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THE EMO SITE (OAC), GULF PROVINCE, PAPUA NEW GUINEA:

Resolving Long-Standing Questions of Antiquity and Implications for the History of the Ancestral *Hiri* Maritime Trade

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Abstract

Since the 1970s the site of Emo (aka 'Samoa', 'OAC') in the Gulf Province of Papua New Guinea has been cited as one of the earliest-known ceramic sites from the southern Papuan lowlands. This site has long been seen as holding c.2000 year old evidence of post-Lapita long-distance maritime trade from (Austronesian-speaking) Motu homelands in the Central Province, where pottery was manufactured, to the (non-Austronesian) Gulf Province some 400km to the west where pottery was received and for which large quantities of sago were exchanged (the ancestral *hiri* trade). However, until now the only three radiocarbon dates available for Emo were out of chronostratigraphic sequence, and few details on the site had been published. This paper presents the results of new excavations and the first detailed series of AMS radiocarbon determinations from Emo, thereby resolving long-standing uncertainties about the age of the site and its implications for the antiquity of the long-distance Motuan *hiri* maritime trade.

Introduction

Emo, previously known to archaeologists as the 'Samoa site' and to the Papua New Guinea (PNG) National Museum and Art Gallery as site 'OAC', has been cited in the archaeological literature as one of the oldest known pottery-bearing sites of the southern (Papuan) lowlands of PNG since it was first excavated in the early 1970s (e.g. McNiven *et al.* 2006:69; Rhoads 1983). Yet its antiquity has remained largely speculative, for until now the only three radiocarbon dates obtained from the site have been out of sequence. Despite these uncertainties, Emo is referenced as a site of 'the first millennium A.D.' by Bulmer (1975:48); 'which dates from 1800 years ago' by Rhoads (1982:133); probably dating to 'within the first 800 years of the Papuan pottery sequence' by Rhoads (1983:99); potentially containing pre-2000 BP ceramics by McNiven *et al.* (2006:69-70); as being associated with the 'Early Period', within which the 'allocation of sherds to any particular time within the period is problematic' by Bickler (1997:158); as dating to the 'earliest pottery occupational levels of the south Papuan coast', sometime between 1850±95 BP and 2430±370 BP and 'likely occurring somewhere short of 2,000 years ago', by Summerhayes and Allen (2007:102); and supporting 'occupation back to 2500 yr BP' by Barham (1999:100).

Here we present results of new excavations undertaken at Emo in February 2008. Our primary aim was to redate the site using fine-grained excavation methods, with a detailed understanding of the site's depositional and cultural chrono-stratigraphy in mind. It represents the first of a series of new excavations in the Gulf Province of PNG aimed at better understanding the history and inter-regional dynamics of ancestral *hiri* trade relations across some 500km from the pottery-producing centres of Port Moresby in the east to the recipient villages of the Gulf Province in the west.

The *Hiri* Trade

The peoples of the Port Moresby area – in particular the Motu but also, to a lesser degree, the Koita – were renowned makers of ceramic vessels during the early ethnohistoric period from the 1870s to the 1960s (Figure 1). 'All of the Motu villages made pots, with the exception of two, Vabukori and Tatana, that specialized in the manufacture of shell ornaments … Thus there were manufacturing specialties even among the villages participating in the same trade system' (Bulmer 1978:42, following Oram 1975). During early ethnographic times the pottery-making villages included Porebada, Boera, Lea Lea, Manumanu, Pari, Hanuabada, Elevara and Tanabada (Lampert 1968:77, after Barton 1910; Chalmers 1887; Haddon 1894:149). Pottery was manufactured by women both for domestic use and for local, regional and distant (*hiri*) trade. The regional trade involved women carrying pots by canoe or on foot to kin or trade partners in nearby inland Gabadi, Doura and Koita villages (in particular villages along the Aroa River), in exchange for garden and meat produce, in particular yams and bananas. In time the Gabadi, Doura and Koita villagers themselves would exchange some of these pots further afield, resulting in a widespread spatial patterning of ceramic pots amenable to archaeological investigation (Groves 1960:8).

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Figure 1 Motu village near Port Moresby in the late 1800s getting ready for the annual *hiri* expedition, the accumulated pots being ready for loading onto the *lagatoi* (attributed to J.W. Lindt).

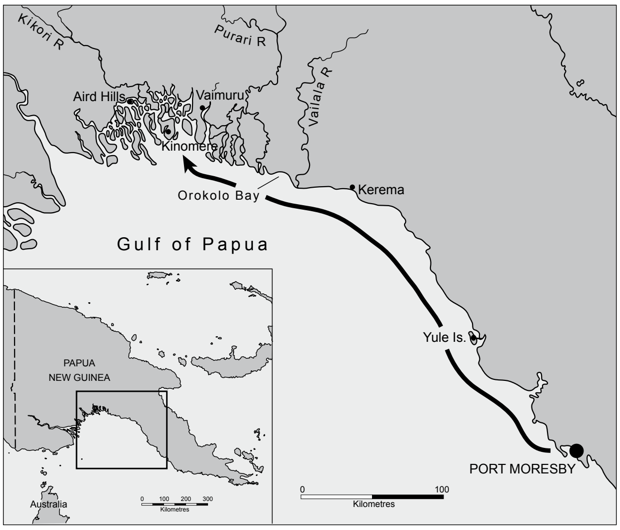

Figure 2 The annual Motuan *hiri* expeditions from Port Moresby region.

The more far-reaching *hiri* trade is an ethnographically reported trade system involving Austronesian-speaking (principally Western Motu) ceramic pot manufacturers and traders sailing annually to villages in the Gulf of Papua (Dutton 1980). The *hiri* trade journeys are well-documented in the late nineteenth and early twentieth century literature (e.g. Barton 1910; Chalmers 1895; Chester 1878; see Oram 1982 for a review). Trade voyagers set-off in fleets of (typically around 20) multihulled sailing ships (*lagatoi*) from the Port Moresby area of Bootless Bay and Caution Bay when the southeast trade winds blew, typically in October or November, and returned with the monsoons around January. These trading expeditions brought ceramic pots and shell valuables to the western Gulf Province villages, in return for sago and canoe hulls that would be strapped to the ships for the return voyage. Fort (1886:15) reported that annually '20,000 pots were taken, for which they would bring back in exchange about 150 tons of sago'; other estimates indicate around 30,000 pots and up to 600 tons of sago per annum (see Allen 1977; Allen and Rye 1982 for reviews). Motu traders regularly travelled to the Gulf Province coastal villages as far west as Vaimuru along the Purari River delta, and there are suggestions in local oral traditions that the Motu trade expeditions sometimes went further west (Figure 2). These villages then served as redistribution centres for inland villages and villages further to the west (e.g. those of the Kikori River and nearby river systems) (e.g. Chester 1878:9; Oram 1982). Groves (1960:3) writes that in the 1950s 'Motu pottery traditionally found its way, and still finds its way, into almost every village along the shores of the Papuan Gulf and in the immediate hinterland'. The ubiquity of this cultural product gives it great archaeological potential, allowing archaeologists to investigate cultural change, including past inter-regional relations and interactions across close and distant communities. The finding of a rock painting of a large, *lagatoi*-like crab-claw canoe on Dauan in northern Torres Strait (McNiven *et al.* 2004:244) suggests that at least on rare occasions *hiri* traders may have ventured even further west to northern Torres Strait. As Groves (1960:8) concludes from the ethnography, the Motu *hiri* trading network was 'more extensive than any other yet reported from Papua and New Guinea', and in this, *hiri* holds a special place in PNG's cultural history.

Professional archaeological research since the late 1960s indicates that the ethnographically recognisable *hiri* trade system and its associated ceramic traditions probably began around 500 years ago (see David 2008). Older ceramic traditions across the Gulf and Central Provinces also suggest that the historical *hiri* descended from a further 1500 years or more of formalised long-distance maritime trade relations across the region (e.g. Allen 1972, 1977; Bulmer 1978, 1982; Rhoads 1982; for a review and significantly expanded radiocarbon chronology see David 2008). At the other end of the chronological spectrum, *hiri* expeditions were severely disrupted during World War II when Motu villages were evacuated and also as a result of increasing involvement in the wage economy since the mid-1900s (Ryan 1970; see also May and Tuckson 2000:59). Formal *hiri* trade expeditions continued sporadically into the 1960s.

Motuan oral tradition has it that the *hiri* trading voyages were begun by the legendary Edai Siabo near present-day Boera village, a short distance to the west of Port Moresby (e.g. Barton 1910; Lewis 1994:134-135). According to genealogical reckoning, this would date the origin of the *hiri* to around 350 years ago by most calculations.

Hiri Pottery and the Significance of Emo

The late nineteenth and early twentieth century ethnographic records from Motuan pottery manufacturing villages identify a number of formal pottery shapes and decorative designs within a single general ceramic style. Pottery was made in most Motu-speaking villages.

Numerically predominant among ceramic vessels during the 1870s to 1960s were *uro* cooking pots (Figure 3), *hodu* water jars (typically larger and deeper than the *uro*) and *nau* dishes (Arifin 1990:31; Barton 1910:114; Bulmer 1971; Chalmers 1887:122; Finsch 1914:270). More recent, mid-twentieth century commentators have documented up to 12 Motu pottery types. Not all of these pottery types are said to have been traded by the Motu. A number of pot shapes were further subdivided into size classes by the Motu to create a broader range of distinctive and formalised vessel types (Arifin 1990:35).

Motu pottery was made with paddle and anvil technique (rather than coil technique as practiced in some other parts of Melanesia), the paddles commonly being ridged, although 'This ridging is normally erased by the potter in the final paddling with a smooth paddle' (Bulmer 1978:57). Ceramic manufacturers made both plain (undecorated) and decorated wares, the latter representing makers' marks enabling the male traders to keep track of whose (female kin) products they were exchanging (see Groves 1960 for details of such *siaisiai* services). However *uro*, in ethnographic times the principal trade item, was usually undecorated. More generally, pottery made for domestic use was undecorated (Bulmer 1978:61).

Previous archaeological research both within the Central Province (where the pots were made) and Gulf Province (to where the pots were traded) has revealed the existence of a range of ancient ceramic conventions that were not practiced during the late nineteenth and early twentieth centuries: vessel shapes and decorative designs have changed significantly through time. Emo has long been heralded as a key site by which the ancestral *hiri* trade's antiquity can be better worked out, because since the 1970s it has remained the oldest reported location of imported ceramics into the Gulf Province; Bickler (1997) has shown that the earliest analysed pottery sherds from archaeological sites in the Gulf Province came from Motuan pottery-producing homelands. Yet a detailed and reliable chrono-stratigraphic study of Emo has not until now been produced; therefore, until we know precisely how old Emo is, we cannot know with any certainty how old the (direct or indirect) *hiri* trade to the Aird Hills is. This paper addresses this question of the antiquity of Emo and its pottery sherds.

Emo

The archaeological site of Emo is located on flat ground 30m west of the Komo River, on elevated land 15m above the river's high tide mark (Figure 4). The site is located along the northeastern edge of the twentieth century missionary village of Samoa (Figures 5-6), but, as we were told at Samoa and Ero villages, within Porome customary lands; this is consistent with Rhoads' (1983:97) observation that 'The peoples inhabiting the area near Aird Hills were Porome language speakers'.

Archaeological research in Emo began in 1971 when Bowdler undertook five small excavations totaling 4.5m^2 (Rhoads 1983). This was followed by another excavation programme in 1976, when Rhoads excavated a further 1m^2. Rhoads (1983) published a short report on both of these excavations, noting that:

> the site's stratigraphy … consists of shell midden within a darkly stained soil matrix, overlying dense red mud. The shell remains vary in consistency with smaller fragments normally associated with near surface, intrusive features (i.e. pits and post holes). Although the stratigraphy is complex, its depositional integrity is secure outside the physical limits of these disturbances. In most places the cultural deposits reach a depth of 60cm below present ground surface' (Rhoads 1983:98).

Eight stratigraphic units were reported, including the culturally sterile basal 'red mud'. Three conventional radiocarbon determinations were obtained 'from the same level' (Rhoads 1983:98), one of 1850±95 BP (I-6153), submitted by Bowdler on charcoal from 55–60cm below the surface; the other two (2430±370 BP [ANU-2061A] and 1220±180 BP [ANU-2061B]) submitted by Rhoads on paired charcoal and shell respectively, also from 55–60cm below the surface. The youngest of these

Figure 3 Ceramic pot (*uro*) in the Gulf Province village of Epemeavo in August 2007, obtained in the past through *hiri* trade (Photograph: Bruno David).

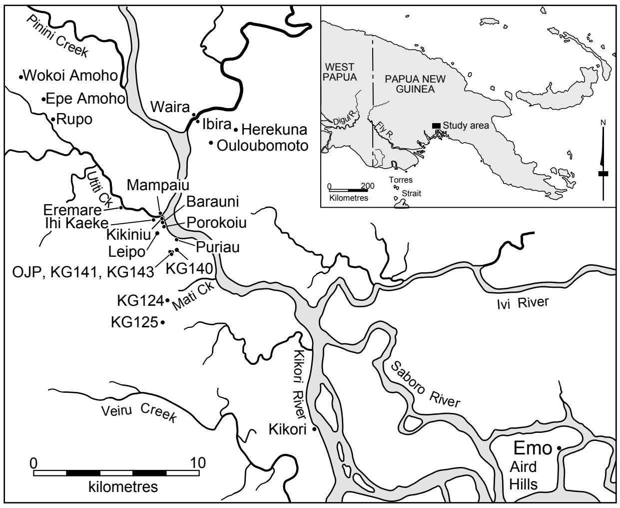

Figure 4 Kikori River delta, Gulf Province, showing location of Emo, Aird Hills and nearby excavated archaeological sites.

Figure 5 The Aird Hills: Emo, with Kumukumu mountain in background (Photograph: Bruno David).

