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Eurimbula Site 1

Introduction

This chapter reports the results of archaeological investigations at Eurimbula Site 1, a large site complex on the eastern margin of Eurimbula National Park. Test excavations conducted in 1995 (reported in Ulm et al. 1999a) revealed a low density cultural sequence with marked discontinuities in the distribution and antiquity of remains across the site complex. The densest and oldest deposits, dating to shortly before 3,000 BP, were located along the southern margin of the site with lower density deposits dating to the recent past across the northern two-thirds of the site. Densities of cultural material were also found to decrease markedly with distance from the creek. The excavations reported below sought to increase the sample of material available for analysis by targetting the concentrated near-creek deposits identified at the southern end of the site complex. Analyses of excavated material demonstrate extensive, low intensity site use from 3,000 BP into the historical period, with significant changes in both faunal and stone artefact assemblages over the last 1,500 years.

Site description and setting

Eurimbula Site 1 is a large, stratified midden complex intermittently exposed in a steep erosion section on the western bank of Round Hill Creek on the eastern boundary of Eurimbula National Park (Figs 12.1–12.2). The approximate centre-point of the site complex is located 4km southwest of Round Hill Head (Latitude: 24°11’32”S; Longitude: 151°51’45”E). The site is approximately 2km long (north-south) and up to 100m wide (east-west), although surface exposures of shell and stone artefacts are mainly confined to a 50m wide band parallel to the creek bank (Figs 12.3–12.4). The site thus covers a minimum area of 100,000m^2. It was formed on and in a series of low Holocene beach ridges and swales which run roughly parallel to the modern coastline forming Bustard Bay. These features were formed by the massive amounts of sand delivered to the coast by long-shore drift and long-shore transport of sediments on the continental shelf. Hopley (1985:76–7) defines this general area as a depositional coastline characterised by a series of beach ridges trailing northwards from the northern side of almost every estuary of note (see also Rowland 1987). A feature of these dunes is a band of dark cemented organic sands exposed in several locations in the erosion face approximately mid-way down the profile, commonly known as coffee rock in southeast Queensland (Fig. 12.5).

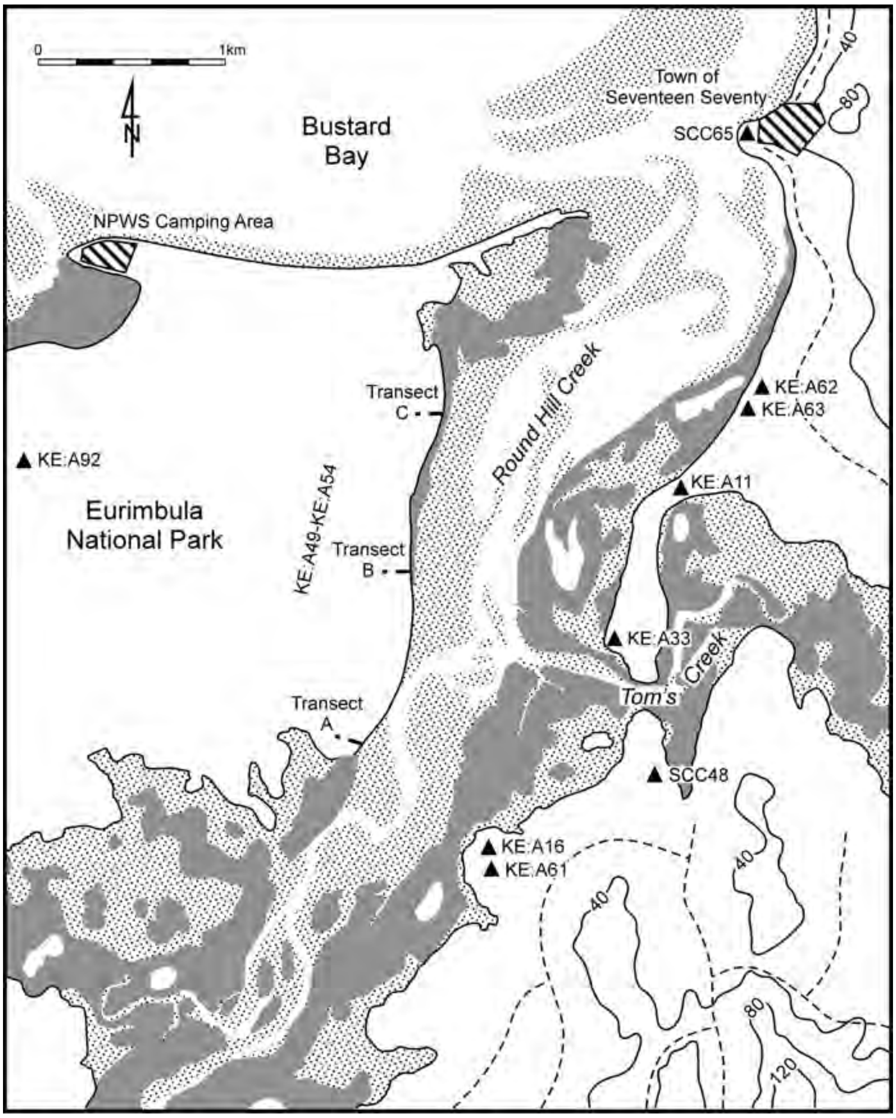

Figure 12.1 Lower reaches of Round Hill Creek, showing the location of Transects A, B and C at Eurimbula Site 1. Dark grey shading indicates the general extent of mangrove vegetation. Stippling indicates the general location of intertidal flats. Dashed lines are sealed roads.

Recent models proposed for southeast Queensland and northern New South Wales associate coffee rock formation with rising sea-levels in the mid-Holocene. It is thought that a subterranean salt wedge created by rising sea-levels interacts with organic material in coastal saltmarsh or back-barrier swamps to cement clastic material into humicretes or coffee rock (Maria Cotter, School of Human and Environmental Studies, University of New England, pers. comm., 2000). Therefore, the coffee rock exposed at Eurimbula Site 1 is likely to pre-date the Holocene highstand in the region dated to around 5,500 BP (see Chapter 2). Sediments located above this feature therefore post-date the mid-Holocene.

Large stone artefacts are common on or at the base of the erosion bank, having eroded out of *in situ* deposits located towards the top of the bank profile. The majority of these artefacts are manufactured on rhyolitic tuff. Occasional artefacts were also encountered on the fringing beach, suggesting significant bank retreat in these parts of the site, the deflation of larger stone artefacts and the complete removal of shell, charcoal and other lighter materials. The northern two-thirds of the site is bordered by a dense mangrove fringe which thins from north to south (Fig. 12.1). The mangrove fringe disappears altogether along the southern c.500m of the bank, coincident with an area of major recent bank retreat. The c.4m high creek bank in this area is very exposed: it abuts the main channel of Round Hill Creek and does not have a mangrove fringe to dissipate tidal surge (Figs 12.1, 12.3). The base of the bank in this area is littered with the remains of large trees which have eroded out of the bank. In places the bases of these trees occur up to 30m east of the current erosion bank in the subtidal zone, indicating significant bank recession. Few cultural materials have been observed along this section, possibly because they were removed by erosion. This observation accords well with previous findings revealing markedly decreased quantities of cultural material with distance from the creek margin (see below). A dense mangrove fringe commences at the extreme south of the erosion bank adjacent to large supratidal claypans and saltflats. Cultural material is abundant at the northern and southern extremities of the erosion bank where mangrove fringe development and the orientation of the creek channel may have reduced the impact of erosion, at least in recent times. At the northern end the frontal dune is set back slightly from the creek, offering further protection to deposits.

The cultural deposits border the extensive and shallow Round Hill Creek estuary, which comprises extensive intertidal and subtidal flats, samphire and claypan saltflats, seagrass beds and mangrove communities. Seagrass beds occur on the shallow banks in the middle reaches of the creek, concentrated near its confluence with Tom's Creek (Fig. 2.7). Although Olsen (1980a:17) referred to these beds as transitory seasonal features confined to the warmer months, they have been observed throughout the year during recent fieldtrips. Seagrass beds currently support a small population of mud arks (*Anadara trapezia*), with sometimes dense clumps of rock oysters (*Saccostrea glomerata*) and common nerites (*Nerita balteata*) attached to mangrove root substrates. Telescope mud whelks (*Telescopium telescopium*) are common amongst rearward mangroves.

Mangrove vegetation is dominated by spotted mangroves (*Rhizophora stylosa*) backed by yellow mangroves (*Ceriops tagal*) and grey mangroves (*Avicennia marina*) (Olsen 1980a:17). These vegetation communities appear to be persistent features in the local landscape with mangrove pollen dating to c.3,500 BP recovered from cored sediments underlying modern freshwater wetlands draining into Round Hill Creek (Maria Cotter, School of Human and Environmental Studies, University of New England, pers. comm., 2000). The position of the cored sediments suggests an expanded mid-Holocene Round Hill Creek estuary coincident with a sea-level highstand, with subsequent migration of vegetation zones associated with falling sea-levels. Cook (in Beaglehole 1968:256) and Banks (in Beaglehole 1963:65) noted many mangroves around the 'skirts' of the Round Hill Creek estuary during inspections on 23 May 1770. Shanco and Timmins (1975) noted saltmarsh backing the mangrove fringe comprising marine couch (*Sporobolus virginicus*), sea purslane (*Sesuvium portulacastrum*), and Australian seablite (*Sueada australis*) and other chenopods further inland. The seeds of marine couch are known to be an Aboriginal food source (Davie 1998:35). The site area is vegetated by tall open eucalypt forest (*Eucalyptus tereticornis*, *E. tessalaris*, *E. intermedia*, *Melaleuca dealbata*) with occasional cloudy teatree (*M. dealbata*) and weeping cabbage palm (*Livistonia decipiens*) more frequent towards the open beach. The understorey contains occasional concentrations of swamp fern (*Blechnum indicum*) and common bracken (*Pteridum esculentum*). The southern margin of the site adjacent to Transect A (Fig. 12.2) abuts a band of melaleuca (*M. quinquenervia*, *M. dealbata*) forest fringing the edge of the saltflats, with more diverse vegetation communities further to the south. An area of closed dry rainforest occurs <2km west of the site, comprising diverse vegetation including many Aboriginal bush food sources such as burdekin plum (*Pleiogynium timorense*), bumpy ash (*Flindersia schottiana*), brown pine (*Podocarpus elatus*) and native cherry (*Exocarpus latifolius*).

