-term camps as are found dating from ca. 500 bp to recent times in other parts of the island. However, after the development of rich littoral resources adjacent to Toulkerrie people chose to camp there for longer periods. Of course, more research is necessary before refutation of this position may be considered; for the present it remains a working hypothesis.

<u>Hypothesis 3: Foraging and Settlement from Stradbroke Island</u>

This hypothesis moves up one notch of abstraction (and speculation) from Hypothesis 2 in that it posits that the island was visited by Stradbroke Island Aborigines on foraging trips from some 2000 years ago, and it wasn't until about 400-500 years ago that a group settled there permanently (Bowen 1989). In short, the Ngugi people of Moreton Island who occupied the island when Europeans first came to the area, are perhaps descended from a Stradbroke Island group which split to form a separate socio-political entity on the island about 500 years ago. This hypothesis would also explain the divergence between the two related dialects (Ngugi and Noonukl) of the language shared by these two island peoples (Prof. R. Dixon, Australian National University - pers. comm. 1989).

The question posed by Bowen was why and how did this recolonization develop? As to why this "budding off" event occurred, Bowen has argued that the cause was social rather than environmental (1989:69). In brief, social tension created by increased population density on Stradbroke Island, led to fissioning of part of the group (probably split along clan and family lines) to form a new group as a way to alleviate that tension and to resolve growing social conflict. As the details of this model are the subject of another paper (Bowen and Hall - in prep) we refer to it here in order to point out the need to develop both models of change which incorporate socio-cultural parameters as well as to search for "middle range" linkages between them and the archaeological record.

Of the three hypotheses advanced to explain the perceived change in the archaeological record at Toulkerrie 2, we feel that only Hypothesis 1 has been rejected in the broad sense. That is, differential preservation may have been a factor influencing archaeological survival but only in relation to Hypothesis 2. At present Hypothesis 2 conforms best to the evidence presented. Hypothesis 3 is of a higher order of inference and requires much more middle-range research (as defined by Binford 1982) before it may be tested.

In conclusion, the midden complex at Toulkerrie is a significant scientific resource. We feel that it - and other sites like it (e.g. Sandstone Point) - have the potential of providing a crucial key to unlocking the detail surrounding prehistoric changes in the Aboriginal lifeway on Moreton Island and the Moreton Region in general.

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