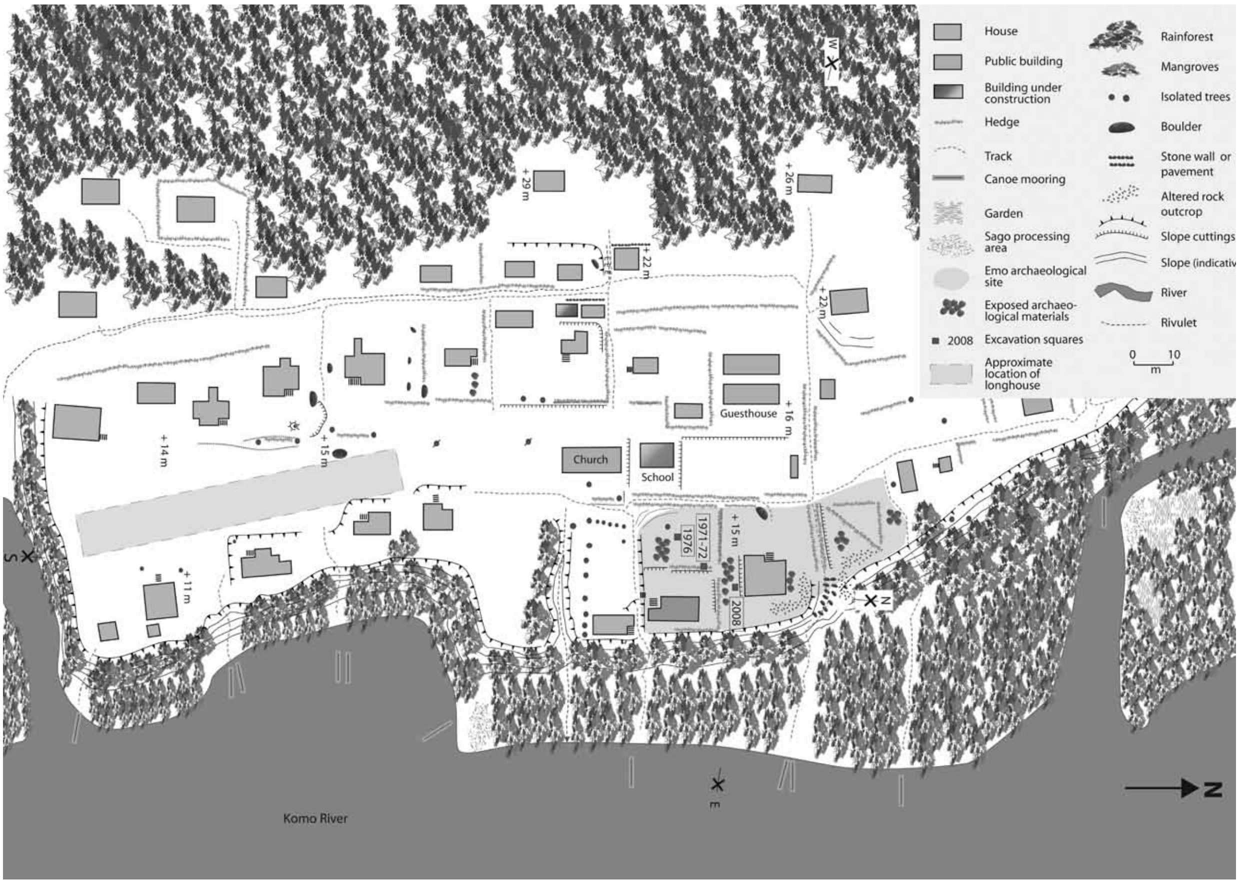

Figure 6A Emo, plan of site and current village of Samoa.

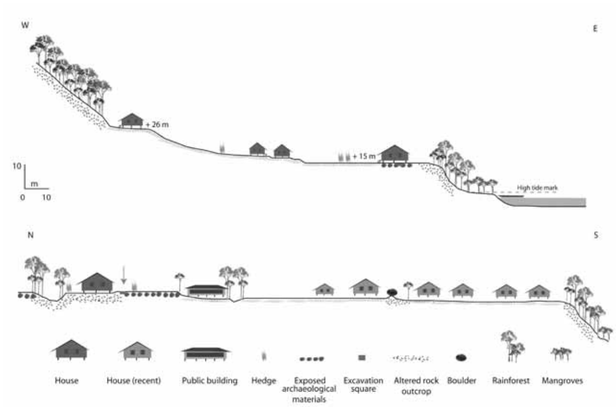

Figure 6B Emo, showing W–E and N–S cross-sections marked in Figure 6A.

Figure 7 Emo, Squares A and B south and west walls after completion of excavation, showing the complex stratigraphy (Photograph: Bruno David).

determinations was on *Batissa violacea* shell, which incorporates a reservoir effect correction factor of 2900±150 years based on a single radiocarbon determination on a recent shell from nearby limestone-rich waters (Polach 1980:A.68). However, the Aird Hills themselves are of volcanic origins, and the Emo shells are likely to have come from nearby volcanic rather than limestone environments. As Polach (1980:A.68) noted, at the time that the Emo shell date was obtained it was already known that shell 'Environmental Correction Factors' (ECF) could range from 450±35 to 5700±200 years. Therefore, while Rhoads' (1980) radiocarbon date on archaeological shell used an ECF of 2900±150 years, this was more or less a 'stab in the dark' and potentially contained a significant dating error of up to 2800 years. The Emo shell date was thus understood at the time to be highly problematic due to doubts about which reservoir effect to use. Consequently, that date was rejected by Rhoads (1983:99) as too young, leaving the original 1850±95 BP and subsequent 2430±370 BP charcoal dates as alternative indicators of the site's antiquity. Yet the 2430±370 BP date contains a very large standard deviation and is thus of limited precision and usefulness. These three conventional radiocarbon dates obtained by Bowdler and Rhoads have remained until now the sole basis for the oft-cited

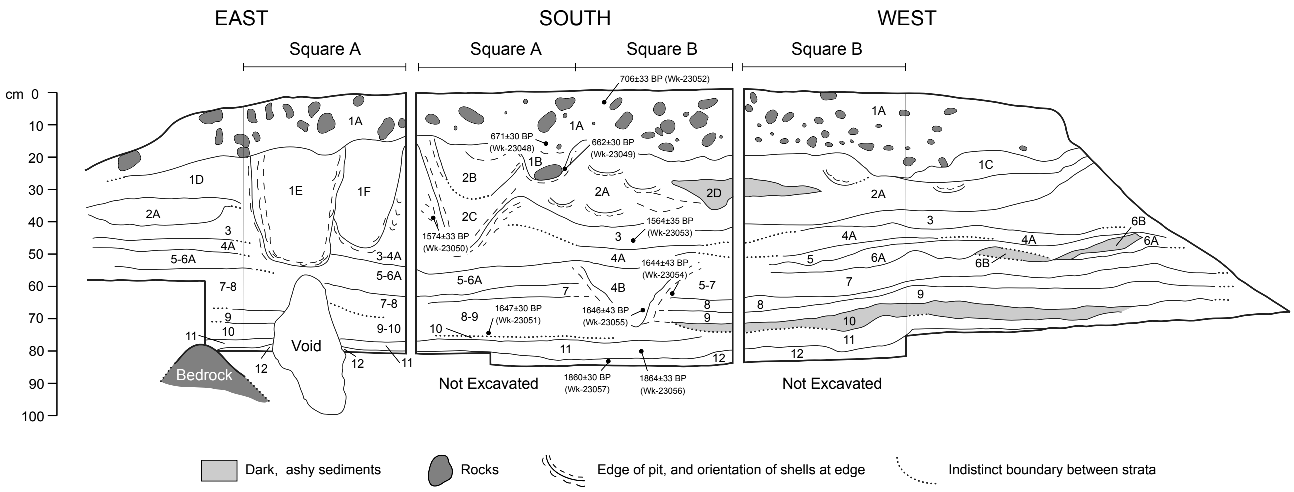

Figure 8 Emo, Squares A and B, east, south and west section drawings and location of radiocarbon dates.

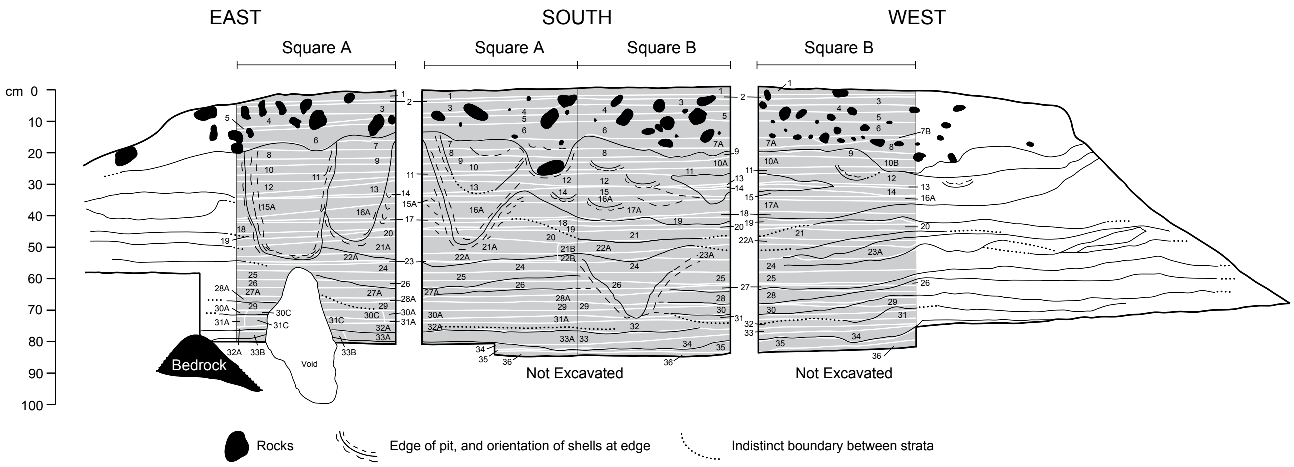

Figure 9 Emo, Squares A and B, east, south and west section drawings with XUs superimposed.

but uneasy claims of Emo as dating to the commencement of southern PNG's ceramic sequence around 2000 BP, although Rhoads (1983:99) was cautious in interpretation, suggesting that, taking the uncertainty of the shell correction factor and the large standard deviation of the 2430±370 BP date into account, 'an age of 1900 BP best approximates the earliest date for site occupation'. This was essentially deferring to Bowdler's original single radiocarbon date as indicative of the site's antiquity. To this day, because these radiocarbon dates are problematic, archaeologists do not know precisely what to do with the Emo results, although they are clearly of interest to archaeologists tracking the origins and subsequent history of ceramic production and specialised, long-distance maritime trade, including the ethnographically-known *hiri* and the presence of apparently 'early' ceramic types at Emo (in particular, red-slipped pottery, despite the antiquity and longevity of red-slipped pottery being poorly understood across southern PNG).

The Excavation

Two juxtaposed 50cm x 50cm squares (A and B) were excavated in February 2008 by BD, J-MG, and NA. The squares were positioned along the NNE, exposed edge and topographically most elevated surviving portion of the site. Here the stratigraphy is exposed in a vertical cutting made for the construction of a house in 2001, located 2m to the south of the site. Archaeological deposits here are at their thickest. The ground surface is covered by a thick growth of low grass that holds surface sediments together; apart from the anthropogenic cuttings for house construction, there are no signs of erosion.

Squares A and B were located approximately 7m to the northeast of Bowdler's original excavations. Excavation of Squares A and B proceeded in Excavation Units (XUs) averaging 2.4cm thick, following the stratigraphy where evident, although individual Stratigraphic Units (SUs) could not easily be differentiated because of the apparent similarities in colour, texture and contents of the various strata. It was only after the excavations were completed that the complex stratigraphy was exposed. Tables S1 and S2 (supplementary information) list the excavation details for Squares A and B.

Stratigraphy

The Emo excavations revealed 12 major layers or SUs (SU1-12, starting with SU1 at the surface) subdivided into 24 major and sub-SUs. SU1 is subdivided into SU1A-1G; SU2 into SU2A-2E;

SU4 into SU4A-4B; and SU6 into SU6A-6B. SU3, SU5 and SU7-12 are not further subdivided. All SUs except for the basal SU12 are cultural layers, each containing very dense shell and other cultural remains with minor amounts of non-cultural sediments (Figures 7-9). Indeed, by weight only 0.5% of the total excavated sediments >2.8mm in size from Square A, and 1.3% from Square B, consist of non-cultural materials. Tables S3 and S4 list details of the sediments from each SU.

Radiocarbon Dates

Ten AMS radiocarbon ages have been obtained, four from Square A and six from Square B (Table 1). All radiocarbon ages are on charcoal collected *in situ* in three dimensions. These are all in good stratigraphic order and can be used to resolve the chronological uncertainties raised by Rhoads (1983).

The radiocarbon determinations show four clear occupational phases. Based on the midpoints of the highest probability ranges at a single standard deviation, the four phases are:

- Phase 1: 1780 cal BP (= approximately 1840 years ago).
- Phase 2: 1560 cal BP (= approximately 1620 years ago).
- Phase 3: 1470 cal BP (= approximately 1530 years ago).
- Phase 4: 660 cal BP (= approximately 720 years ago).

Generally, XU1-6 date to Phase 4; XU7-22 to Phase 3; XU23-32 to Phase 2; and XU33-34 to Phase 1. However, XUs tend to cut across SUs or sub-SUs, and therefore some XUs contain a combination of cultural sediments from more than one phase, especially in levels close to the edges of phases. The basal XU35-36 date to before the arrival of people at Emo. Within this context, some significant trends are evident and explored below.

The radiocarbon ages do not give clear indications as to how long each phase lasted, but the great similarity of the dates within each phase suggests that occupation during each phase was not prolonged; that is, each phase appears to have lasted two or three decades at the most (and probably less) and was followed by a period of regional abandonment or a shift in site location. Further research into this question is in progress (using shell sizes as an indication of predation pressure on regional resources) to shed more light on the temporal pattern of occupation in the regional landscape.

Archaeological Site Contents

The contents of Squares A and B are similar to each other, and thus support the general patterns outlined below (Tables S5 and S6).

Stone Artefacts

A total of 50 stone artefacts were recovered from Squares A and B – 24 from Square A and 26 from Square B (Table S7). The assemblage mostly comprises flakes (N=32, 62%) and flaked pieces (N=13, 26%). A retouched flaked piece or core, a ground fragment, two retouched flakes and a heat-affected fragment make up the only other artefacts recovered.

Table 1 Radiocarbon determinations, Emo. All ^{14}C dates are AMS, on charcoal. Calibrations undertaken using OxCal v.4.1 (Bronk Ramsey 2009) and the IntCal09 calibration dataset (Reimer *et al.* 2009). *The Wk-23051 date has been ^{13}C fractionation-corrected using a value measured on the accelerator; the value is not reported here because the C isotopes are fractionated during measurement (Fiona Petchey, Waikato Radiocarbon Dating Laboratory, pers. comm., 2009).