Evidence for non-Indigenous use of the site area is limited. There is no vehicular access within 2km of the creek bank containing the cultural deposits, with the only direct access by boat from the Town of Seventeen Seventy on the opposite side of the estuary. The site area is likely to have been selectively logged in the late nineteenth century, although a sawmill, established by 1867 around 3km northwest of the site, focussed on the hoop pine (*Araucaria cunninghamii*) located in the dry rainforest (Buchanan 1999:33; Growcott and Taylor 1996:65–6). A Queensland Parks and Wildlife Service camping area is located on Bustard Beach c.3km north-northwest of the site, although the focus of camper activities is on the open beach and recreational fishing of the adjacent Eurimbula Creek rather than the Round Hill Creek margin of the National Park. Surface survey of the area adjacent to the creek bank revealed occasional concentrations of recent (>AD 1970) beer bottles commonly associated with evidence for recent hearths and modern fishing equipment (e.g. fishing line, broken hand reels etc), suggesting that the area has been used in recent times for short-term camping by recreational fishers.

Numerous archaeological sites have been recorded around the margins of Round Hill Creek (see Fig. 2.11, Appendix 2), with a concentration of sites on the eastern bank of the creek opposite Eurimbula Site 1. Sites include a large shell mound dating to at least 1,600 cal BP (KE:A16) and a large site complex located at the junction of Tom's Creek and Round Hill Creek dating to at least c.1,500 cal BP (KE:A33; see Chapter 13). Other low density shell deposits recorded to the north of the concentration of sites around Tom's Creek (KE:A11; KE:A62–63) may be part of the same site complex, although disturbance associated with recent development activities has obscured the relationships between different exposures of this material.

Previous investigations

Eurimbula Site 1 is the only site on the southern Curtis Coast for which detailed ethnohistoric descriptions are available. The site is almost certainly that seen by Cook and Banks on 23 May 1770 when they explored the estuary by boat after a landing on the eastern bank earlier in the day. Both men made detailed dairy notes of the visit:

> As yet we had seen no people but saw a great deal of smook up and on the west side of the Lagoon which was all too far off for us to go by land excepting one; this we went to and found 10 small fires in a very small compass and some cockle shells laying by them but the people were gone. On the windward or South side of one fire was stuck up a little bark about a foot and a half high and some few pieces lay about in other places; these we concluded were all the covering they had in the night (Cook in Beaglehole 1968:256).

> Many large fires were made at a distance from us where probably the people were. One small one was in our neighbourhood, to this we went; it was burning when we came to it, but the people were gone; near it was left several vessels of bark which we conceivd were intended for water buckets, several shells and fish bones, the remainder I suppose of their last meal. Near the fires, for there were 6 or 7 small ones, were as many peices of soft bark of about the length and breadth of a man: these we supposd to be their beds: on the windward side of the fires was a small shade about a foot high made of bark likewise. The whole was in a thicket of close trees, defended by them from the wind; whether it was realy or not the place of their abode we can only guess. We saw no signs of a house or any thing like the ruins of an old one, and from the ground being much trod we concluded that they had for some time remaind in that place (Banks in Beaglehole 1963:67).

Other members of the landing party also reported the tail of a land animal at the camp to those that remained on the ship (Pickersgill in Bladen 1892:218). Parkinson (in Kippis 1814) noted this as 'the tail of a quadruped which we supposed might be a guanico [rat]'. Although Parkinson (in Kippis 1814) noted in passing that the fires might have been 'only an artifice of theirs to make us think they were numerous', the descriptions of Cook and Banks suggest small (still burning) fires, artefacts and food refuse consistent with a temporarily (and very recently) vacated camp site. Of particular relevance is the observation that the part of the site in active use was clearly located on the estuary rather than the open beach fronting Bustard Bay.

The site was briefly described by Godwin (1990), who noted the archaeological potential of the site as a large stratified deposit not common in the area. Burke (1993) subsequently recorded the deposits in more detail during a heritage management study of the Curtis Coast, identifying 20 separate sites comprising shell scatters and three linear middens. Burke (1993:Appendix 5) originally allocated these sites the field numbers CC-112A, CC-113A, CC-114–CC-131 and pre-allocated site numbers KE:A62–KE:A81, which were subsequently conflated into six sites when formally registered on the Queensland Environmental Protection Agency's (EPA) Indigenous Sites Database as KE:A49–KE:A54. In the site cards lodged with the EPA, Burke noted scattered mud ark, oyster and occasional club whelk in various densities and locales along the creek bank. Material was noted on the surface up to 40m from the creek bank and up to 30cm below the surface in the exposed erosion bank. A single stone artefact was recorded: a large, granitic core, which was thought to derive from the Round Hill Head headland. All of these deposits are referred to collectively here as Eurimbula Site 1. The Queensland Museum Scientific Collection Number is S864.

Test excavations were subsequently undertaken under the auspices of the Gooreng Gooreng Cultural Heritage Project (GGCHP) in April 1995 (reported in Ulm et al. 1999a). The major objective of these excavations was to establish the connection between the prograding beach ridge landforms and the deposition of cultural materials. In particular, data were collected to determine whether pre-European Aboriginal settlement patterns in the area were focussed on the estuary or the ocean beach; if the latter, the focus of settlement would be expected to be parallel to the orientation of the coastline and move northward as beach ridges developed in that direction.

During the initial field season, detailed survey of the erosion bank revealed quantities of shell and occasional stone artefacts which had fallen out of the bank owing to undercutting wave action (Fig. 12.3). Amongst the larger artefacts were several water-rounded microgranite hammerstones exhibiting impact-pitting. Although granites underlie the more recent rhyolitic tuffs which are common in the area, they rarely occur at or near the surface in the south of the study area. The closest documented surface occurrence of microgranite is at Bustard Head, some 20km to the northwest. Several large artefacts manufactured on sandstone and rhyolitic tuff were also noted. A number of these display possible bevelling along at least one margin and are roughly triangular in cross-section (Fig. 12.4). These artefacts appear morphologically similar to the 'bevelled-pounders' found further south, which are recognised as a formal tool type and functionally associated with processing of the root of the swamp fern (*B. indicum*) (Gillieson and Hall 1982; Higgins 1988; McNiven 1992b; Richter 1994). Although rhyolitic tuff is available on the east bank of Round Hill Creek at the junction of Tom's Creek 1km east, only two quarries have been identified: a minor extraction site on Round Hill Head 4km to the northeast (Rowland 1987), and the quarry described in Chapter 9. Sandstones are not common in the study area, indicating at least some transport of this material.

Three areas were selected for test excavation, located at the north, south and centre of the identified deposits (Fig. 12.1). Nine 50cm x 50cm test pits were excavated at 25m intervals along three transects placed approximately at right angles to the erosion face with three pits on each transect (Fig. 12.2). The test pits were placed across the site area in this way to characterise the broad patterns of variation in subsurface deposits. Excavations revealed an extensive, shallow, low

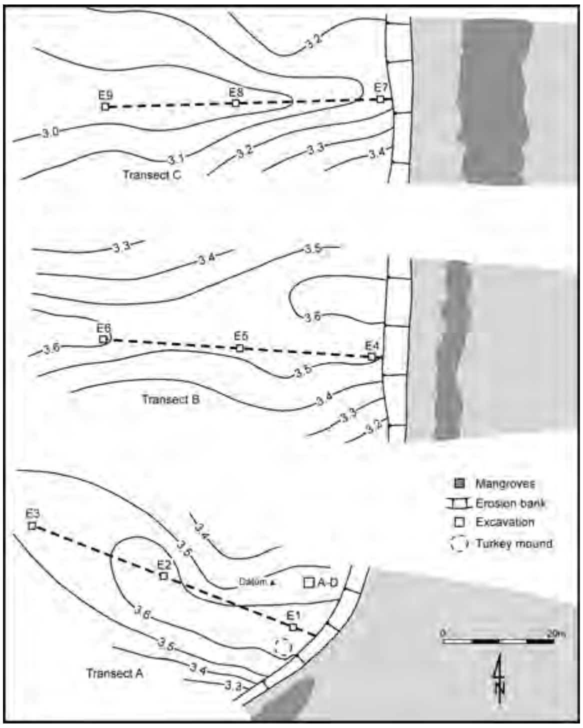

Figure 12.2 Location of test pits along Transects A, B and C at Eurimbula Site 1, showing topography in the immediate area of the transects.

Figure 12.3 General view of steep c.2m high erosion bank at the southern end of Eurimbula Site 1 fronting Round Hill Creek. Facing northwest.

Figure 12.4 Large stone artefact (FS1/2001) manufactured on rhyolitic tuff located mid-way down the erosion bank. Facing west.

density cultural sequence with shell, bone, stone artefacts and charcoal concentrated in the pits excavated along Transect A. Although small quantities of cultural material occur in the remaining pits, there appears to be a general decrease in quantity and diversity towards the sea. Squares E4 and E7, however, do contain substantial quantities of cultural remains in comparison to the other pits of Transects B and C. Cultural deposits were identified up to 50cm deep, with excavations terminating at a depth of c.70cm in culturally-sterile sediments. Shell was common in near-surface deposits with occasional concentrations up to 40cm below ground surface. Whole shells were not recovered from the basal excavated deposits, although occasional stone artefacts were noted in these units. Five radiocarbon dates were obtained, suggesting initial use of the site by 3,020±70 BP (Wk-3945) and probable abandonment in the contact period (Ulm et al. 1999a).

As surface observations had indicated, the two dominant mollusc species were rock oyster (*S. glomerata*) and mud ark (*A. trapezia*). The largest proportion of shell was recovered from Transect A, with Square E1 containing just over 2kg of oyster and mud ark combined. These two taxa exhibit a distinctly bimodal vertical distribution (Ulm et al. 1999a:Fig. 15). The earlier deposits show a dominance of mud ark, whilst the later units illustrate a shift towards exploitation of oyster. This trend was also apparent in Squares E2–E3 (Ulm et al. 1999a:Figs 16–17). Square E1 contained a clearly defined lens of *A. trapezia* located between 30–40cm below ground surface (Figs 12.6–12.7). The remaining squares contained only very small quantities of shell. Very small numbers of fish bone were also recovered. Bone from Squares E1–E9 was re-examined by Deborah Vale (School of Human and Environmental Studies, University of New England) as a component of the current project. Fish bone was identified only in Squares E1–E2 at the southern end of the site and was too fragmentary for identification (Table 12.1).