Square	XU	Depth (cm)	Lab. No.	δ^{13}C‰ (±0.2)	F^{14}C%	^{14}C Age (years BP)	Calibrated Age BP (68.3% probability)	Calibrated Age BP (95.4% probability)
				Phase 4				
B	3	5.1	Wk-23052	-25.3	91.6±0.1	706±33	683-653 (68.2%)	699-636 (78.1%) 594-561 (17.3%)
A	6	16.1	Wk-23048	-27.0	92.0±0.1	671±30	670-645 (38.8%) 586-566 (29.4%)	677-631 (53.3%) 600-559 (42.1%)
A	10	23.1	Wk-23049	-28.7	92.1±0.1	662±30	666-645 (33.9%) 587-565 (34.3%)	674-629 (48.5%) 602-558 (46.9%)
				Phase 3				
A	16A	41.0	Wk-23050	-28.5	82.2±0.1	1574±33	1516-1456 (45.3%) 1445-1415 (22.9%)	1535-1391 (95.4%)
B	21	46.0	Wk-23053	-27.4	82.3±0.1	1564±33	1516-1457 (46.7%) 1444-1429 (11.1%)	1424-1410 (10.4%) 1530-1384 (95.4%)
				Phase 2				
B	26	62.5	Wk-23054	-27.3	81.5±0.2	1644±43	1610-1515 (56.5%) 1460-1441 (7.3%) 1433-1421 (4.4%)	1690-1667 (4.4%) 1627-1413 (91.0%)
B	28	67.8	Wk-23055	-27.4	81.5±0.2	1646±43	1611-1515 (58.4%) 1459-1442 (6.4%) 1432-1422 (3.4%)	1690-1667 (4.8%) 1628-1413 (90.6%)
A	31A	73.0	Wk-23051	*	81.5±0.2	1647±30	1602-1581 (11.8%) 1572-1520 (56.6%)	1687-1674 (1.9%) 1620-1486 (82.2%) 1468-1417 (11.3%)
				Phase 1				
B	34	79.8	Wk-23056	-28.9	79.3±0.1	1864±33	1864-1844 (13.9%) 1830-1773 (38.8%)	1876-1718 (95.4%)
B	36	82.3	Wk-23057	-27.6	79.3±0.1	1860±30	1861-1849 (7.8%) 1827-1736 (60.4%)	1874-1716 (95.4%)

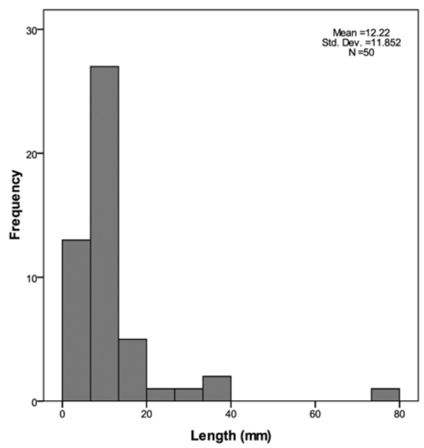

Figure 10 Size frequency distribution for all artefacts from Emo Squares A and B.

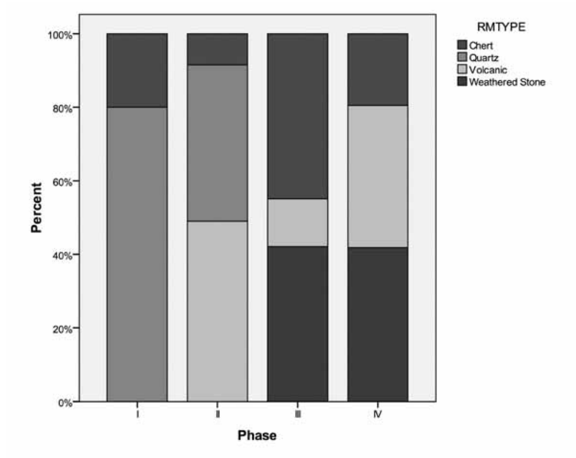

Figure 11 Flaked stone artefacts: proportion of raw material type for each phase at Emo.

Artefacts range in length from 4.7mm to 77.8mm; weights range from <0.1g to 184.9g (Figure 10) (the latter being for a fragment of possibly ground volcanic stone). The size distribution for artefacts shows a major peak at around 10mm, with most artefacts less than 40mm in length.

Chert is the most common raw material type in the assemblage, making up 60% of the artefacts, followed by volcanic stone at 26%. Quartz (6%) and weathered stone of unidentifiable type (8%) are the only other raw materials represented. Cherts were found in a range of colours including white, yellow, red-orange and grey and could be uniform or speckled in colour.

Approximately 66% of the artefacts are incomplete, with marginal fragments most common, followed by heat fragments, distal, medial and proximal fragments and a single right-side cone split. Seven artefacts show signs of heat damage, and six artefacts were heated enough to create spalling and breakage.

Cortex is rare, and while found on seven artefacts only three chert artefacts exhibit cortex. Together with the small size of chert flakes, this probably reflects extensive reduction of chert materials, all of which derive from distant sources (see below).

Flakes are on average quite squat (mean length/width = 1.07±0.41) with typically small platforms (ventral area is on average 6.5 times larger than the platform). Macroscopic edge damage is present on six chert flakes (see Table S8), all of which show signs of use (see below). All but one are broken, and were most likely once much larger.

The volcanic and weathered stone artefacts are typically much larger and heavier than the chert and quartz flakes; all are grey in colour. Volcanic and weathered stone flakes have much smaller ventral relative to platform areas than is the case with the chert flakes (Figure S1). All quartz platforms are crushed. The larger size and relatively larger platforms suggest less pressure on the use of volcanic stone, or at least different reduction behaviours. This may reflect greater availability of volcanic stone or different uses of raw materials.

Stone artefacts are most common in Phase 3, with a peak in artefact discard in XU6 (N=6). Artefact discard is lowest in Phase 1 (N=7), rises slightly in Phase 2 (N=8), rising to the Phase 3 peak (N=20) before dropping slightly in Phase 4 (N=15) (Figure S2).

Retouching and heating are only found in Phases 3 and 4. Volcanic artefacts are absent in Phase 1, peak in Phase 2, then drop to low proportions in Phase 3, then increase again slightly in Phase 4. Artefacts are almost all very small throughout the occupation of the site, but one large chert flake is present in Phase 2, and larger chert and volcanic flakes are found in XU7, XU6 and XU3 (Phase 4). Despite the small sample size, stone artefacts become noticeably more abundant around the time pottery also becomes more abundant and shell valuables make their first appearance at the site. This period of innovation and intensification of flaked stone artefact, ceramic and shell deposition coincides with a relative peak in chert artefact abundance. Hence *hiri* trade for pots may have brought the inhabitants of Emo into more frequent contact with their stone-producing neighbours, in particular those controlling the chert sources located upstream.

Overall, the assemblage reflects the discard of predominantly small flakes and broken pieces, with rare larger flakes. Chert and volcanic artefacts clearly have different life histories, with chert artefacts showing more extensive signs of reduction, including two retouched flakes. Several of the small chert flakes in the assemblage could derive from the retouching of larger flakes that have not been recovered in the excavated sample. Raw material change is present at Emo with a change from chert and quartz at the base of the deposit to the inclusion of volcanic stone and weathered stone in the last three phases of occupation beginning around 1620 years ago (Figure 11). The peak in stone artefact discard in Phase 2 coincides with increased use of volcanic stone and chert, and probably represents strengthened connections between neighbouring groups reflected in transfers of raw materials and other goods.

Stone Artefact Residue and Use-Wear Analysis

A combined residue and use-wear analysis was carried out on a total of 25 stone artefacts from Emo (Table S8, Figures S3-S4). Despite the small size and fragmentary nature of the majority of the sample, 14 were identified as used, with specific functional interpretations made for 10. Of the remaining 11 artefacts, six show no evidence of having been used, and it was not clear whether the remaining five were used or not.

A range of task associations are represented at the site, including skin-working, bone-working and plant processing. Seven instances of plant processing were identified, ranging from cutting plants to scraping resinous wood; three instances of bone-working were identified; and skin-working and ochre grinding were identified once each. It is likely that one artefact was a multifunction tool, possibly used for more than one task.

Pottery

A total of 704 pottery sherds were excavated. Fifty-two (7.4%) of these are decorated. Almost all of these sherds are tiny pieces weighing less than 5g (and most weigh less than 1g). The average weight of all sherds is 0.9g, indicative of the very small and weathered state of the ceramic assemblage. Only seven of these are rim sherds, three of which conjoin. The Emo ceramics include seven neck sherds from everted indirect vessels (typical of *uro* ethnographic forms; see above); six of these are near-surface finds from the uppermost seven XUs of both squares, the other sherd from XU18 of Square A. None of the sherds from everted indirect vessels was recovered from the lowermost levels of the Emo sequence. No sherds from obvious carinated vessels were identified in the entire sequence (Table S9).

Of the 52 decorated sherds, 12 are red-slipped, one is red painted, 31 are either red-slipped or red painted (the sherds are too small to determine which is the correct option), one is red-slipped externally and red painted internally, two are incised, three are either incised or fingernail or shell-impressed, one is red-slipped and incised, and one is red-slipped or red painted and incised or impressed. The red-slipped and red-slipped or red painted sherds occur throughout much of the sequence, with no apparent levels of absence. No shell-impressed decorations were identified, unlike many of the decorated sherds previously recovered from archaeological sites along the southern PNG coastline (e.g. Bulmer 1978; David *et al.* 2009; Vanderwal 1973). The tiny size of the vast majority of sherds does not allow for a detailed investigation of vessel forms and decoration at Emo; we also note that while decorative conventions are reported here, many of the sherds are weathered and may have been decorated (in particular red-slipped or painted) with the surface pigments having since weathered away. For this reason little emphasis should be placed on the varying incidence of pigment on the excavated Emo sherds (this does not apply to incisions/impressions as the weathering on the sherd surfaces is shallower than the incision/impression depths).

Bone Artefacts

Drilled mammal teeth were recovered from Square B XU5 and XU15. Two other bone artefacts found in Square A XU31C and XU26 are a small long bone fragment that has an irregular point fashioned on one end and might have served as a casual engraving or boring implement, and a larger long bone shaft fragment that has been carved internally, perhaps to improve its functionality as a scoop, and also has some cut marks externally. Judging from its size, this bone is probably from a cassowary, human or pig; extraction of ancient DNA may resolve the question of its derivation (Figure S5).

Shells

A total of 165,214 Minimum Number of Individual (MNI) non-land snail shells weighing 148.46kg were excavated from Squares A and B. The vast majority of these – 99.9% by MNI as well as by weight – represent discarded food remains, in particular *B. violacea*, *Neritina* spp., *Pythia scarabaeus* and *Melanoides* sp. However, a small number of shell valuables were also found, consisting of seven drilled shell beads, and eight *Cypraea annulus* fragments representing an MNI of five. Three broken pieces of clam, *Tridacna* sp., were also found in XU18 of Square A and XU24 of Square B; one of these has been drilled (see Tables S10 and S11). These finds are further discussed below.

The four major shell species used as a food resource signal focused exploitation of the mangroves that are typical of the Kikori River delta. *Melanoides* sp., *Neritina* spp. and the bivalve *B. violacea* live both in freshwater and estuarine environments that interface in mangrove ecosystems, while *P. scarabaeus* is a mangrove species that can also exist in adjacent terrestrial woodland environments (Smith 1992). Poraituk and Ulijaszek (1981:13) have noted for the Purari River delta shortly to the east that *Neritina* was the taxon 'most frequently collected' by local peoples, 'and was found regularly at all localities investigated'. In some areas it 'appeared in colonies of hundreds or more. Larger snails were found crawling on tree trunks and nypa fronds. Due to its abundance villagers often collect it for food'. Poraituk and Ulijaszek (1981:14) also note that a species of *Pythia* 'is the most commonly found on rotten leaves and branches … the species is found out of the water'.

A MNI of 49 land snail shells were also excavated. With one exception these are native forest species that inhabit the litter zone, and their incorporation in the deposits is merely indicative of the local forest environment in the area of the site. They comprise *Camaenidae* spp., *Assiminiedae* sp., *Pupinidae* sp. and *Lamprocystis* sp. (F. Helicarionidae). *Subulina octona* (F. Subulinidae) is a small, soil- and litter-inhabiting introduced species originating in the West Indies (Solem 1989). Today this species is almost circum-tropical, having been spread synanthropically by European commerce (Cowie 1998). On a more local scale, it may also have been spread by village-to-village trade. The only specimen excavated at Emo came from the surface XU1 of Square A.

MNI for shellfish for the two excavated squares ($0.42m^3$ excavated) total 21,898 *B. violacea*, 118,462 *Melanoides* sp., 12,911 *P. scarabaeus* and 11,941 *Neritina* spp. While *B. violacea* has elsewhere been measured to contain on average 21g of flesh (Meehan 1982:142) and the latter three taxa are small gastropods each estimated to contain approximately 1g of flesh per individual (based on gastropod flesh:shell ratios presented in Meehan 1982:142), the very large numbers of shellfish represented in the Emo excavations indicate consistent and reliable if not voluminous contributions to the diet. Based on surface clues and recent interviews with residents of Samoa village, we estimate that the site was originally approximately 50m x 30m in size, and that it averaged around 50cm in depth. By volume, the Square A and Square B excavations would thus represent approximately 0.056% of the original c.$750m^3$ of the site. As today we can see that the general range of species on the exposed edges of the site are the same as those represented in Square A and Square B, we can extrapolate for the site as a whole to estimate that some

39,103,571 *B. violacea*, 211,539,286 *Melanoides* sp., 23,055,357 *P. scarabaeus* and 21,323,214 *Neritina* spp. – that is, close to 300 million shellfish were eaten and discarded at Emo during the combined few decades of its occupational history. While such quantities are of themselves inordinately large, *Melanoides*, *Pythia* and *Neritina* in particular each contain very small amounts of flesh, the total extrapolated Emo shellfish amounting to some 1,077,092kg of flesh (or, at an indicative average of 500 kilojoules/100g of flesh [see Brand Miller *et al.* 1993], totalling 5,385,464kJ; see also Poraituk and Ulijaszek 1981:22-25 for nutritional values of shellfish in the broader region), consumable in 449 person-days (or 1.2 person-years) assuming an estimated total daily energy requirement of 12,000 kJ/person/day. Even if we assume that shellfish contributed only one-tenth of the Emo population's complete energy intake, the total kilojoules represented by the shellfish remains in the entire site represent only 12.3 years of food for a single person (or 7 months for 20 people) spread over the entire period of the site's occupation beginning some 1840 years ago.

It is clear that the Emo shell midden does not indicate a large population residing and depositing food remains over any extended period of time, but rather confirms the site as representing a series of short-lived occupational pulses. It is of interest to note that one of the few studies of shellfish exploitation to have been undertaken in the Gulf Province, in this case in the Purari River delta some 50km to the east of the Aird Hills, notes that *B. violacea* is 'highly favoured for eating by the local people' (Poraituk and Ulijaszek 1981:12). They continue: 'The normal way the local people collect these … species is to gather from one location until the population is depleted and then to move collection elsewhere. There is some oral evidence that this practice might be depleting the total population of these molluscs in the region since the people informed us that their numbers were decreasing with recent intensive collection' (Poraituk and Ulijaszek 1981:13). It is clear from the Emo evidence presented here that, firstly, intensive exploitation of shellfish resources has a long antiquity in this part of the Gulf Province, dating back to at least 1800 years ago, and that the pulsating nature of *site* occupation holds potential for archaeologically investigating *regional* resource use through an examination of archaeological shell sizes with implications for past predation pressures on shell populations. Such a study is now in progress and will be reported elsewhere.

Hearth Stones and Charcoal

The uppermost SU1A and SU1B contain large numbers of hearth stones totalling more than 40kg, consistent with the presence of relatively large amounts of charcoal in those layers. The stratigraphic evidence also indicates the presence of earth ovens in these uppermost SUs.

Plant Remains

Seed and fruit macrofossils were recovered from Emo. Preliminary analysis shows the presence of nutshell and fruitstones in Square B. These include charred *Cocos nucifera* (coconut) nutshell (XUs 7-9, 12, 15 and 16) and *Pandanus* key (XU7) fragments, as well as a few *Celtis* fruitstones (XU10). All of these come from Phase 3, dated to around 1530 years ago, indicating that coconut, *Pandanus* and *Celtis* were managed and exploited at or near Emo at that time. Other specimens remain unidentified. From Square A only uncharred husk fragments of *Areca catechu* (betelnut) were present in XU1, probably from very recent activity. The presence of coconut and *Pandanus* at depth in the strata shows the use of plant foods at the site. Forthcoming analyses of the full charred plant remain assemblage may add to this picture.

Non-Shell Fauna

A total of 280g of bone were recovered from Square A and 274g from Square B (Tables S12-S15). Avian eggshell from the two squares weighed 4.44g and 0.94g, respectively. A very small quantity of crustacean exoskeleton (0.04g in Square A, probably all crab) completes the faunal assemblage. All of the material appears to be cultural in origin, although some of the smaller rodents may conceivably have died naturally within the context of the midden heap.

The taxonomic composition of the assemblage is summarised for each phase in Tables S12 and S14. Because the quantity of remains from individual XUs is typically quite small, for analysis the assemblages are pooled according to the four main occupation phases. For this analysis, the main domesticates (pig and dog) are separated from the remaining mammals which represent the proceeds of hunting in the forest environments of the Aird Hills.

Most of the bone in all taxonomic categories is unburnt, unweathered and often relatively unfragmented, allowing for allocation of almost all pieces at least to a major taxonomic category. Five major taxa are represented among the vertebrate remains (in descending order of total quantity): fish, mammals, squamates (lizards and snakes), turtles, birds and frogs. The excellent preservation of the bone and other faunal remains reflects the protective midden environment. Broad taxonomic composition of the assemblage is generally consistent across all four occupation phases.

The fish bone is dominated by the remains of catfish of the family Ariidae – these are most readily identified from their distinctive lenticular otoliths and finely tuberculate head plates. At least six other major groups of fish are represented, including members of the families Plotosidae (Catfish), Serranidae (Coral-cod, Coral Trout etc), Scaridae (Parrotfish), Lethrinidae (Emperors), Platycephalidae (Flatheads) and Lutjanidae (Wrass). The composition of the fish assemblage is consistent with the modern fish community that inhabits the lower reaches of the larger rivers of the Papuan Gulf (Aplin and Rhoads 1980). A wide variety of sizes of fish are represented, suggestive of varied procurement techniques, probably including trapping and spearing.

Pig and dog remains are found throughout Phases 2-4 (Tables S13 and S15) and some larger fragments of bone from within Phase 1 might yet be identified as pig using ancient DNA. Although direct dating of selected bones and teeth has yet to be completed, the fairly even distribution of pig remains in particular through the stratigraphy speaks against all of the specimens from lower levels being intrusive. This pattern contrasts sharply with that described recently by O'Connor *et al.* (in press) for sites in north coastal New Guinea where the bulk of the pig remains comes from surficial contexts, and where pig bones and teeth from deeper levels yielded essentially modern radiocarbon dates when subject to direct determinations. From the very

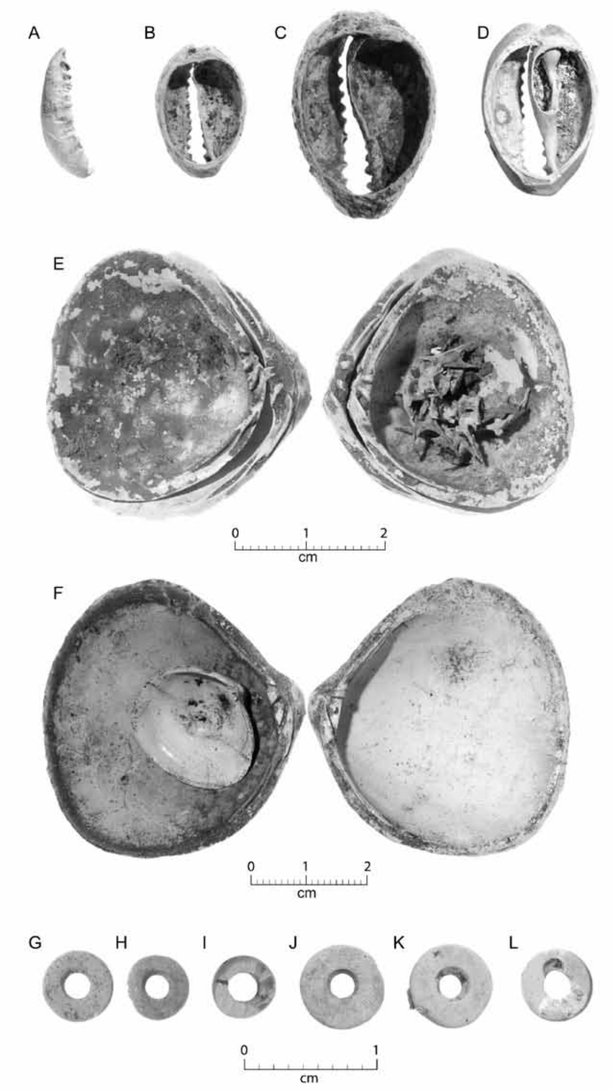

Figure 12 Excavated cultural objects from Emo. A: Square B XU17A; B: Square A XU13; C: Square A XU22B; D: Square A XU20; E: Square A XU32A; F: Square B XU17B; G: Square A XU12; H: Square A XU12; I: Square A XU14; J: Square A XU18; K: Square A XU20; L: Square B XU16A.

fragmentary Emo remains it is difficult to form any opinion as to whether the pig remains are likely to derive from culling of a domestic population, maintained around dwellings and in sago swamps (Hughes 1970), or are the result of the hunting of wild pigs. Rhoads (1980) reported a difference in age profiles of pig remains between open village sites and rockshelters in the Waira region of the middle Kikori River. Pig remains from rockshelters were more often derived from younger pigs, perhaps reflecting easier hunting of young wild pigs or a selective transport of larger captures back to villages. The small sample of pig teeth from the Emo site includes both young and old individuals but there are too few specimens to warrant further analysis.

Wild mammal remains (Tables S13 and S15) include two species of bandicoot (*Echymipera* spp.), two cuscuses (*Phalanger* sp. and *Spilocuscus maculatus*), a wallaby (*Thylogale* sp.) and a variety of rats ranging from the medium-sized white-tailed rat (*Uromys* sp. cf. *U. caudimaculatus*) and water rat (*Hydromys chrysogaster*) to various smaller species (*Melomys* sp., *Rattus* sp.). All of these species can be obtained in lowland rainforest habitats in the Aird Hills, with bandicoots and cuscus predominating over the other groups. The relative paucity of wild mammal remains compared with fish in particular suggests either that relatively little effort was made to obtain wild mammals through hunting or snaring, or that the proceeds of hunting expeditions were consumed and discarded elsewhere.

The modest quantity of reptile bone is dominated by the remains of small- to medium-sized pythons (Boidae), with lesser amounts of fanged colubroid snakes (probably including file snakes, Family Acrochordidae) and very occasional fragments of monitor (*Varanus* spp.) and other lizards (Tables S13 and S15). The scarcity of larger snakes and monitors in this assemblage contrasts with other lowland Melanesian assemblages reported by Pasveer (2004) and O'Connor *et al.* (2005a, 2005b) and is not readily explicable in terms of local habitat. One possibility is that it reflects a somewhat more residential community at Emo that depleted local populations of larger snakes and monitors, and shifted the demographic profile towards younger and smaller individuals. This hypothesis can be further explored through more precise taxonomic identification of the python remains, a task requiring access to more specialised reference collections and osteological knowledge than presently available.

Turtles are surprisingly scarce throughout the deposit (Tables S13 and S15). All diagnostic remains seem to be derived from freshwater chelid turtles but some chunkier fragments might be from pig-nosed turtles, *Carettochelys* sp.

Bird and frog bones are both very poorly represented (Tables S13 and S15). This is somewhat surprising in the case of birds, especially in view of the fact that eggshell from two different kinds of birds indicates at least some occasional exploitation of this group.

Avian eggshell is derived almost equally from cassowary eggs (thick-walled and with characteristic flattened nodules) and a second type that is thin-walled and externally smooth (Tables S13 and S15). This second group is consistent in morphology and curvature with eggs of a mound-builder of the family Megapodidae, several species of which occur in the hinterland of the Papuan Gulf.

Overall, the character of the faunal assemblage varies little through the sequence and suggests a long-term reliance on occasional fishing and hunting to supplement the consumption of shellfish and whatever vegetable matter was gathered or produced.

Pollen

The pollen and spore concentration throughout the Emo Square B profile is very low, suggesting that the site has been exposed to oxidation and surface disturbance resulting in abrasion and loss of palynomorphs from the record. One exception is the top sample (Square B XU1) which contains the most pollen, with Poaceae (dominant), Cyperaceae, Amaranthaceae (minor) and some fern spores (Cyathea) present, suggesting an open grassy environment. This is clearly associated with contemporary conditions. Fungal spores including dung fungi (Sporomiella and Podospora), perhaps indicative of pigs, are also found in this sample. Micro-charcoal (5-125 micron) shows much better preservation and is at a very high concentration throughout the site.

Summary

Starting with the lowermost deposits, people first came to Emo during Phase 1, some 1840 years ago, at which time the ground surface was clayey. Four major species of shellfish – *B. violacea*, *Neritina* sp., *P. scarabaeus* and *Melanoides* sp. – were each gathered and eaten. Some fish and wild mammals were obtained, and it is possible that pig was either maintained as domestic stock or hunted in nearby lowland rainforest (Tables S13 and S15). The thinness of Phase 1 deposits indicates that people did not stay in this part of Emo for very long; indeed, the presence of a single SU (SU11) in this phase indicates that Phase 1 was a single-episode occupational event lasting less than a few decades, and probably only a few weeks, months or years at the most. Undecorated pottery sherds are found in low numbers (N=14), indicating that (ancestral *hiri*) trade relations between Central Province (Port Moresby area) pottery manufacturers and sailors and Gulf Province trade partners has an antiquity dating back to at least 1840 years ago, given that Bickler (1997) had previously found that the earliest ceramics found in the Gulf Province came from the Port Moresby area.

Phase 2 (dating to about 1620 years ago) is the period when SUs 5-10 were deposited. These layers are generally subhorizontally stratified, but include also the relatively shallow, inverted cone-shaped pit of SU2B whose function is uncertain. Phase 2 sediments are again dominated by the four major shellfish taxa seen in Phase 1 while animal bones (predominantly fish, wild mammals and pig) again form a secondary component. One curious find dating to Phase 2 is the presence of a complete and closed *B. violacea* bivalve enclosing a slightly smaller closed *B. violacea* bivalve shell which in turn encloses the bones of a very small fish (Figure 12). The purpose of this complex construction is unknown, but could relate to either play or to some form of magic/ritual activity. An isolated human tooth was also found in XU25 of Square A. Pottery sherds are again found in low numbers, and consist of 62 undecorated and two decorated sherds (1 red-slipped and 1 red-slipped or red painted). However, 19 of these undecorated sherds come from XU23A in Square B, at the interface of Phase 2 and Phase 3 (including SU5 and SU6A) sediments; this assemblage may, therefore, include Phase 3 sherds.

Phase 3 (dating to about 1530 years ago) sediments continue the pattern of very dense concentrations of the shellfish species seen in Phases 1 and 2. Again, animal bones occur as a secondary component and with essentially the same taxonomic emphasis. Sediments from this phase come from SU2-4A. Pottery is again present, in somewhat higher densities than previously (N=362); 38 of these sherds are decorated. The decorated sherds consist of seven cases of red-slipping, one case of red painting, 27 cases of indeterminate red-slipping or red painting, one sherd with external red-slip and internally red painted, one sherd with red-slip and subsequent linear incisions, and one case of red-slip and either linear incisions or impressions. Assuming generally similar durations of deposition (as indicated by the radiocarbon ages), pottery is now arriving at Emo five to six times as abundantly as during Phase 2, if the excavated ceramics are any indication. Small, drilled circular shell beads (N=6 in Square A, 2 in Square B) and six imported *C. annulus* shallow reef shells (of a kind used during ethnographic times for bride-wealth, compensation and status) are also restricted to this phase (this species does not live in this part of the Gulf Province and was almost certainly imported from the Central Province where it is abundant). A small number of drilled mammal teeth, clearly parts of necklaces, were also found in the same layers. The largest of the three excavated fragments of clam (*Tridacna* sp.), weighing 80g, also comes from Phase 3, with the other two excavated fragments (weighing 10.7g between them) coming from the Phase 2/Phase 3 interface. Like the *C. annulus*, the clam was also an imported item coming from a reef environment typical of the Central Province. Five human teeth fragments are present within the Phase 3 sediments in Square A, and one in Square B.