Stone artefacts (n=61) were concentrated at the southern end of the site in the vicinity of Transect A. A range of artefact types was represented, including flakes, flaked pieces and broken flakes as well as one backed artefact. Five raw materials are represented in the assemblage: quartz, quartzite, rhyolitic tuff, silcrete and a coarse sandstone. While quartz and rhyolitic tuff occur locally, the remaining raw materials are not common, suggesting the transport of stone into the area. Overall, rhyolitic tuff is the dominant raw material, although quartz is also well-represented. Significantly, there is a general pattern for artefacts manufactured on non-local raw material to be located towards the base of the cultural deposit. This pattern was noted in Squares E1–E3. Owing to the location of these raw material types in the excavations and based on the limited dating of the site, it seems likely that these artefacts are generally older than artefacts produced on local stone. This indicates a change in raw material focus in the local area and identifies a potentially important change in resource use that requires further investigation.

The primary objectives of further excavations in the vicinity of Square E1 were to: (1) expand the excavated sample to help understand the activities undertaken at the site; (2) recover data through controlled excavations which are directly comparable to other excavations conducted under the auspices of the

Table 12.1 Fish bone abundance, Eurimbula Site 1, Squares E1–E2.

SQUARE	XU	NUMBER SPECIMENS	TOTAL WEIGHT (g)
E1	2	12	0.13
E1	5	3	0.05
E1	6	16	0.19
E1	7	23	0.20
E1	8	3	0.10
E1	9	6	0.04
E1	10	11	0.05
E2	3	2	0.02
Total	–	76	0.78

Figure 12.5 Cleaned c.2.5m high section of erosion bank located along the southern third of the site, showing dark band of coffee rock mid-way down the profile. Facing west.

Figure 12.7 Close-up view of mud ark (*A. trapezia*) shell lens encountered during excavation, Square E1, XU10. Facing west.

Figure 12.6 General view of completed excavation, Square E1, showing shell lens mid-way down the western profile. Facing west.

Figure 12.8 General view of completed excavation at Squares A–D. Note large roots towards the top of the profile. Facing southwest.

Southern Curtis Coast Regional Archaeological Project (SCCRAP); and (3) collect further shell/charcoal paired samples, if possible, for radiocarbon dating to address issues of local marine reservoir effect in the Round Hill Creek estuary system. For further details on the results of earlier test excavations see Francis (1999), Lilley et al. (1996), Reid (1997) and Ulm et al. (1999a).

Excavation methods

A detailed surface examination of the entire lower western margin of Round Hill Creek was undertaken before final selection of the area to be excavated. Visibility away from creek margins was limited owing to dense vegetation cover, although erosion banks and clearings were examined in detail. The survey confirmed the results of previous studies, with scatters of surface shell and stone artefacts found to be concentrated at the southern end of the site and, more generally, in close proximity to the erosion bank. As in the earlier investigations, many large stone artefacts were located along the erosion bank. Ten of these artefacts were collected from the erosion bank for laboratory analysis. Square E1 from the 1996 excavations was relocated and backfill removed to allow plotting of the new excavation onto the same basemap as that used on the previous excavations. A $1m^2$ excavation grid comprising four 50cm × 50cm pits (Squares A–D) was excavated between 21 February and 9 March 1999 (Fig. 12.2).

The excavation grid was situated in a level area 7.9m north-northeast of Square E1 and 160cm west of the top of the erosion bank (Latitude: 24°11'54"S; Longitude: 151°51'34"E). The new excavation was situated further away from the brush-turkey mound to minimise the potential for disturbance to the surface and near-surface cultural deposits. Although a near-surface date of 220±80 BP (Wk-5601) was obtained for Square E1, it is difficult to interpret owing to the proximity of the pit to the mound and the presence of large quantities of shell which have been scratched-up onto the surface of the mound. Fragments of shell and charcoal were present amongst the leaf litter on the surface both within the gridded area and in the immediate vicinity of the pit. A site datum was established 5.76m west of the centre western margin of the excavation grid. Excavation proceeded in shallow, arbitrary excavation units averaging 3.2cm in depth and 10.9kg in weight. Excavation ceased at a maximum depth of 80.5cm below ground surface after several units of culturally-sterile sediments had been removed (Fig. 12.8). A total of 98 XUs was removed, distributed as follows: Square A (25 XUs), Square B (24 XUs), Square C (26 XUs), Square D (23 XUs). A total of 1,069.5kg of sediment was excavated. It was gently dry-sieved through 3mm screens onto a plastic tarpaulin located 4m northeast of the excavation to prevent contamination of underlying sediments. Stone (n=23), charcoal (n=8) and shell (n=2) specimens encountered *in situ* during excavation were plotted three-dimensionally. The excavation was backfilled with a layer of plastic sample bags across the base, followed by a 15cm thick layer of sterile white sands from the beach at the base of the erosion bank and finally the sediments that had passed through the sieve (see Chapter 3 for a detailed discussion of the standard excavation methods employed at all sites).

Cultural deposit and stratigraphy

Excavation revealed approximately 55cm of sediments containing cultural material overlying culturally-sterile sands (Table 12.2). The pit yielded quantities of shellfish remains, dominated by rock oyster (*S. glomerata*) and mud ark (*A. trapezia*) with occasional hercules club whelk (*Pyrazus ebininus*) and common nerite (*N. balteata*), particularly from the upper 30cm of the deposit. Minute shell fragments and occasional small stone artefacts were recovered to the base of excavations. Fish bone was recovered from every excavation unit in the top 35cm, with occasional pieces present to the base of SUIII (Table 12.3). As the excavation was situated on a sandy dune, bedrock was not reached, although excavation continued for 20cm below the last *in situ* cultural material encountered. The rate of site accumulation calculated using the methods outlined by Stein et al. (2003) was relatively slow overall at some 1.42cm/100 years.

The deposit can be divided into four major stratigraphic units (SUs) on the basis of sediment colour and texture (Table 12.3, Fig. 12.9). The stratigraphy is not straightforward owing to mottling of parts of the deposit resulting from root penetration and burrowing which obscure the interface between units. Cultural materials were encountered *in situ* to the base of SUIII. Shell and stone recovered from the sieve residue below this level are thought to derive from higher up the sequence (see below). Mottling is a feature of SUIV, suggesting some penetration by roots and/or burrowing animals (see below). Acidity (pH) values are slightly acidic to neutral throughout (6.0–7.0). This stratigraphic sequence accords well with that described for the nearby Square E1 (Ulm et al. 1999a:108).

Table 12.2 Eurimbula Site 1, Squares A–D: summary excavation data and dominant materials. Data from Squares E1–E9 are included for comparison (after Ulm et al. 1999a:Appendix A–I).

SQUARE	XUs (#)	DEPTH (cm)	WEIGHT (kg)	SHELL (g)	BONE (g)	CHARCOAL (g)	ARTEFACTS (g)	STONE (g)	ORGANIC (g)
A	25	77.6	264.3	1459.6	6.6	118.6	2.9	18.0	3371.7
B	24	80.5	266.1	2096.4	7.6	133.8	25.9	65.4	2170.1
C	26	80.3	282.5	1919.3	8.7	96.1	4.6	66.3	2185.0
D	23	79.7	256.6	1192.0	5.1	282.9	132.8	58.0	1780.8
Subtotal	98	–	1069.5	6667.3	28.0	631.4	166.3	207.7	9507.6
E1	15	66.6	209.1	2451.0	3.0	194.0	16.1	NA	562.9
E2	9	51.1	161.0	177.6	0.5	159.5	43.9	NA	14.4
E3	9	47.7	143.5	211.6	0.1	94.2	4.0	NA	435.0
E4	6	29.5	100.0	1190.8	0.8	1.3	9.7	NA	13.7
E5	9	44.4	165.5	16.3	0	197.4	0	NA	155.0
E6	7	43.1	144.0	24.7	0	112.8	0	NA	425.9
E7	8	45.8	150.7	144.1	0	83.2	0	NA	320.4
E8	5	33.4	90.3	6.3	0	30.6	0	NA	99.5
E9	5	30.5	84.1	0	0	16.4	0	NA	1.6
Subtotal	73	–	1248.2	4222.4	4.4	889.4	73.7	NA	2028.4
Total	171	–	2317.7	10889.7	32.4	1520.8	240.0	207.7	11536.0

Table 12.3 Stratigraphic Unit descriptions, Eurimbula Site 1, Squares A–D.

SU	DESCRIPTION
I	Extends across the entire square with an average depth of 2.5cm and a maximum depth of 4cm below ground surface. The unit comprises greyish brown (2.5Y-5/2) medium subangular and poorly-sorted humic sands that are consolidated by a dense, matted fibrous root matrix. The surface of the unit is covered by leaf litter. Occasional tuffs of grass penetrate this surface layer with numerous small, fibrous roots. Cultural materials include occasional oyster and mud ark shell fragments, land snail and charcoal. pH values are slightly acidic (6.5).
II	Extends across the entire square with a maximum thickness of 28cm and a maximum depth of 32cm below the surface. It comprises fine subrounded and poorly-sorted dark greyish brown (10YR-4/2) to very dark greyish brown (10YR-3/2) sediments. The soils are humic and contain numerous roots up to 4cm in diameter. Large quantities of oyster and occasional mud ark, fish bone, stone artefacts and charcoal were recovered from the unit. pH values are slightly acidic (6.0–6.5).
III	Extends across the entire square with a maximum thickness of 36cm and a maximum depth of 58cm below the surface. The transition between SUII and SUIII is poorly defined owing to grading and mottling of the deposit from dark greyish brown (10YR-4/2)/brown (10YR-5/3) at the top to yellowish brown (10YR-5/4) at the base of the unit. Cultural material includes abundant mud ark (particularly in Squares B–C), with occasional oyster fragments, fish bone, charcoal and stone artefacts. Active tree roots are common in this unit, though fewer than SUII. pH values are slightly acidic to neutral (6.0–7.0), with an average of 6.5.
IV	Extends across the entire base of the excavation with a minimum thickness of 30cm and a maximum depth of at least 80cm below the surface. The base of this unit was not reached. Sediments comprise moist loosely consolidated light olive brown (2.5Y-5/4) to pale yellow (2.5Y-7/4) sediments with few roots. This unit appears to be culturally-sterile with abundant blocky charcoal (especially in Square D) and small pumice nodules. The several small stone artefacts and minute shell fragments recovered from this unit are thought to derive from the upper SUs. pH values are slightly acidic to neutral (6.0–7.0), with an average of 6.5.