Phase 4 (dating to 720 years ago) has a character different from the earlier deposits. While three of the shellfish species dominant in the lower deposits are again abundant – *B. violacea*, *Neritina* sp. and *Melanoides* sp. – *P. scarabaeus* is now rare (Figure 13). Phase 4 deposits contain numerous natural rocks probably used in earth ovens, some containing shallow cut marks of indeterminate function. Some of these rocks also contain shallow cupules probably representing nut-cracking anvil stones (Figure S6). Vertebrate animal bones again form a secondary component of the total faunal remains but the quantity appears somewhat higher due in part to the presence of some larger fragments of pig bone. Charcoal fragments are also more prevalent, consistent with the presence of earth oven stones, indicating the cooking of vertebrate animals in this part of the site. Pottery sherds again occur in peak quantities and include a total of 264 sherds, 12 of which are decorated. The decorations consist of four red-slipped, three red-slipped or red painted, three incised or impressed (possibly including fingernail impressed), and two linear impressed sherds (Figure 14); the incisions appear to be becoming more common. Five of the seven everted indirect sherds come from this Phase; a sixth is from XU7A of Square B, at the interface between Phases 3 and 4. The implication is that it is only around 720 years ago that the predominant ethnographic vessel form (*uro*) relating to *hiri* trade begins to be clearly identified in the Emo sequence, although sample sizes are very small and this conclusion should thus be treated with caution. One human tooth fragment occurs in Square B. European objects (glass, metal, plastic) only occur in the top 3cm of the deposit (XU1-2), indicating that except for the uppermost two XUs Phase 4 deposits ceased well before the 1900s; the radiocarbon ages indicate that Phase 4 ended around 700 years ago. However, the presence of small amounts of glass, metal and plastic in XU1-2 indicate very recent, late nineteenth to twentieth century occupation at Emo, consistent with ethnographic records and with the presence of the twentieth-century Samoa village. We here divide this most recent period of Emo's occupation into Phases 5 and 6; represented archaeologically by the uppermost 3cm of Squares A and B which contain all of the European-contact objects. Phase 5 relates to late nineteenth century to early twentieth century occupation as evidenced by ethnographic records (e.g. Butcher 1963). Phase 6 relates to the missionary village of Samoa, established by missionaries in the mid-1900s and continuing to this day.

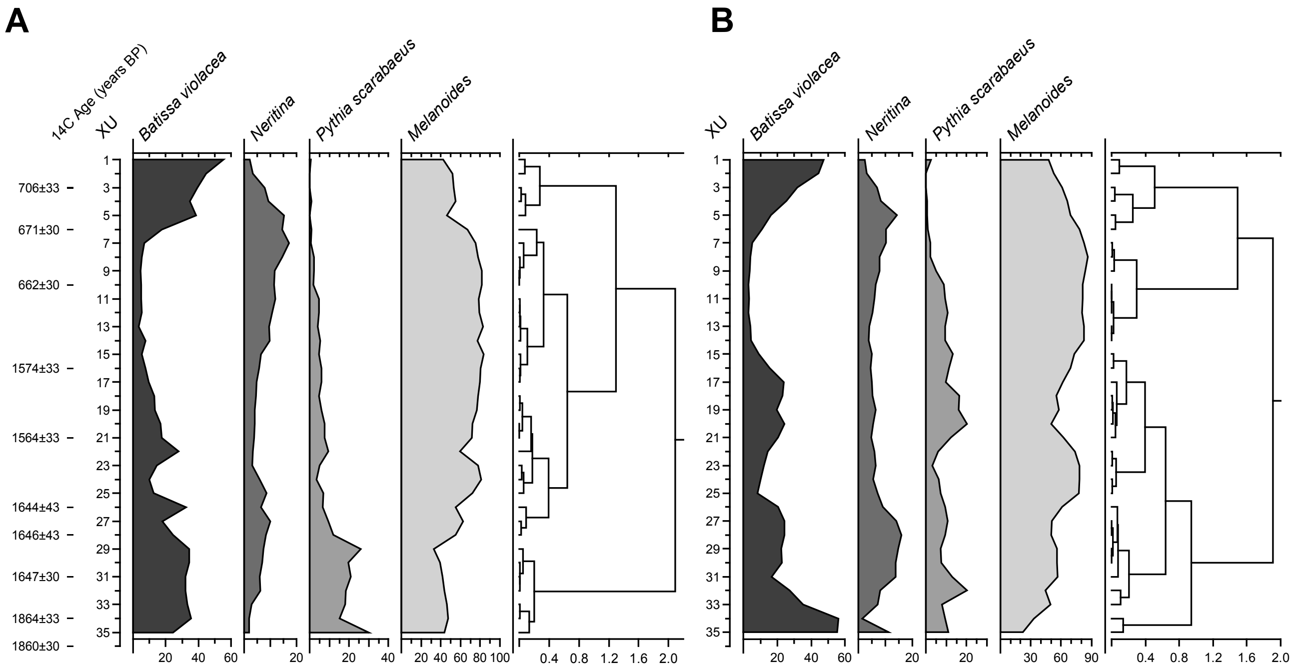

Figure 13 Relative frequencies of the four common shell taxa, *B. violacea*, *Melanoides* sp., *Neritina* sp. and *P. scarabaeus* at Emo by excavation square and XU. A: Square A; B: Square B. For the presentation of data, TILIA spreadsheet and TGVIEW (v. 2.0.2). Constrained Incremental Sum of Squares (CONISS) cluster analysis was performed and the results displayed as dendrograms on the diagram. The analysis was carried out on percentage data, stratigraphically constrained and with a square-root transformation (Edwards and Cavalli Sforza's chord distance). For further information see Grimm (1987).

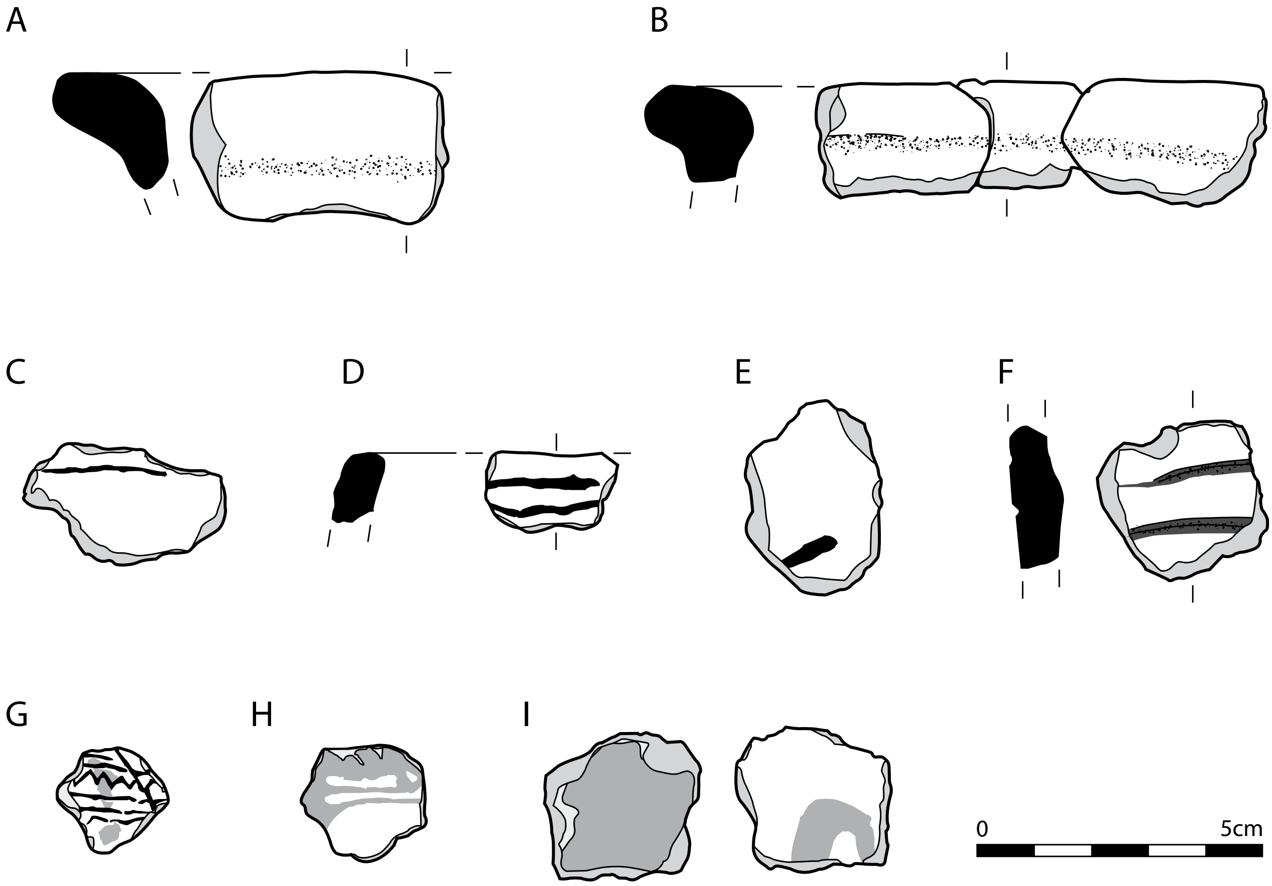

Figure 14 Excavated pottery sherds from Emo, Squares A and B. A: Square A XU3; B: Square A XU15a; C: Square A XU2; D: Square A XU3; E, F: recovered from eroded sediments in front of Squares A and B; G: Square B XU9; H: Square A XU8; I: Square B XU14.

Conclusion

The results of the recent excavations at Emo indicate the following:

1. People first arrived and lived at Emo about 1840 years ago.
2. Since then, there is archaeological and ethnographic evidence of five subsequent phases of occupation, dating to 1620, 1530, 720 years ago (based entirely on archaeological evidence), to the early twentieth century AD (based largely on ethnographic evidence) and to the mid-twentieth century (the missionary village of Samoa). Each of these phases was of relatively short duration (none shows evidence of hundreds of years of use, but rather of periods of time measured in decades or less). The village of Samoa is a very recent, mid-twentieth century colonial-period missionary village.
3. During each of the first four occupational phases, the residents of Emo exploited and ate the abundant local shellfish, with a secondary focus on vertebrate fauna in particular fish, pig and wild mammals.
4. Pig remains were found throughout the deposit. While there are strong grounds to suggest that pigs were present from the earliest phase of occupation dating to around 1840 years ago, this needs to be confirmed by direct radiocarbon dating of potentially early specimens. If possible pig remains from Phase 1 can be taxonomically confirmed using ancient DNA, these might be among the earliest pig remains yet recovered on mainland New Guinea (O'Connor *et al.* in press). Without further excavation, it may not be possible to determine whether the pigs were derived from domestic stock or from hunting of a wild population.
5. Dogs also seem to be present from early times, at least from Phase 2 dated to around 1620 years ago. While the identification of these remains is not in doubt, direct radiocarbon dating is still required to be certain of the antiquity of these remains. Dogs presumably were kept as domestic animals and may have been used on hunting expeditions, as they are in many parts of the island of New Guinea today.
6. Coconuts were being consumed, and probably grown at or near Emo, during Phase 3 dated to around 1530 years ago. Coconuts are not native to the mangrove-rich river deltas of the Gulf Province, and must therefore have been introduced from further afield, possibly with the ancestral *hiri* voyages documented in this paper.
7. During the first two phases of occupation, small numbers of clay pots found their way into this area, but around 1530 years ago pottery begins to appear in noticeably higher quantities and shell valuables make their first appearance, indicating that the ancestral Motu *hiri* trade began to be more regular and pottery and shell valuables were acquired in this part of the Gulf Province. We do not know whether ancestral Motu *hiri* traders came directly to this area at that time, or whether, like more recent times, they established trade partnerships with nearby groups further to the east (e.g. at Vaimuru) who in turn traded imported goods with their own trade partners from Emo through inland and river delta redistribution networks. The presence of the drilled shell beads, *C. annulus* and *Tridacna* sp. at this time indicates either the commencement of shell valuable imports with the trade pots, or a significant intensification of such trade; the importation of shell valuables into Gulf Province recipient villages was also documented for the ethnographic Motu *hiri* trade. It is significant that the timing of this Phase of intensified ancestral *hiri* trade corresponds well with the commencement of the first intensive occupational pulse (the 'Early Major Pulse') in the Kopi region of the mid-Kikori River some 20km to 35km upstream of the Aird Hills, which David (2008) has argued began c.1450 cal BP (1500 years ago) and lasted until c.950 cal BP (1000 years ago).
8. At the same time that imported ceramic sherds increase significantly in numbers and shell valuables make their first appearance at Emo – both suggesting more regular trade partnerships with incoming (ancestral *hiri*) seafaring traders from the east after 1530 years ago – the incidence of imported, curated chert artefacts also begins to increase noticeably, suggesting heightened levels of trade with stone tool manufacturers in the highlands foothills to the north. Chert sago pounders have not been found in the Emo excavations, but tiny flakes resulting from various uses (retouch flakes, use-impact flakes) indicate that around 1530 years regular trade relations with highlands foothills chert tool manufacturers became established across much of the lowlands. We suggest that the establishment of ongoing trade relations with peoples with chert sources was the result of increased need for access to stone sago pounders resulting from the increased demands caused by the large-scale production of sago for the ancestral *hiri* trade closer to the coast. The establishment of large coastal trading centres following the onset of regular *hiri* trade also led to an increased need for stone tools for the manufacture of a broad range of wooden items (including sacred boards, implements and weapons, structures) (see point 7). Kakare (1976:69), a local Motumotu man whose homeland was 180km west of Port Moresby, recounted in 1976 how his ancestral village was drawn from the hinterland to the coast by the *hiri* trade:

   > According to my grandfather Suve Lari some Vabukori men came in a *lakatoi* (Motu trading canoe) to the mouth of the Lakekamu river about 200 years ago. This date was worked out by the author by counting back the generations using twenty year intervals from the time of Tamate's (James Chalmers) arrival in MotuMotu in 1879. The Motu met some Toaripi people who lived at Karikara Murumuru (village of darkness) up the Karova creek off the Lakekamu river. Their *lakatoi*, however, could not get up the narrow creek to Karikara Murumuru village. It was then decided to shift the Toaripi people and their possessions to a more accessible position at the mouth of the Lakekamu river. A change in the course of the Lakekamu river has since made the sandspit where they built the new village into an island. The Vabukori men called the new village MotuMotu.