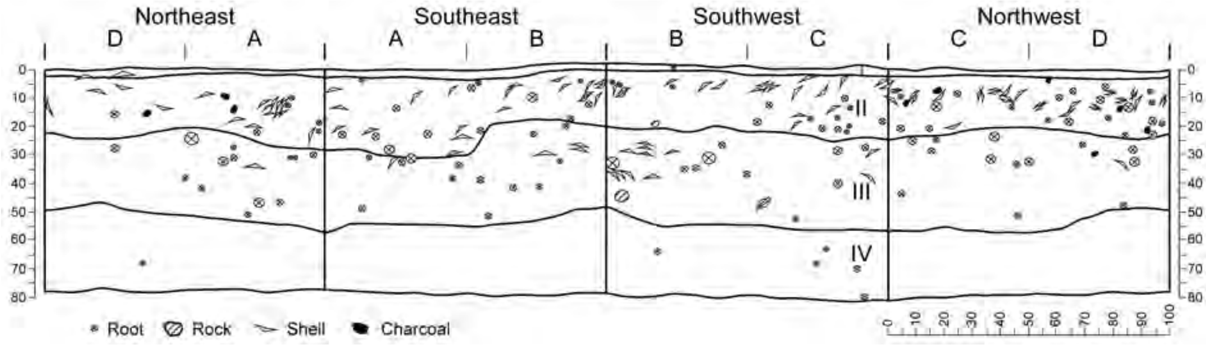

Figure 12.9 Stratigraphic section, Eurimbula Site 1, Squares A–D.

Radiocarbon dating and chronology

Twelve radiocarbon determinations have been obtained for the deposits, including the five obtained for the initial excavations (Lilley et al. 1996; Ulm et al. 1999a). As part of the present project, three further dates were obtained on samples from the initial excavations (one each from Squares E3, E4 and E7) to increase understanding of intra-site temporal variability. In total, three dates were obtained from Square E1, with one each from Squares E2–E4, two from Square E7 and four from Squares A–D. Seven dates were obtained on charcoal and five on *A. trapezia* samples (Table 12.4). A shell date from a discrete shell lens in Square E1, XU10 (Wk-3944), was paired with a charcoal sample from the same feature (Wk-5215) to investigate local marine reservoir conditions (see Chapter 4). Local reservoir effects may be a major factor in dating shell material from the Round Hill Creek estuary, as freshwater input from adjacent wetlands and incomplete isotopic exchange with the open ocean may have significantly altered radiocarbon activity within the estuary. The paired sample exhibits an apparent difference of 790 ^{14}C years (Table 12.4). The most probable explanation for this wide discrepancy is a lack of association between the shell and charcoal samples selected for dating. Although the discrete shell lens from which the samples derived appeared to be a secure stratigraphic context, it is possible that bulk sampling of the lens from the section resulted in contamination by more recent charcoal fragments. Alternatively, this apparent anomaly may be accounted for by mobilisation of small charcoal fragments in the matrix, as it is unlikely that densely packed shell valves with large surface areas such as that contained in the lens have moved far in the deposit (see Hughes and Lampert 1977). Calibration calculations for dates obtained on marine shell samples in Table 12.4 therefore employ a ΔR correction value of –305±61, a provisional estimate based on a single shell/charcoal pair from the Tom's Creek Site Complex on the opposite side of Round Hill Creek (see Chapter 4 for details). It must be emphasised that this value was adopted as a first approximation, and less confidence can be placed in this figure than those available for other estuaries where more than one value has been determined.

Figure 12.10 plots the intercept closest to the mid-point of all calibrated ages against depth. All 12 samples show generally good concordance between age and sample depth. The linear regression only includes dates from Transect A, and excludes the paired samples (Wk-3944/Wk-5215) from Square E1 and the shell sample from Square E3 owing to uncertainties in sample provenance and marine reservoir offset. The regression shows a strong correlation between age and depth (r^2=0.9830) for these six determinations. Note that the origin intercept has not been forced through zero as it is not assumed that the surface represents 0 cal BP. Although straight line regressions can mask potentially significant variation in deposition rates (e.g. David and Chant 1995:377), they illustrate the general age-depth relationship of the deposit as a whole. All dates on *A. trapezia* samples shown in Figure 12.10 have been calibrated with the provisional ΔR= –305±61.

The good concordance between the calibrated ages of Wk-8554, Wk-8553 and Wk-3944 and the expected general depth of these ages based on the linear regression lends further support to the broad validity of the ΔR employed.

Table 12.4 Radiocarbon dates from Eurimbula Site 1 (see Appendix 1 for full radiometric data for each determination). E* This date was undertaken on a sample of shell from a dense surface scatter adjacent to Square E7.

SQUARE	XU	DEPTH (cm)	LAB. NO.	SAMPLE	δ^{13}C (‰)	^{14}C AGE	CALIBRATED AGE/S
E1	5	9.5	Wk-5601	charcoal	−27±0.2	220±80	432(277,173,150,8,4)0
E1	10	35	Wk-3944	*A. trapezia*	−0.8±0.2	2390±60	2689(2347)2170
E1	10	35	Wk-5215	charcoal	−25.3±0.2	1600±160	1823(1416)1173
E2	9	50	Wk-3945	charcoal	−26.5±0.2	3020±70	3358(3205,3190,3162,3146, 3143,3086,3083)2948
E3	7	28.4–34.1	Wk-8553	*A. trapezia*	−0.6±0.2	1790±60	1869(1683)1479
E4	4	15-20	Wk-8554	*A. trapezia*	−0.9±0.2	560±55	619(493)317
E*	0	0	Wk-3946	*A. trapezia*	0±0.2	560±50	616(493)322
E7	5	18.8–24	Wk-8555	*A. trapezia*	−0.4±0.2	440±60	modern
A	5	9.7–12.4	Wk-10967	charcoal	−25±0.2	379±121	619(431,359,327)0
A	17	43.7–46.6	Wk-7688	charcoal	−25.5±0.2	2390±70	2710(2349)2158
B	12	34.4–38	Wk-10968	charcoal	−26±0.2	2218±126	2453(2282,2274,2151)1872
D	15	45.4–47.9	Wk-7687	charcoal	−24.7±0.2	2770±110	3158(2841,2829,2787)2547

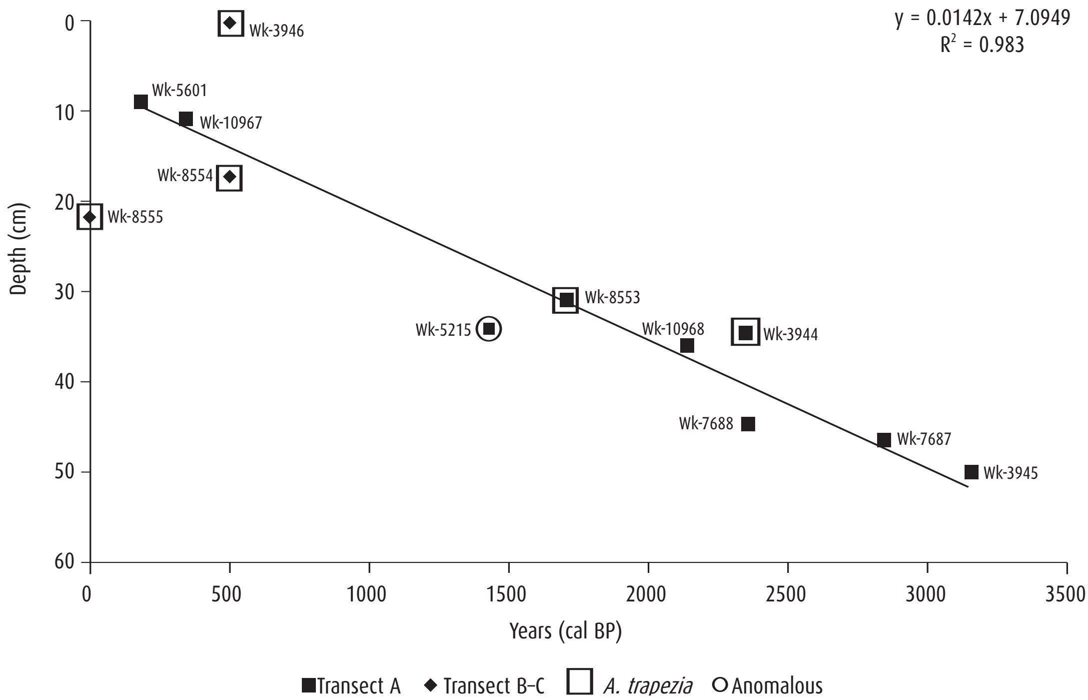

Figure 12.10 Age-depth relationship of all radiocarbon determinations obtained at Eurimbula Site 1 (n=12). The linear regression shown only includes the six dates obtained on charcoal samples from Transect A, Squares A–D, E1–E2.

Results from the two shell dates (Wk-3946 and Wk-8555) originating from and near Square E7 are problematic. The original date (Wk-3946) reported in Ulm et al. (1999a:Table 1) was undertaken on a sample collected from a dense exposure of *A. trapezia* on the erosion bank adjacent to Square E7. Wk-8555 was subsequently submitted to date a small concentration of *A. trapezia* in Square E7. It returned a modern calibrated result employing the ΔR= –305±61 value. The conventional radiocarbon dates (i.e. uncalibrated) of both determinations, however, overlap at two standard deviations, raising the possibility that they date the same or closely spaced events. The deflated context of the surface-collected sample adds further ambiguity. One possibility is that the surface material originated from the same stratum as the shell material dated from the square.

The dates from Squares A–D accord well with the earlier determinations obtained from Square E1, indicating that the top 10–15cm of the site dates to the last 500 years, with a concentration of cultural material between 30–40cm dating to 2,000–2,500 years ago, including the shell lens identified in Square E1. The basal undated cultural deposits probably belong to the 3,000–3,500 BP interval. The lowest stone artefact encountered *in situ* (see below) was recovered from a depth of 55.4cm, indicating that the cultural deposit pre-dates the lowest radiocarbon determination of c.2,800 cal BP (Wk-7687). These deposits are of broadly equivalent depth to the date of c.3,100 cal BP (Wk-3945) obtained from Square E2 (see Table 12.4) and may be of a similar antiquity. Dates from the basal units of Squares A–D therefore support the single date from Square E2, confirming occupation of the site by 3,000 BP. Samples dated from excavations conducted along Transects B and C indicate a much more recent chronology for the deposits north of Transect A, with widespread occupation apparently confined to the last 500 years. Dates from the top units of Squares E1 and E7 dating to the last 200–300 years combined with Cook's and Banks' ethnohistoric observations in AD 1770 suggest use of the site in the contact period. This scenario accords with evidence for post-contact occupation in the form of flaked bottle glass at the Tom's Creek Site Complex on the opposite side of Round Hill Creek. The dates are thus in sequence overall, suggesting first occupation shortly before c.3,000 cal BP and abandonment in the historical period (i.e. the last 150 years).