   Motumotu village has continued its existence ever since. It is such a process of establishment of coastal trading centres that the *hiri* trade encouraged.
9. There is little evidence in this part of Emo of the early twentieth century village of Phase 5, indicating that this ethnohistoric village had not been in this area for very long prior to the arrival of missionaries in the Aird Hills and the

establishment of a nearby government station at Kikori in 1912. The predominant archaeological expression is of the pulsating sequence of ancestral villages that date back from 1840 to 720 years ago.

10. As previously argued by David (2008), occupation along the Kikori River, including its delta, is best understood as a series of pulses characterised by shifting residential locations rather than long duration village histories in set locations. These pulses relate to the dynamics of long-distance *hiri* (and ancestral *hiri*) exchange partnerships and how the importation and redistribution of ceramic vessels and shell valuables brought by Motu seafarers articulate with regional systems of alliance and enmity. While the establishment of long-distance trade between Gulf Province and Central Province partners led to the establishment and growth of relatively stable and large coastal village locations as regional trade centres (see point 7), further inland the smaller villages were vulnerable to changing relations of alliance and redistribution on the one hand, and raiding on the other, with the powerful coastal groups who largely controlled the *hiri* trade and whose populations quickly grew. Among these upstream groups ethnographic records document high rates of head-hunting by raiding parties from the large coastal villages such as found among the Kerewo of Goaribari and Aidio and Paia of the Omati River mouth, leading upstream tribes such as the Rumu to relocate villages away from major waterways and at times on hilltops for reasons of protection. Local oral traditions recount ongoing enmity between the Porome of the Aird Hills and the Kerewo during ethnographic times. It comes as no surprise, therefore, to find that, archaeologically, Emo witnessed pulses of occupation which we suggest represent the coming and going of relatively exposed villages on the edge of the Komo River on the one hand, and more protected inland village locations (such as Kumukumu on the nearby mountain-top) on the other. It is in this pulsating movement of villages and dynamics of intertribal relations that the Emo occupational phases and Porome spatial history are readily understood, a process of shifting site location that largely reflects the growth of coastal trade centres and the powerful regional polities that they engendered.

During the early ethnographic period of the late 1800s into the 1900s, Indigenous peoples of the Gulf Province were subject to two largely opposing demographic-settlement forces: headhunting and long-distance maritime trade partnerships and their redistribution networks. The pervasiveness of headhunting, driven by cosmologies focused on the appropriation of embodied spiritual powers (as well-illustrated in the Kerewo '*agibe* cult' for example – see Haddon [1918], which involved appropriate lineage members consulting 'skull shrines' where *kaia 'imunu* spirits reside prior to battle [Austen 1935:342]) affected all of the coastal regions of the western Gulf Province, the Western Province and the eastern regions of West Papua. At times headhunting raiding parties involved fleets of large war canoes carrying many hundreds of heavily armed warriors travelling along the southern Papuan coastline, Torres Strait and major river systems of southwestern Papua New Guinea in search of human heads. For example, Haddon (1918:180) writes of the Kerewo headhunting raids

> I was informed at Dopima [on Goaribari island, 38.4km SSW of Emo] that when a new war canoe (*obi*) is made the warriors go in it to a strange village on the mainland and kill a man … the body is eaten and the skull attached to an *agiba* [sacred board and 'skull shrine']. In Ubua, an off-shoot from Kerewa [aka Otoia village] in the Kikori estuary, the beheaded corpse is held over the bow of the new canoe, so that the latter is covered with blood … In all cases the body of the victim was eaten and the skull kept in the *dubu daima* [men's longhouse where sacred objects were also kept]. The Kerewa folk were in the habit of raiding the bush tribes of the Omati and those of neighbouring rivers, but most raids appear to have been made right up to the hills on the Sirebi River, which flows from the east into the Kikori some thirty miles from its mouth.

The arrival of such incoming enemy forces spread fear among local populations who adapted (where possible) by locating settlements in hidden settings away from the coast and major river systems. This was the situation in the middle Kikori River, where settlements tended to be small (typically dozens of inhabitants) and located along small creeks and on hilltops with good rainforest cover. In the region of the Aird Hills, the largest and most feared headhunting tribe was the Kerewo, a coastal group whose villagers typically numbered between one and two thousand per village (e.g. Otoia, Dopima on the island of Goaribari). Among these large villages, intertribal headhunting often led to revenge raids, as exemplified by an early nineteenth century patrol report:

> Last May, the natives of Morigio Island [58km SW of Emo], Turama River, came across to the east bank of the Turama River, and murdered eleven natives belonging to the village of Yawobi, on the Paibuna River [c.46km SW of Emo]. On word reaching the station, the Assistant Resident Magistrate proceeded to the scene of the massacre, and from thence to Morigio Island. This island is a huge swamp, with hardly an acre of dry ground on it. Before leaving for Morigio, 22 canoes from Goari-Bari, with fighting men all painted and well armed with a large supply of bows and arrows, appeared on the scene. They were most anxious to go to Morigio and avenge the deaths of the eleven murdered men, which meant they would kill men, women, and children. [T]he Assistant Resident Magistrate, knowing full well what would happen if he allowed those people to accompany him, sent them back, much to their disgust. On the approach of the officer and his party the murderers deserted their villages, and took to the swamps (Ryan 1913, cited in Goldman and Tauka 1998:60).

The net effect of such raids on coastal and small inland villages by large coastal warring parties was the dispersal of the small inland settlements into camouflaged villages that were effectively also refuges, and the consolidation of large coastal villages into powerful village-based tribal polities.

Largely countering these headhunting processes of inland village dispersal and population culling were forces of agglomeration and population growth caused by the establishment of centrifugal trading stations operationalised in the *hiri*. The coming of Motu *hiri* long-distance maritime traders called for recognised trading centres along the coast, to which incoming *lagatoi* could yearly berth and establish trading relations, attracting residents into centralising settlements in the process. This process of settlement growth consolidated local groups into aggrandising village-based tribal polities who quickly achieved military superiority over neighbouring inland groups, and thereby the power to control and maintain headhunting practices and cosmologies. The raiding success of these large villages enabled them to grow rapidly into powerful tribes feared by neighbouring and distant riverine groups along the Kikori and other neighbouring rivers and their tributaries.

The interplay of these opposing forces of centralisation and village growth caused by the establishment of (ancestral *hiri*) trading centres on the one hand, and population culling and refugial village dispersal on the other, led to pulsating settlement trends in non-coastal regions, with villages being drawn to resource-rich river frontage during times of alliance and peace expressed by lulls in headhunting raids, and dispersal into camouflaged locations away from the major rivers during times of heightened headhunting activity. We argue that it is in such a setting of ongoing headhunting flux and rhythms of *hiri* trade partnerships that the Emo archaeological pulses should be seen.

Ongoing archaeological research in the sequence of Porome villages as recorded from oral traditions, and in ancestral Kerewo villages on the island of Goaribari and neighbouring Omati River mouth, are aimed at further investigating these processes of social change and settlement growth in the Gulf Province far recipient end of the ancestral *hiri* trade network of Papua New Guinea.

Supplementary Information

Supplementary information for this article is available online at www.australianarchaeologicalassociation.com.au.

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SUPPLEMENTARY INFORMATION

The Emo Site (Oac), Gulf Province, Papua New Guinea: Resolving Long-Standing Questions of Antiquity and Implications for the History of the Ancestral *Hiri* Maritime Trade

Bruno David, Jean-Michel Geneste, Ken Aplin, Jean-Jacques Delannoy, Nick Araho, Chris Clarkson, Kate Connell, Simon Haberle, Bryce Barker, Lara Lamb, John Stanisic, Andrew Fairbairn, Robert Skelly and Cassandra Rowe

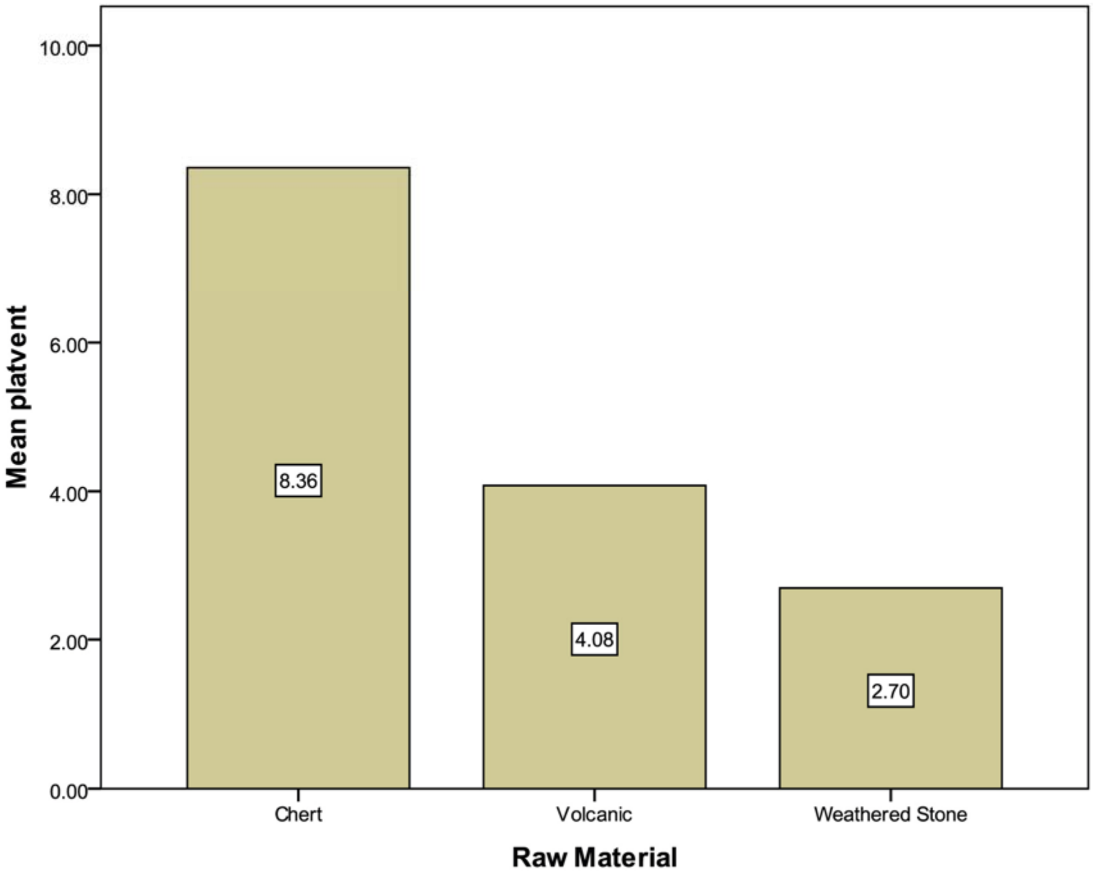

Figure S1 Size of platform relative to ventral area for Emo artefacts, by raw material type (ventral area/platform area).

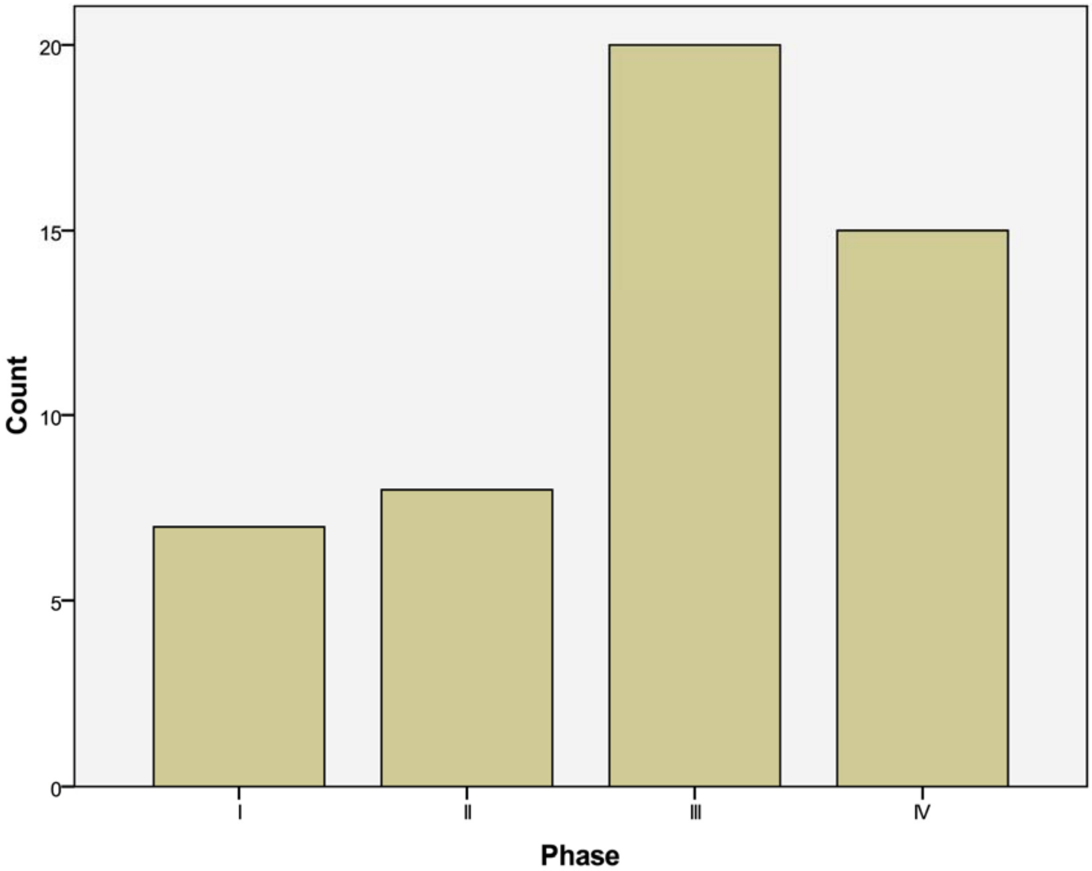

Figure S2 Number of artefacts in each phase at Emo.