Stratigraphic integrity and disturbance

Several lines of evidence suggest that the deposit exhibits reasonable stratigraphic integrity. The sequence of radiocarbon dates is in order, with a regular age-depth relationship. There is also a predictable shell decay profile with highly weathered whole specimens recovered from the base of the deposit and relatively well-preserved specimens from the upper deposit. During excavation it was noted that small shell fragments recovered from the lower units were almost exclusively associated with small, rounded patches of dark grey sediment, which may indicate an origin from higher up the profile owing to burrowing and subsequent infilling. The sediments comprising these patches appear to derive from SUI (based on colour and grain characteristics). In contrast, stone artefacts encountered *in situ* in the lower units were found to be surrounded by yellowish brown sediments, indicating an *in situ* provenance in SUIII. The lowest *in situ* stone artefact recovered was from Square B, XU19, some 55.4cm below ground surface. This large flaked piece manufactured on rhyolitic tuff is 40.3mm in maximum dimension and weighs 14.3g. The broad surface area of this artefact and its association with the native yellowish brown sediments of SUIII suggest a valid stratigraphic relationship. In the initial series of excavations, several cavities were encountered in Square E3 along Transect A, presumably resulting from animal burrowing (Ulm et al. 1999a:108). A small burrow cavity was also noted in Square A, XU15–16, between 39.6–43.7cm in depth. The major source of post-depositional disturbance appears to be the presence of numerous roots throughout the deposit. Abundant fibrous roots occur to a depth of c.40cm with a zone of larger roots between 20–30cm (Fig. 12.16). The tuber of a convolvulus (*Ipomoea* sp.) was found in Square A, XU7, at a depth of 15.7–18.4cm. Tree roots are a feature of both the previous (Ulm et al. 1999a:108–10) and current excavations. Concentrations of shell encountered immediately above and below large, living roots suggest that they has been vertically displaced by root penetration and growth. However, conjoining *A. trapezia* valves found at a depth of 34.5–38cm in the adjacent Square B (see below) and conjoining fragments of non-artefactual stone found in Square D, XU13 suggest that the impact of burrowing can be very localised. Some evidence for insect burrowing was also noted in the form of a witchetty grub (*Cossidae* sp.) encountered some c.22–25cm below the surface in Square A, and active ant burrowing in the near-surface units of Square B, with burrows up to 2mm in diameter and to a depth of 5cm.

Conjoin analysis of the *A. trapezia* assemblage suggests that despite its relatively low density of cultural remains, the deposit has reasonable integrity. Out of a total of 95 measured intact and broken valves, 62 were excluded from consideration owing to an absence of hinge length or valve length and width, indicating the presence of valve damage (especially marginal damage). This left only 33 relatively intact valves for the conjoin analysis using the methods previously described in Chapter 5. A total minimum number of six *A. trapezia* conjoins was identified from Squares A–D. Most pairs (n=4) were separated by 6.5cm or less. A single conjoin had a maximum separation of just over 10cm (Table 12.5). Although this distribution largely reflects the main distribution of *A. trapezia* in the deposit, the six bivalve conjoin sets identified between 9.7–34.4cm below ground surface bracket some 25cm of the upper cultural deposit, supporting the impression gained from the radiocarbon chronology that shell and charcoal materials within the deposit are mostly *in situ*. This is also the zone of major tree root penetration, indicating that valves are generally closely associated despite visual impressions suggesting low site integrity.

The *A. trapezia* assemblage is generally in poor condition with a high ratio of broken to intact valves (15:1) and high rates of fragmentation. This indicates that the shells have probably been exposed to sustained heating after initial discard (see Chapter 5) and / or mechanical damage from treadage. Only the middle excavation units of Squares B and C had sufficient NISP of *A. trapezia* for calculation of fragmentation. Rates are relatively high in this part of the sequence, with an average of 234.7 NISP / 100g with a range of 94.5–473.7.

Table 12.5 Identified *A. trapezia* conjoin sets, Eurimbula Site 1, Squares A–D.

	SQUARE/XU				
CONJOIN SET	L	R	MEAN DEPTH (cm)	MIN. SEPARATION (cm)	MAX. SEPARATION (cm)
Set 1	D/9	B/8	23.44	0.28	7.92
Set 2	A/6	A/5	12.69	0	6.02
Set 3	A/6	C/9	17.54	3.68	10.20
Set 4	B/6	D/6	15.40	0.24	6.48
Set 5	A/7	C/8	17.54	1.02	3.68
Set 6	B/11	B/11	32.43	0	3.94

Laboratory methods

Owing to the relatively low density of cultural material recovered from the site, all squares were analysed to maximise the available sample (see Chapter 3 for a detailed discussion of the standard laboratory methods employed at all sites). In the sections below, the results are summarised although the data from Square B is the main one illustrated in Figures 12.11–12.18. This approach has been adopted to minimise repetition. Further summary results for all excavated squares are presented in Appendix 4. Use-wear and residue analyses were conducted on selected stone artefacts in the Archaeological Sciences Laboratory, University of Queensland, using standard procedures outlined by Loy (1994).

Cultural materials

Invertebrate remains

Eighteen taxa of shellfish weighing 6,667.3g were recovered from Squares A–D, consisting of six marine bivalves, eight marine gastropods and four terrestrial gastropods (Table 12.6). The shell deposit is dominated by rock oyster (*S. glomerata*), comprising 69.7% of the shell assemblage by weight (Fig. 12.13), followed by mud ark (*A. trapezia*) (29%) (Fig. 12.14). The remaining 16 taxa are relatively rare in the deposit, each contributing less than 1% of the shell assemblage by weight. The assemblage exhibits low diversity with a calculated Shannon-Weaver Function (H′) of 0.715 and Simpson's Index of Diversity (1–D) of 0.308. The oyster and mud ark together with other taxa represented in small quantities in the shellfish assemblage, such as scallop (*Pinctada albina sugillata*), hercules club whelk (*P. ebininus*) and common nerite (*N. balteata*), suggest foraging strategies focussed on the mangrove fringe and adjacent intertidal and subtidal flats. The majority of shell was recovered from the upper deposit, with 87% of shell by weight occurring in the top c.30cm of the excavation.

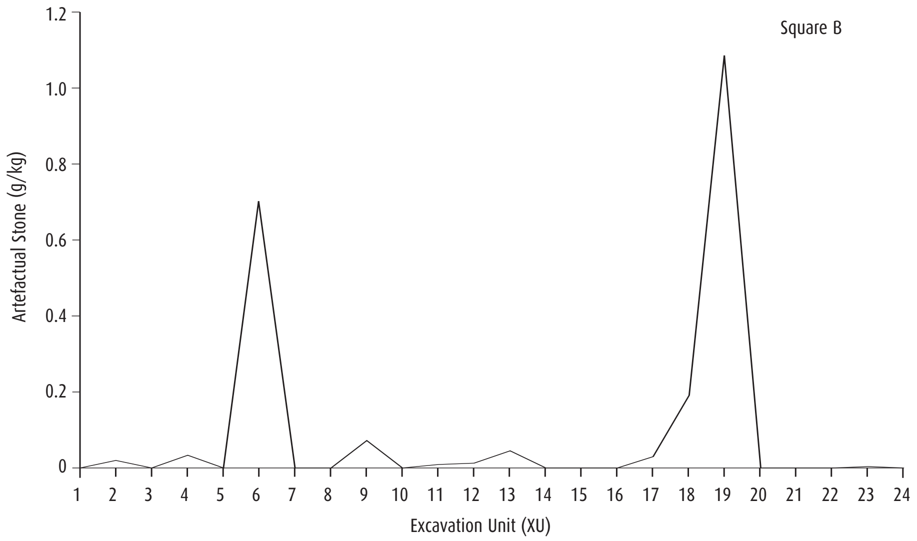

Figure 12.11 Abundance of artefactual stone.

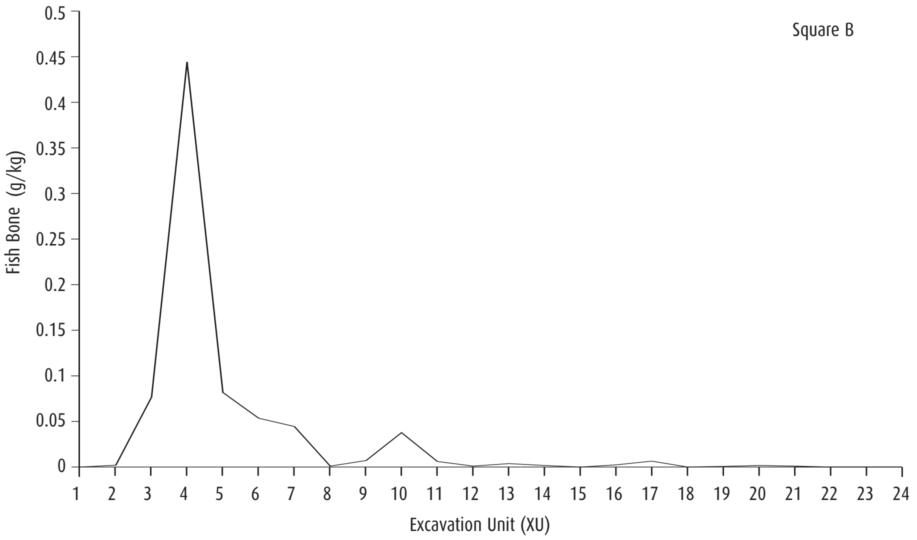

Figure 12.12 Abundance of fish bone.

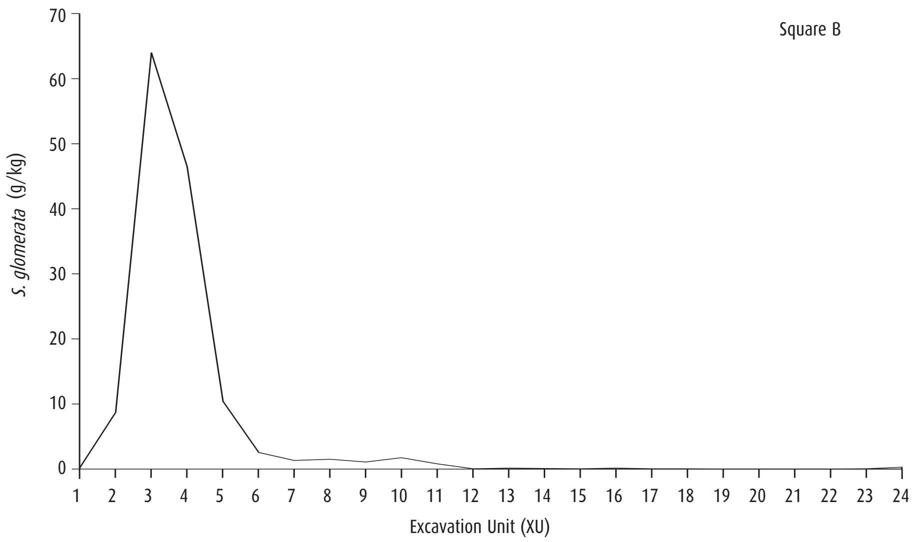

Figure 12.13 Abundance of oyster (*S. glomerata*).

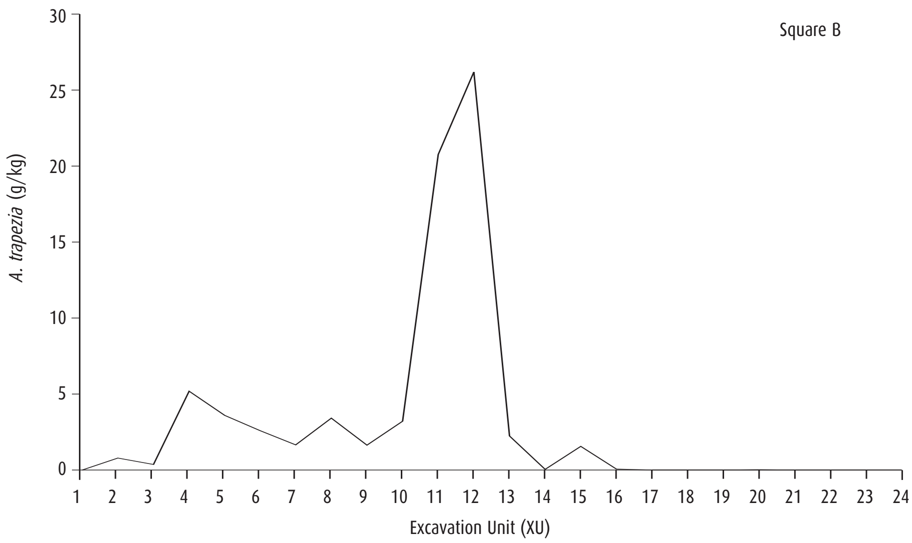

Figure 12.14 Abundance of mud ark (*A. trapezia*).

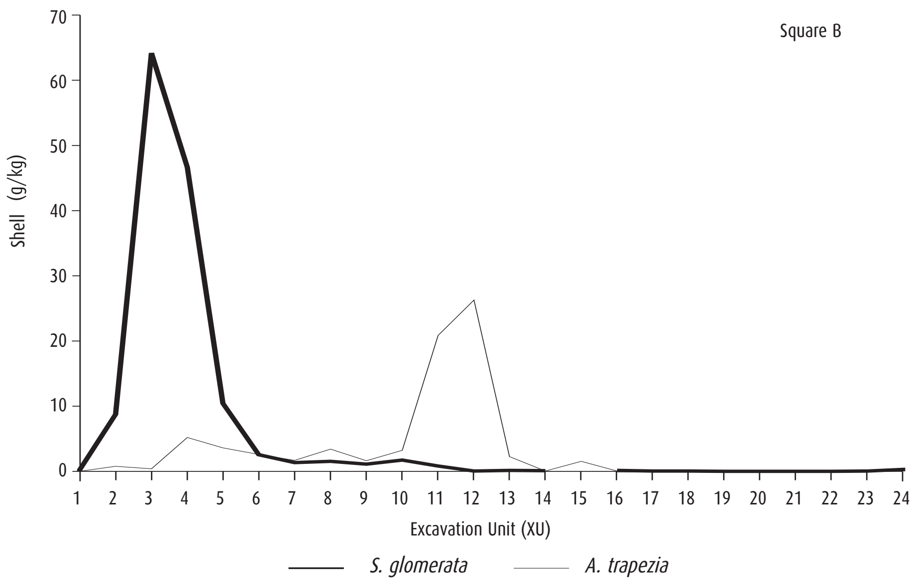

Figure 12.15 Abundance of dominant shell taxa.

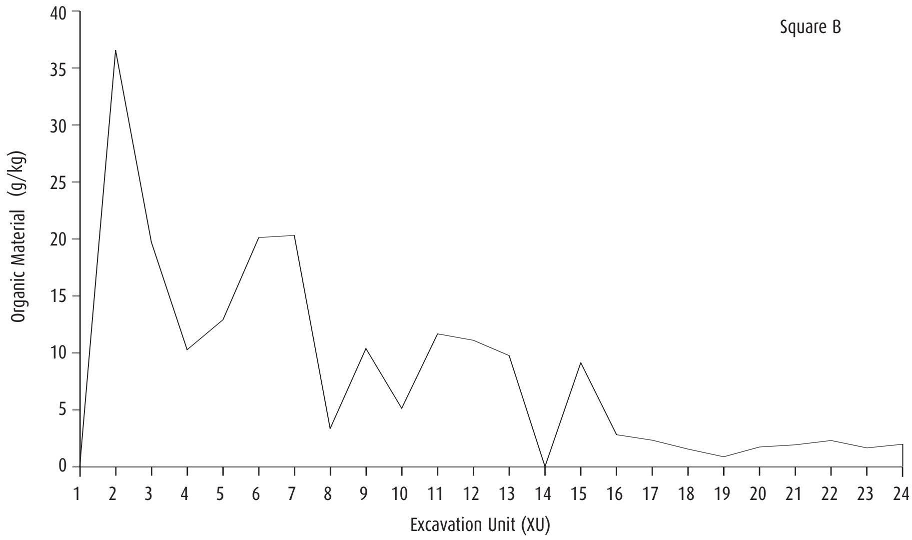

Figure 12.16 Abundance of organic material.

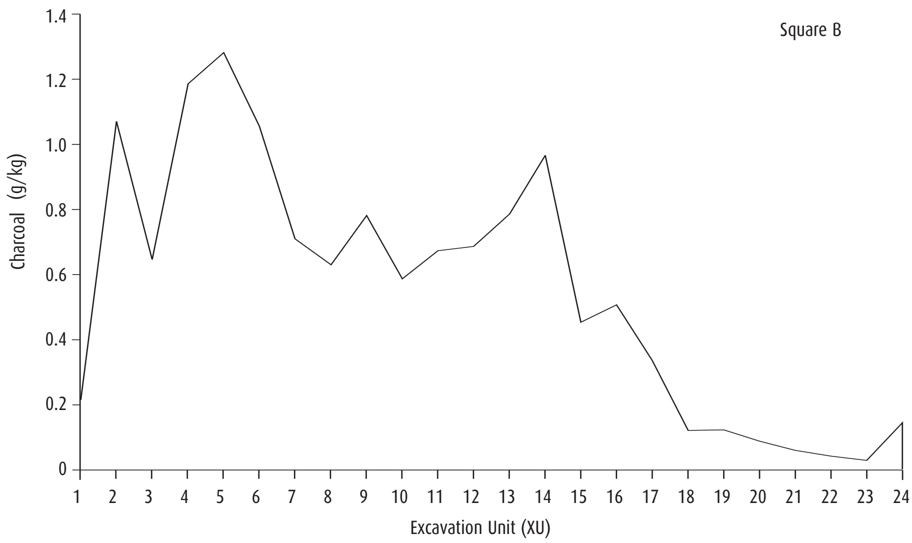

Figure 12.17 Abundance of charcoal.

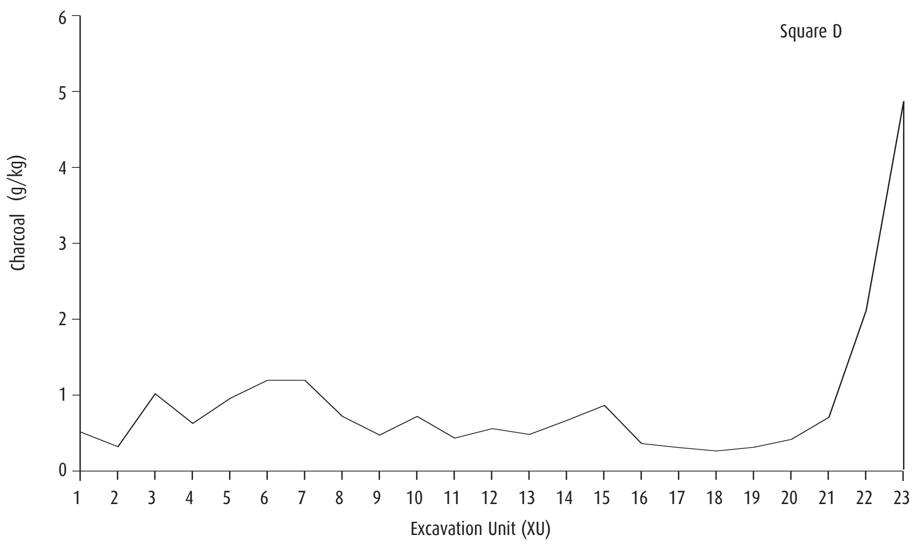

Figure 12.18 Abundance of charcoal.

Table 12.6 Presence/absence of shellfish identified in Eurimbula Site 1, Squares A–D.

FAMILY	SPECIES	SQUARE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	TOTAL (g)
		MARINE BIVALVIA																											
Arcidae	*Anadara trapezia*	A		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X							
		B		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X							
		C				X	X	X	X	X	X	X	X	X	X	X	X	X	X										
		D				X	X	X	X	X	X	X	X	X	X		X	X		X									1936.7273
Donacidae	*Donax deltoides*	B							X																				0.5711
Mytilidae	*Trichomya hirsutus*	B			X																								
		C				X							X																0.1631
Ostreidae	*Saccostrea glomerata*	A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			
		B	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
		C	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
		D	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X					4648.3022
Pteriidae	*Pinctada albina sugillata*	A				X																							
		B		X	X	X	X																						
		C				X	X																						
		D					X	X																					11.8758
Tellinidae	*Tellina* sp.	A									X																		0.9566
		MARINE GASTROPODA																											
Batillariidae	*Pyrazus ebininus*	A					X																						18.2000
Batillariidae	*Velacumantus australis*	C													X														1.2748
Ellobiidae	*Ophicardelus sulcatus*	A		X																									
		B		X	X																								
		C		X	X																								
		D		X																									1.7967
Lottidae	*Acmaeid* sp.	A				X																							
		B				X																							0.1241
Littorinidae	*Bembicium nanum*	A				X	X																						
		B			X	X	X					X		X		X				X									
		C		X	X		X	X					X																
		D				X	X	X	X			X																	7.5868
Littorinidae	*Littoraria* sp.	C		X																									0.0347
Neritidae	*Nerita balteata*	A			X	X	X				X																		
		B				X	X					X																	
		D			X																								10.7585
Trochidae	*Thalotia* sp.	A		X			X	X	X																				1.8349
		TERRESTRIAL GASTROPODA																											
Camaenidae	*Figuladra* sp.	A					X	X	X	X	X		X		X														
		B			X	X	X	X			X		X	X											X				
		C			X	X			X																				
		D				X	X	X																					24.3205
Camaenidae	*Trachiopsis mucosa*	A		X									X																
		B		X		X	X	X	X				X		X											X			
		C		X		X		X																					
		D		X			X	X		X																			2.0204
Pupillidae	*Pupoides pacificus*	D		X																									0.0058
Subulinidae	*Eremopeas tuckeri*	A		X		X																							
		B		X																									
		D												X															0.7191

Table 12.7 Metrical data for intact and broken (with umbo) *A. trapezia* valves from Eurimbula Site 1, Squares A–D. Note that excavation units for each square have been collapsed for purposes of analysis. Excavation unit depth and size is approximately equivalent across squares for broad comparison.