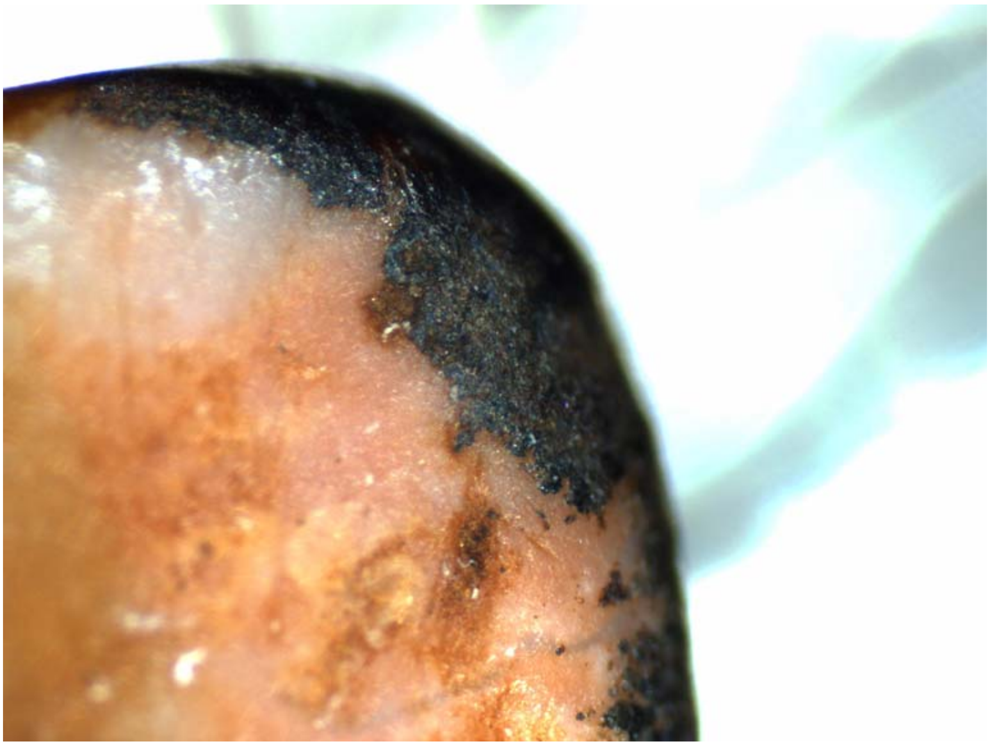

Figure S3 Heavy rounding and fungus on Artefact #23 edge (50X-dark field illumination).

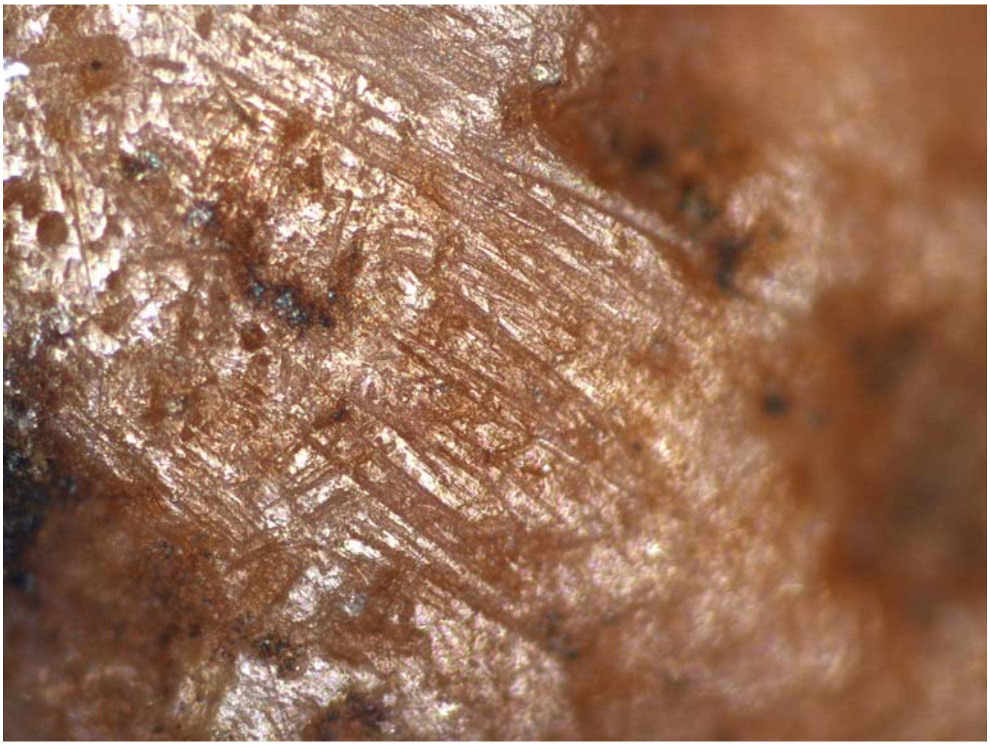

Figure S4 Striations perpendicular to use edge on Artefact #23 (100X-bright field illumination).

Figure S5 Bone artefacts. A: Square A, eroded from deposits in front of Square A; B: Square A XU26; C: Square B XU5; D: Square B XU15; E: possible artefact, Square A XU31C.

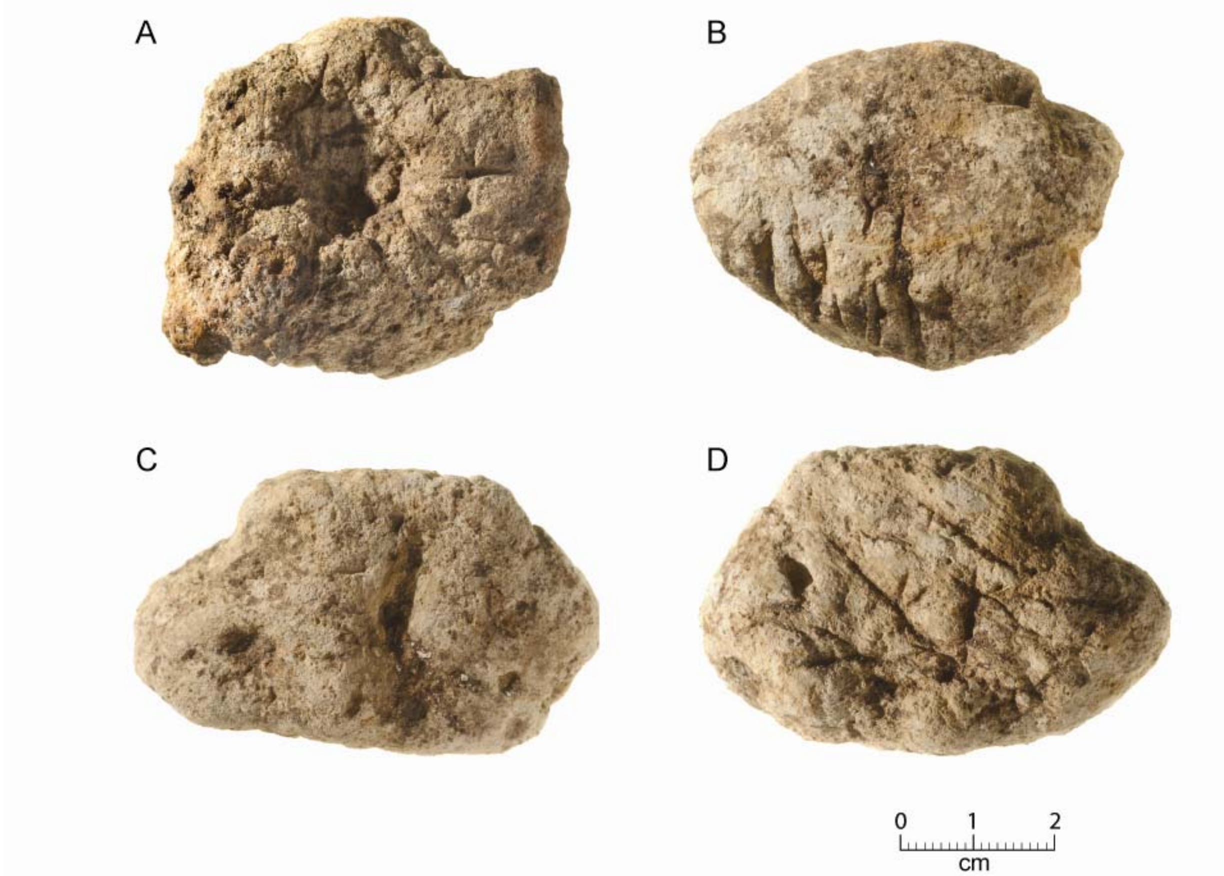

Figure S6 Excavated marked stones from Emo Phase 4. A: Square B XU7A; B: Square B XU8; C: Square B XU27; C: Square B XU27.

Table S1 Details of each Excavation Unit, Square A. SUs in bold contribute the majority of the XU deposit.

XU	SU	^{14}C Age (years BP)	Mean Depth at Top (cm)	Mean Depth at Centre (cm)	Mean Depth at Base (cm)	Mean Thickness (cm)	Area (m^2)	Weight (kg)	Volume (m^3)	% of Sediments >2.84mm (g)
1	**1A**		0.0	0.8	1.5	1.5	0.25	6.1	0.0038	32.6
2	**1A**		1.5	2.2	2.9	1.4	0.25	4.4	0.0035	34.0
3	**1A**		2.9	4.2	5.5	2.6	0.25	9.1	0.0065	43.3
4	**1A**		5.5	7.4	9.3	3.8	0.25	11.6	0.0095	46.4
5	**1A**		9.3	10.2	11.0	1.7	0.25	5.9	0.0043	43.9
6	**1A**/1F/2B/2C	671 ± 30	11.0	13.1	15.1	4.1	0.25	11.4	0.0103	48.1
7	1A/**1B**/1E/**1F**/2A/**2B**/2C		15.1	16.5	17.9	2.8	0.25	7.1	0.0070	44.2
8	**1B**/1D/**1E**/**1F**/2A/**2B**/2C		17.9	19.3	20.6	2.7	0.25	5.9	0.0068	41.9
9	**1B**/1D/**1E**/**1F**/2A/**2B**/2C		20.6	21.5	22.4	1.8	0.25	5.1	0.0045	46.9
10	**1B**/1D/**1E**/**1F**/2A/**2B**/2C	662 ± 30	22.4	23.8	25.2	2.8	0.25	7.4	0.0070	40.6
11	**1B**/1D/**1E**/**1F**/2A/**2B**/2C		25.2	26.2	27.2	2.0	0.25	5.9	0.0050	51.8
12	1B/1D/**1E**/**1F**/**2A**/**2B**/2C		27.2	28.9	30.6	3.4	0.25	5.6	0.0085	52.2
13	**1E**/**1F**/**2A**/2B/2C/2E		30.6	31.5	32.4	1.8	0.25	4.9	0.0045	55.0
14	**1E**/**1F**/**2A**/2B/**2C**/2E/3		32.4	33.8	35.2	2.8	0.25	5.7	0.0070	52.5
15A	**1E**/**1F**/2A/**2C**/3		35.2	36.6	38.0	2.8	0.24	5.9	0.0067	56.9
15B	**2E**		35.2	36.2	37.1	1.9	0.01	0.3	0.0002	86.8
16A	**1E**/**1F**/2A/**2C**/3	1574 ± 33	38.0	40.0	41.9	3.9	0.23	6.9	0.0090	62.1
16B	**2E**		37.1	39.6	42.0	4.9	0.02	0.2	0.0010	63.3
17	**1E**/**1F**/**2C**/**3**		41.9	42.3	42.7	0.8	0.25	2.5	0.0020	64.7
18	**1E**/**1F**/**2C**/**3**/4A		42.7	44.1	45.4	2.7	0.25	7.0	0.0068	55.8
19	**1E**/**1F**/**2C**/3/**4A**		45.4	46.1	46.8	1.4	0.25	4.6	0.0035	52.6
20	**1E**/1F/2C/3/**4A**		46.8	48.3	49.7	2.9	0.25	7.0	0.0073	49.1
21A	**1E**/1F/2C/**4A**/5/6A		49.7	51.5	53.3	3.6	0.22	6.6	0.0079	57.1
21B	**4A**		49.7	51.6	53.4	3.7	0.03	3.7	0.0011	31.4
22A	**4A**/**5**/**6A**		53.3	54.5	55.7	2.4	0.19	5.2	0.0046	57.8
22B	4A/**5**/**6A**		53.4	54.7	55.9	2.5	0.06	1.7	0.0015	57.9
23	4A/**5**/**6A**/7/8		55.7	56.0	56.2	0.5	0.25	1.4	0.0013	57.9
24	1G/4A/**5**/**6A**/7/8		56.2	57.8	59.4	3.2	0.25	8.4	0.0080	58.2
25	1G/5/6A/7/8		59.4	60.7	62.0	2.6	0.25	4.3	0.0065	61.4
26	1G/5/6A/7/8		62.0	63.2	64.3	2.3	0.25	7.8	0.0058	60.2
27A	**7**/**8**/**9**		64.3	65.7	67.1	2.8	0.20	4.4	0.0056	62.3
27B	**1G**		64.3	65.4	66.5	2.2	0.05	0.9	0.0011	44.8
28A	7/**8**/**9**		67.1	69.0	68.8	1.7	0.20	3.2	0.0034	49.7
28B	**1G**		66.5	67.7	68.9	2.4	0.05	0.6	0.0012	44.8
29	1G/7/**8**/**9**		68.8	70.0	71.1	2.3	0.25	6.4	0.0058	45.4
30A	**8**/**9**/10		71.1	72.3	73.5	2.4	0.20	3.8	0.0048	58.0
30B	**1G**		71.1	72.3	73.5	2.4	0.01	0.6	0.0002	12.6
30C	**1G**/**9**/**10**		71.1	72.3	73.5	2.4	0.04	1.5	0.0010	45.5
31A	**8**/**9**/10	1647 ± 30	73.5	74.3	75.1	1.6	0.20	3.8	0.0032	44.6
31B	**1G**		73.5	74.9	76.3	2.8	0.01	0.5	0.0003	8.3
31C	**1G**/**9**/**10**		73.5	74.6	75.6	2.1	0.04	2.8	0.0008	51.8
32A	**9**/**10**/11		75.1	76.7	78.3	3.2	0.23	4.5	0.0074	34.1
32B	**1G**		75.8	77.4	78.9	3.1	0.02	2.9	0.0006	17.9
33A	**11**/12		78.3	80.2	82.0	3.7	0.18	4.7	0.0067	23.5
33B	**1G**/11/12		78.9	80.5	82.1	3.2	0.07	1.5	0.0022	32.5
34	**11**/12		82.0	82.3	82.5	0.5	0.13	2.5	0.0006	7.2
35	11/**12**		82.5	83.4	84.3	1.8	0.13	3.8	0.0023	2.3
36	**12**		84.3	84.9	85.4	1.1	0.13	1.4	0.0014	2.0
Total						**2.4**		**219.4**	**0.2095**	

Table S2 Details of each Excavation Unit, Square B. SUs in bold contribute the majority of the XU deposit.