	MEAN LENGTH			MEAN WIDTH			MEAN HEIGHT			MEAN WEIGHT			MEAN HINGE		
XU	n	mm	±	n	mm	±	n	mm	±	n	g	±	n	mm	±
4	0	0	0	0	0	0	3	14.9	3.1	3	9.5	5.9	1	20.0	0
5	1	57.7	0	1	51.9	0	3	16.5	4.2	3	15.7	10.9	2	28.0	9.9
6	2	52.7	2.8	1	52.3	0	7	16.7	1.7	8	15.7	5.6	5	30.4	5.0
7	3	45.2	1.9	5	41.0	4.7	7	16.5	3.1	9	19.0	8.8	7	30.1	6.2
8	0	0	0	0	0	0	5	17.8	2.5	5	15.2	4.8	4	31.0	7.1
9	0	0	0	1	47.2	0	6	17.2	3.8	13	12.3	9.6	5	32.6	5.7
10	0	0	0	0	0	0	1	13.7	0	5	11.6	8.9	2	34.5	0.7
11	2	46.2	12.4	2	41.9	10.2	12	13.8	3.2	27	5.9	4.0	6	26.7	5.1
12	1	50.7	0	1	43.3	0	3	16.5	2.6	11	8.8	8.8	1	35.0	0
13	0	0	0	0	0	0	3	12.1	3.0	10	5.7	2.1	0	0	0
14	0	0	0	0	0	0	0	0	0	1	5.4	0	0	0	0

Although a more diverse assemblage of shellfish taxa were identified in Squares A–D than during the initial excavations, the dominance of rock oyster and mud ark was reinforced (Ulm et al. 1999a:112). The bimodal trend in the vertical distribution of these taxa observed previously was also documented in the Squares A–D assemblage (Fig. 12.15). Overall, 86.1% (4,000.4g) of rock oyster by weight was recovered from the top 13.5cm of the deposit, with 88.3% (1,709.5g) of the mud ark from 13.5–60cm. The possible implications of this trend are discussed below.

There is no significant change in the mean size of *A. trapezia* throughout the deposit as measured by height (owing to the high rates of damage to valve margins few valves are amenable to measurement of other attributes) (χ^2=1.9624, df=9, p≤0.05) (Table 12.7). The mean length of *A. trapezia* (as approximated by regression from the height measurements, y=1.8847x+14.491) is c.44mm.

Vertebrate remains

Fish bone is present throughout the cultural deposit, totalling 26.93g and consisting of 1,345 pieces of bone with a NISP of 18. A total MNI of 15 was calculated by summing the MNI for each excavation unit (Table 12.8). Identified taxa in descending order of abundance include Sparidae (bream, tarwhine, snapper) (NISP=8; MNI=8), Sillaginidae (whiting) (NISP=10; MNI=7) and Mugilidae (mullet) (NISP=1; MNI=1). Although fish bone occurs in every unit, it is most abundant in units where shell is also abundant (compare Figs 12.12 and 12.13).

In Square A three Sparidae identifications were made, two from XU6 identified from a vertebra and an otolith and one from XU7 from a dentary. The otolith was identified as bream (*Acanthopagrus australis*). In Square B, XU4, a single vertebra each was identified as belonging to Sillaginidae and Mugilidae and a Sparidae otolith was identified as snapper (*Chrysophrys auratus*). XU5 contained two vertebrae identified as Sparidae and Sillaginidae, and two otoliths identified as Sillaginidae. The centrum diameter of the Sillaginidae vertebrae from the adjacent XUs is similar suggesting that they derive from the same individual. A single vertebra and three otoliths in Square C, XU6, were identified to the Sparidae family, two of which are snapper, and two further otoliths were identified as Sillaginidae. XU9 contained an otolith identified as snapper. Square D, XU4, contained a Sparidae otolith (see Vale 2002, 2004 for further details).

Of the eight vertebral samples subjected to DNA analysis, only one returned a positive fish-like polymerase chain reaction (PCR) product, although this extract did not produce a product when sequenced (Hlinka et al. 2002). Taphonomic factors are thought to be responsible for the low amplification success rate.

Table 12.8 Fish bone abundance, Eurimbula Site 1, Squares A–D.

	SQUARE A				SQUARE B				SQUARE C				SQUARE D			
XU	NUMBER SPECIMENS	TOTAL WEIGHT (g)	NISP	MNI	NUMBER SPECIMENS	TOTAL WEIGHT (g)	NISP	MNI	NUMBER SPECIMENS	TOTAL WEIGHT (g)	NISP	MNI	NUMBER SPECIMENS	TOTAL WEIGHT (g)	NISP	MNI
2	0	0	0	0	2	0.02	0	0	5	0.50	0	0	5	0.01	0	0
3	9	0.06	0	0	32	0.69	0	0	7	0.09	0	0	2	0.01	0	0
4	20	0.25	0	0	187	4.04	3	3	20	0.33	0	0	15	0.31	1	1
5	49	1.54	0	0	28	0.75	4	2	95	1.98	0	0	128	1.86	0	0
6	72	2.05	2	2	50	0.57	0	0	97	3.99	6	5	44	0.87	0	0
7	52	0.82	1	1	36	0.44	0	0	75	0.97	0	0	40	1.41	0	0
8	25	0.36	0	0	3	0.01	0	0	26	0.46	0	0	2	0.01	0	0
9	16	0.24	0	0	4	0.09	0	0	8	0.28	1	1	13	0.19	0	0
10	20	0.44	0	0	25	0.37	0	0	13	0.08	0	0	4	0.04	0	0
11	12	0.13	0	0	8	0.07	0	0	9	0.10	0	0	1	0.19	0	0
12	5	0.08	0	0	5	0.01	0	0	6	0.02	0	0	6	0.06	0	0
13	5	0.08	0	0	4	0.04	0	0	2	0.01	0	0	1	0.03	0	0
14	7	0.11	0	0	4	0.02	0	0	3	0.01	0	0	0	0	0	0
15	6	0.04	0	0	0	0	0	0	0	0	0	0	1	0.01	0	0
16	2	0.01	0	0	4	0.02	0	0	2	0.01	0	0	0	0	0	0
17	0	0	0	0	6	0.06	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	5	0.01	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	2	0.02	0	0	2	0.01	0	0	0	0	0	0
21	1	0.01	0	0	2	0.01	0	0	1	0.03	0	0	0	0	0	0
22	1	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	2	0.01	0	0	0	0	0	0
24	1	0.03	0	0	0	0	0	0	0	0	0	0	NA	NA	NA	NA
25	0	0	0	0	NA	NA	NA	NA	0	0	0	0	NA	NA	NA	NA
26	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	NA	NA	NA	NA
Total	303	6.26	3	3	407	7.24	7	5	373	8.43	7	6	262	5.00	1	1

Seventeen pieces of bone weighing 1.0916g in total could not be assigned to a fish skeletal element. The generally small size of these specimens and the lack of diagnostic attributes prevented identification to taxon.

Stone artefacts

Stone artefacts are distributed throughout the cultural deposit between 1–73cm depth (Fig. 12.11). A total of 70 stone artefacts weighing 166.3g was identified in Squares A–D (Table 12.9). Eight of these were plotted *in situ* between 4.9–55.4cm during excavation with the remainder recovered from the sieve residue. Virtually the entire assemblage is manufactured on rhyolitic tuff (n=45) with the remainder on quartz (n=23), ignimbrite (n=1) and volcanic ash (n=1). Rhyolitic tuff and quartz are available from local headlands, while the source/s of the ignimbrite and volcanic ash are unknown. Most artefacts are extremely small, with an average maximum dimension of 10.9mm and average weight of 2.4g. Two of the largest artefacts recovered from the excavation were located towards the base of the cultural deposit. Both are flaked pieces manufactured on rhyolitic tuff recovered from Square B, XU19, and Square D, XU13, at respective depths of 55.4cm and 38cm below ground surface.

The only identified technological types in Squares A–D are a single flake and broken flake recovered from 45cm and 51–54cm respectively. The two artefacts manufactured on non-local raw materials also appear lower in the sequence at 34cm (ignimbrite) and 45cm (volcanic ash) in deposits dating to before 1,500 years ago. This pattern was also evident in the previous excavations. Few technological categories were represented with just two flakes, one broken flake, a backed artefact and 57 flaked pieces identified. Notably, the backed artefact was manufactured on silcrete and recovered from the basal units of Square E2 (see below). A radiocarbon date from the unit below that containing the backed artefact returned an age of 3,020±70 BP (Wk-3945). A small silcrete flake was recovered from the basal units of Square E1 and a silcrete flaked piece was found in the basal deposits of Square E3. Although the current data do not support earlier findings suggesting a dramatic shift from non-local raw material use to exclusive use of rhyolitic tuff in the recent sequence (Ulm et al. 1999a), several patterns are suggested. Artefacts manufactured on rhyolitic tuff are represented throughout the excavated sequence. However, artefacts manufactured on high quality siliceous stone (i.e. silcrete) tend to be located towards the base of the cultural deposit. These artefacts commonly exhibit retouch and rarely retain cortex suggesting careful manufacture and maintenance. The rhyolitic tuff assemblage, in contrast, is best characterised as the result of an expedient technology. Few artefacts have evidence for retouch or extensive use. In addition, many of the large stone artefacts observed on the erosion bank appear to be manufactured from rhyolitic tuff and to have derived from shallow deposits dating to the last 500 years. The presence of retouched tools, including the backed artefact, manufactured on non-local stone in the lower part of the sequence and the dominance of expedient artefacts on local stone in more recent deposits, including the large stone artefacts on the bank, may indicate a shift in both raw material use and technology.

A small sample of stone artefacts from Squares A–D have been subject to limited residue analysis. Francis (1999) examined six stone artefacts (FS19, 37, 60, 142, 161, 176) from a range of depths and manufactured on a variety of raw materials ranging in weight from 0.8–79.2g. All specimens were examined using an Olympus® metallurgical incident-light microscope under low level (<800x) magnification (see Loy 1994 for a discussion of techniques). All six artefacts exhibited surface features associated with post-depositional processes including rootlets, sand grains, spores and mycelium. All but one (FS60) of the artefacts was found to exhibit archaeological residues, comprising resin, cellulose, starch grains and charcoal. These residues are consistent with use of stone artefacts in a variety of plant processing activities.

Table 12.9 Stone artefacts from Eurimbula Site 1, Squares A–D.

SQUARE	RHYOLITIC TUFF				QUARTZ		IGNIMBRITE		VOLCANIC ASH		TOTAL	
	FLAKE		FLAKED PIECE		FLAKED PIECE		FLAKED PIECE		BROKEN FLAKE			
	#	(g)	#	(g)	#	(g)	#	(g)	#	(g)	#	(g)
A	–	–	15	0.9398	4	0.1851	–	–	1	1.7721	20	2.897
B	1	1.9297	10	22.7418	5	1.2640	–	–	–	–	16	25.9355
C	–	–	10	4.0993	7	0.4709	–	–	–	–	17	4.5702
D	–	–	9	82.0836	7	2.2371	1	48.5000	–	–	17	132.8207
Total	1	1.9297	44	109.8645	23	4.1571	1	48.5000	1	1.7721	70	166.2234

Lamb (2003) examined two large artefacts (FS233/1999; FS1/2001) both exhibiting roughly triangular cross-sections and probable bevelling along at least one margin, surface-collected from the erosion bank bordering Round Hill Creek. In addition to microscopic examination of *in situ* residues, aqueous samples from multiple locations on each artefact were extracted for microscopic examination on slides before staining with Congo Red solution to detect the presence of cooked or otherwise damaged starch in the archaeological residues. Both tools exhibited plant resides, comprising cellulose, parenchyma tissue, sclereids and bordered pits with quantities of both raw and cooked starch grains observed (Lamb 2003). Cooked, partially cooked and otherwise damaged starch grains were abundant and found concentrated along the tool margins. The presence of both undamaged and damaged starch grains indicates the processing of raw as well as cooked plants. Some grains exhibited similar sizes and morphology to reference specimens of cooked swamp fern (*B. indicum*). This finding is not only consistent with other studies linking heavy stone implements of this form to swamp fern processing (Hall et al. 1989; Robertson 1994), but extends the known range of use of this artefact type and associated plant processing technologies north from previously documented occurrences in the Moreton Bay, Cooloola and Fraser Island regions. Both residue and use-wear studies clearly indicate that plant processing was an important activity undertaken at the site.

Other remains

A range of other material was recovered from the site. Small pieces of pumice totalling 8.2g were recovered, concentrated towards the base of the deposit. Charcoal, totalling some 631.4g, is present throughout the deposit (Figs 12.17–12.18). Some 25% (156.2g) of this charcoal was recovered from Square D, XU22–23, and is not associated with cultural material. The presence of charcoal in culturally-sterile sediments below the shell deposit suggests that some of the other small quantities of charcoal in the assemblage may be natural. Large quantities of organic material, totalling 9,507.6g, were recovered, mainly comprising tree roots (Fig. 12.16). Small quantities of non-artefactual stone were also recovered (207.7g), consisting of mainly the native ironstone in dune deposits.

Discussion

Excavations and analyses presented here expand the results available from previous investigations revealing a low density sequence of cultural material distributed over a large area with the most intensive and widespread period of occupation dating to the last 500 years. The distribution of cultural material indicates tightly-focussed settlement strategies in a linear pattern parallel to the creek margin, suggesting a pattern of estuary-focussed settlement. Dates from the basal units of Squares A–D support the isolated date from Square E2, confirming a pre-3,000 BP antiquity for site occupation. Site chronology and stratigraphy indicate that occupation post-dates regional sea-level highstand between c.5,500–3,700 BP (Larcombe et al. 1995). Two lines of evidence support this argument. First, the oldest excavated cultural materials are dated to shortly before 3,000 years ago and occur within 50cm of the modern ground surface. Second, all cultural materials excavated or observed *in situ* in the erosion section are located in sediments stratigraphically above the humicrete or coffee rock unit which probably dates to shortly before the mid-Holocene highstand. This finding has several important implications. If the model of coffee rock formation outlines above is accurate, it indicates that dune landforms supporting barrier swamps were in place prior to the mid-Holocene. However, no cultural materials have been observed in or below the level of the coffee rock, suggesting that people either did not use the area, or only used it ephemerally, prior to the late Holocene despite the presence of rich wetland resources.

The excavations and analyses also demonstrate that although the cultural deposits at Eurimbula Site 1 are of relatively low density, the extent and recent chronology of the majority of the site complex indicates that a large quantity of cultural material was discarded over a relatively short period of time. To put this into perspective, we can extrapolate the figures available from the analysed excavations to the estimated site area for illustration purposes. The deposits cover a minimum area of 100,000m^2. Exposures of shell and stone artefacts are visible discontinuously along the 2km long erosion bank and surface surveys and excavations have demonstrated the presence of cultural material up to at least 50m inland. Erosion at the southern end of the site suggests that at least 30m of bank recession has occurred in some parts of the site, reinforcing the above site area estimate as an absolute minimum. Excavation of Squares E1–E9 and A–D indicates that the average density of shell recovered is 3.35kg/m^2. If this average density figure is taken as a basis for calculations, the entire site area is likely to exhibit a minimum of 335,000kg of shell. These figures become more plausible when it is considered that an unknown quantity of possibly denser deposits once located seaward of the current site has been removed by erosion.

Changes in use of faunal and stone resources are also documented at the site. Oyster and mud ark exhibit a distinctly bimodal distribution. Mud ark dominates earlier deposits and oyster the more recent part of the sequence, indicating a shift to more intensive exploitation of oyster. By far the majority of oyster is dated to the last 500 years. Reid (1997:17) hypothesised that there may have been a recent change in estuary conditions which favoured oysters, replacing the earlier populations of mud arks, although radiocarbon dates indicate that at least some mud arks were available into the historic period. Habitat change may well have expanded and contracted the niches available for oysters and mud arks respectively. Mud arks are found on or just below the surface of muddy and sandy substrates in estuaries and are frequently associated with seagrass, while oysters generally prefer clear water and require a rocky or mangrove root substrate. Rocky substrates do not occur in the estuarine sections of Round Hill Creek, with the nearest intertidal rocky substrates suitable for oyster spat attachment located near the Town of Seventeen Seventy at some distance from the site (Fig. 12.1). This suggests that the majority of oysters entering the site probably grew on mangrove substrates as they do in the estuary today. An increase in the abundance of oyster may therefore have been related to an expansion of mangrove communities in the estuary. An expansion of mangroves would also have reduced the area available for seagrass colonisation and therefore associated mud ark habitats. A recent expansion of mangrove communities is also indicated by the late appearance of the telescope mud whelk (*T. telescopium*), a mangrove gastropod which dominates the modern mollusc biomass but virtually absent from archaeological deposits.

The presence of carefully made and retouched tools, including a backed artefact, manufactured on possibly non-local highly siliceous stone in older deposits and the dominance of expedient artefacts on local raw materials in more recent deposits may indicate a shift in both access to raw material and changes in technology. The small sample sizes do not permit this trend to be examined in more detail at this stage, although the large stone artefacts manufactured on local materials identified in near-surface contexts along the erosion bank support this general pattern.

The distribution of surface and subsurface material suggests that occupation was concentrated along the creek margin, immediately adjacent to the diverse resources it offered. The presence of heavy stone implements exhibiting plant residues indicates that a range of subsistence activities took place at the site. As noted above, these artefacts are morphologically similar to bevelled-edged implements functionally associated with plant food processing in southeast Queensland. McNiven (1992b) found fragments of such implements in deposits at Cooloola dating to c.5,000 BP, although they are thought to only have come into widespread use in southeast Queensland in the late Holocene, when they are associated with restructuring of settlement and subsistence systems including more sedentary camps and increasing localisation of resource use (Ulm and Hall 1996). Until now, the geographical distribution of this implement type was thought to be restricted to the Moreton Bay area north to Cooloola and Fraser Island. The identification of heavy stone artefacts associated with plant processing on the southern Curtis Coast is therefore significant. The concentration of cultural remains along Transect A may thus reflect strategic decisions in site location. This transect is situated close to a variety of vegetation zones, including open forest habitats, extensive estuarine mangrove communities and tidal flats at the southern end of Round Hill Creek and freshwater swamps to the southwest (Olsen 1980a; QDEH 1994). The diversity of resources offered by these environments may have been a factor in the more intensive use of this area of the site. Conversely, evidence for the decrease in cultural material seaward from this transect may simply be related to variability in local resource availability, with a reduction in the area of intertidal flats towards the ocean.

This pattern cannot simply be explained in terms of differential preservation. Archaeological deposits at Eurimbula Site 1 are located towards the top of long, stratified dune sequences formed several thousand years earlier. These findings contrast with those originally presented in Ulm et al. (1999a:111) suggesting that 'the location of the excavations towards the seaward and thus more recently-formed edge of a prograding shoreline … suggest survey and excavation in older deposits to landward may locate material dating to at least the time of sea-level stabilization 6,000–7,000 years ago'. In fact, it appears that the landform and the broad estuarine resource mosaic was in place well before initial human settlement of the lands bordering Round Hill Creek.

As concluded by the previous investigations of the site (Ulm et al. 1999a), results do not suggest any obvious connection between the deposition of cultural remains and the formation of beach ridges. The quantity and location of cultural remains recovered in the excavations, however, strongly suggest that resource availability was a major factor in structuring local settlement patterns and hence deposition of cultural material. Regardless of whether the beach ridges at Eurimbula formed continuously or episodically, evidence suggests that the geomorphological occurrences of the last 3,000 years did not affect subsistence patterns, which were strongly focussed on Round Hill Creek rather than the ocean beach.

Summary

Eurimbula Site 1 was occupied before 3,000 BP, and is the only site in the region with indications of occupation around 2,000 years ago. An initial long period of low intensity occupation focussed at the southern end of the site is followed by widespread evidence for occupation across the entire site complex area over the last 500 years. The increase in evidence for use of the site over the last 1,500 years is accompanied by a general shift in the representation of particular shellfish taxa (from mud ark to oyster) and greater representation of local raw materials in the stone artefact inventory, with a higher degree of curation evident in the earlier assemblage.