XU	SU	^{14}C Age (years BP)	Mean Depth at Top (cm)	Mean Depth at Centre (cm)	Mean Depth at Base (cm)	Mean Thickness (cm)	Area (m^2)	Weight (kg)	Volume (m^3)	% of Sediments >2.84mm (g)
1	**1A**		0.0	0.9	1.8	1.8	0.25	6.0	0.0045	26.6
2	**1A**		1.8	2.4	3.0	1.2	0.25	4.8	0.0030	23.1
3	**1A**	706 ± 33	3.0	4.1	5.2	2.2	0.25	5.8	0.0055	40.2
4	**1A**		5.2	6.9	8.5	3.3	0.25	8.8	0.0083	47.3
5	**1A**		8.5	9.8	11.1	2.6	0.25	9.0	0.0065	47.0
6	**1A**		11.1	13.5	15.8	4.7	0.25	16.4	0.0118	51.6
7A	**1A**/2A		15.8	17.3	18.7	2.9	0.20	6.1	0.0058	48.7
7B	**1A**		15.8	16.0	16.1	0.3	0.05	3.7	0.0002	40.1
8	**1A**/2A		18.2	19.4	20.6	2.4	0.25	6.5	0.0060	39.7
9	1A/**2A**		20.6	21.5	22.4	1.8	0.25	4.8	0.0045	37.7
10A	**2A**		22.4	23.8	25.2	2.8	0.24	7.9	0.0067	36.1
10B	**1A**		22.4	23.6	24.8	2.4	0.01	0.3	0.0002	10.6
11	1A/**2A**/2D		25.2	26.2	27.2	2.0	0.25	4.0	0.0050	36.2
12	**2A**/2D		27.2	29.0	30.8	3.6	0.25	8.0	0.0090	40.1
13	**2A**/2D		30.8	31.1	31.4	0.6	0.25	1.2	0.0015	42.2
14	**2A**/**2D**		31.4	31.8	32.2	0.8	0.25	4.0	0.0020	50.2
15	**2A**/**2D**		32.2	34.2	36.1	3.9	0.25	5.4	0.0098	47.3
16A	**2A**/**2D**		36.1	36.9	37.6	1.5	0.24	4.7	0.0036	46.7
16B	**2E**		36.1	36.9	37.6	1.5	0.01	0.6	0.0002	49.1
17A	**2A**/2D/3		37.6	40.1	42.5	4.9	0.24	5.3	0.0118	52.3
17B	**2E**		37.6	40.1	42.5	4.9	0.01	0.5	0.0005	55.4
18	**2A**/3		42.5	42.9	43.3	0.8	0.25	2.5	0.0020	59.6
19	**2A**/3/**4A**		43.3	44.1	44.8	1.5	0.25	2.7	0.0038	62.0
20	3/**4A**		44.8	46.0	47.1	2.3	0.25	5.8	0.0058	50.7
21	3/**4A**/5/6A	1564 ± 33	47.1	48.7	50.2	3.1	0.25	7.0	0.0078	44.2
22A	**4A**/5/6A		50.2	51.8	53.3	3.1	0.21	5.8	0.0065	34.3
22B	**4A**		50.2	51.8	53.3	3.1	0.04	2.0	0.0012	50.0
23A	**4A**/**4B**/**5**/**6A**		53.3	55.0	56.7	3.4	0.16	6.3	0.0054	36.5
23B	4A/**4B**		53.3	54.6	55.8	2.5	0.09	3.4	0.0023	47.8
24	**4B**/5/**6A**/**7**		56.2	58.0	59.8	3.6	0.25	8.6	0.0090	57.4
25	**4B**/6A/**7**/8		59.8	61.7	63.6	3.8	0.25	?	0.0095	?
26	**4B**/**7**/8/9	1644 ± 43	63.6	64.3	65.0	1.4	0.25	4.9	0.0035	56.0
27	**4B**/**7**/**8**/9		65.0	65.9	66.7	1.7	0.25	4.0	0.0043	46.8
28	**4B**/**8**/**9**/10	1646 ± 43	66.7	67.9	69.1	2.4	0.25	6.6	0.0060	43.8
29	**4B**/**9**/**10**		69.1	70.1	71.0	1.9	0.25	4.8	0.0048	37.8
30	4B/**9**/**10**/11		71.0	72.3	73.6	2.6	0.25	6.1	0.0065	50.1
31	4B/**9**/**10**/11		73.6	74.5	75.4	1.8	0.25	5.8	0.0045	56.1
32	**9**/**10**/**11**		75.4	76.7	77.9	2.5	0.25	4.1	0.0063	60.8
33	**11**		77.9	79.1	80.3	2.4	0.25	4.5	0.0060	38.0
34	**11**	1864 ± 33	80.3	80.7	81.1	0.8	0.25	5.1	0.0020	17.0
35	**12**		81.1	82.4	83.6	2.5	0.25	6.5	0.0063	5.5
36	**12**	1860 ± 30	83.6	84.3	84.9	1.3	0.25	5.5	0.0033	2.8
Total						**2.4**		**215.8**	**0.2126**	

Table S3 Description of SUs and sub-SUs from the Emo excavations.

SU	Square A XUs	Square B XUs	Description
1A	1-7	1-6, 7A, 7B, 8, 9, 10B, 11	
1B	7-12		
1C	Not present in the excavated squares		SU1A consists of humid, blackish earthy soil containing numerous rocks with a notable paucity of shells. In contrast, SU1C, SU1D, SU1E and SU1F are rich in light-coloured and friable *Batissa violacea* valves, and contain numerous interstitial spaces indicative of biological organism activity. SU1E and SU1F appear to be postholes contemporaneous with the base of SU1A rather than strictly dating to the period of SU1A's sediment accumulation.
1D	8-12		
1E	7-14, 15A, 16A, 17-20, 21A		
1F	6-14, 15A, 16A, 17-20, 21A		
1G	24-26, 27B, 28B, 29, 30B, 30C, 31B, 31C, 32B, 33B		
2A	7-14, 15A, 16A	7A, 8-9, 10A, 11-15, 16A, 17A, 18-19	SU2A is a shell-rich layer (predominantly small *Batissa vioalcea* valves and gastropods) containing fine blackish sediments. This SU is regular and largely *in situ* in those areas represented in the sections, but towards its southern end it has been disturbed by postholes and other post-depositional (probably animal) intrusions (SU1B, 1E, SU1F, SU2B, SU2C). SU2B and SU2C appear to be disturbance pits of unknown origin, while SU2D is a dark ashy lens. The interface of SU2 with underlying SU3 represents a major stratigraphic break (i.e. a change in sedimentation regimes). In other words, SU2 represents a sedimentary phase different to that of the underlying SUs and different also to that of overlying SU1.
2B	6-14		
2C	6-14, 15A, 16A, 17-20, 21A		
2D		11-15, 16A, 17A	
2E	13-14, 15B, 16B	16B, 17B	
3	14, 15A, 16A, 17-20	17A, 18-21	This SU is 5-15cm thick, a visible on the three exposed sections (west, south, east) and contains a predominance of large *Batissa violacea* valves. Orange-tan in colour with brownish-black interstitial soil. The interface with the overlying and underlying SUs is marked, except in those areas where intrusive postholes (SU1E, SU1F, SU2C) are apparent.
4A	18-20, 21A, 21B, 22A, 22B, 23-24	19-21, 22A, 22B, 23A, 23B,	Homogeneous in colour and texture, this SU is of variable thickness, ranging from c.3-12cm thick. Shells are regularly coated with grayish-tan clay. This SU is evident in the western, southern and eastern ends, except in those areas where this layer has been disturbed by intrusive features from above (generally postholes, e.g. SU1E, 1F, 2C). *Batissa violacea* valves are generally 3-6cm in maximum length. The interface with overlying SU3 is marked.
4B		23A, 23B, 24-31	Localised pit dug from the base of SU4A.
5	21A, 22A, 22B, 23-26	21, 22A, 23A, 24	In the western section, SU5 is undulated and irregularly 1-3cm thick. It appears to be a local variation of SU4A that disappears towards the northern end of the western section. It consists of a rich shell matrix, predominantly *Batissa violacea* and *Melanoides* sp., mixed with grayish-tan clay.
6A	21A, 22A, 22B, 23-26	21, 22A, 23A, 24-25	This SU overlies SU7 and is composed largely of compacted and crushed *Melanoides* and *Neritina* spp. mixed with more clayey and more humid sediments. This SU is 1-4cm thick. Its interface with surrounding SUs is difficult to follow and indistinct towards the south.
6B	Not present in the excavated squares		
7	23-26, 27A, 28A, 29	24-27	*Melanoides* sp.-rich layer, generally yellowish in colour, tilting slightly towards the south where its thickness varies from 5 to 10cm. This SU contains blackish lenses of sediment in its northern end; one of these lenses is 30cm long and 3cm thick. The interface with SU8 below is fairly marked, and with the overlying SU6A containing large *Batissa violacea* shells is more difficult to follow and undulated. On its southern side, this SU is post-depositionally disturbed by postholes and thus difficult to distinguish with overlying SU4A and SU3, which are also rich in small shells in this area

SU	Square A XUs	Square B XUs	Description
8	23-26, 27A, 28A, 29, 30A, 31A	25-28	Subhorizontal layer, 3-4cm thick, of a distinctive orange-tan colour. This layer consists of a predominantly *Batissa violaea* and *Melanoides* sp. Assemblage, with little sediment between the shells. Interface with the overlying SU is fairly marked. This SU is difficult to distinguish from SU9 and SU10 towards the southern and especially eastern walls, where post-depositional disturbance is evident in the form of a land-crab or bandicoot hole (in the east) and a posthole (in the south).
9	27A, 28A, 29, 30A, 30C, 31A, 31C, 32A	26-32	Subhorizontal layer, 3-7cm thick and whose contents are indistinguishable from those of SU10. It is distinguished by the presence of a blackish clay and a dark-tan stain on the shell surfaces. Along the eastern side of the exposed profile, this layer is disturbed by post-depositional, anthropogenic processes. The interface with the overlying SU is fairly marked, and evident in SU9's thinness and almost exclusive shell content.
10	30A, 30C, 31A, 31C, 32A	28-32	Subhorizontal layer, 3-5cm thick. Interface with overlying and underlying SUs is marked, notably due to its distinctive, shell-rich contents. This SU consists largely of *Batissa violacea* shells, including noticeably medium-sized and large specimens, with poor, brown-coloured clayey soil, noticeably more organic than in surrounding SU. In Square B *in situ* lenticular clayey lenses were noted amongst the shells.
11	32A, 33A, 33B, 34-35	30-34	Beige-coloured clay layer, 1-3cm thick, containing predominantly crushed *Batissa violacea* shell. Present across the excavated deposits. Interface with overlying SU is marked.
12	33A, 33B, 34-36	35-36	Thick, beige-coloured clay layer. Homogeneous in colour and texture across the excavated squares, with rare small pieces of weathered bedrock. Present across the entire sectioned profile. Estimated 20 to 30cm thick.

Table S4 Sediment analyses, Square B (except for XU32A which is from Square A). *pH soil/water suspension ratio of 1:5. **% lost on ignition. ***PSA-Backman Culter LS 100 (HCl- and H_2O_2-treated samples): medium sand = 212–600 microns, fine sand = 212–63 microns, silt = 63–2 microns, clay = < 2 microns; na = not analysed.

XU	pH*	% OM** (550°C)	% Carbonates** (1000°C)	Particle Size Distribution (%)***			
				Medium Sand	Fine Sand	Silt	Clay
1	7.18	22.48	29.33	0.60	30.10	63.78	5.52
2	7.21	22.16	26.80	0.10	27.40	66.45	6.05
3	7.32	20.38	26.71	0.30	23.30	70.28	6.12
4	7.40	19.79	24.25	2.60	29.90	62.60	4.90
5	7.46	18.09	27.18	0.00	29.30	65.30	5.40
6	7.58	14.21	29.13	6.30	34.70	54.25	4.75
7A	7.68	12.44	30.24	0.80	31.40	62.22	5.58
7B	7.60	18.58	23.47	3.20	41.80	50.91	4.09
8	7.61	10.96	32.79	0.00	25.90	66.15	7.95
9	7.63	13.71	30.26	0.10	30.90	62.65	6.35
10A	7.68	9.12	31.58	0.00	25.40	66.70	7.90
10B	7.50	17.33	23.77	0.50	38.60	56.00	4.90
11	7.80	8.22	36.07	1.10	30.60	61.50	6.80
12	7.70	5.71	38.87	0.00	19.30	72.30	8.40
13	7.73	8.39	34.50	0.00	5.10	83.30	11.60
14	7.75	8.94	34.09	0.00	15.10	75.10	9.80
15	7.76	7.83	35.81	0.00	6.90	80.00	13.10
16A	7.78	6.50	36.50	0.00	2.20	84.50	13.30
16B	7.90	6.95	36.90	6.20	11.80	73.20	8.80
17A	7.82	7.81	34.19	0.00	3.70	82.90	13.40
17B	7.73	6.66	36.16	0.00	5.00	81.20	13.80
18	7.75	4.92	38.85	0.00	5.70	82.20	12.10
19	7.82	6.69	35.81	0.00	2.60	87.20	10.20
20	7.82	6.06	36.06	0.00	0.00	85.50	14.50
21	7.91	6.12	32.92	0.00	0.40	86.70	12.90
22A	7.96	3.87	37.98	1.60	7.30	81.80	9.30
22B	7.96	4.25	37.01	4.50	4.10	79.60	11.80
23A	7.91	7.02	25.86	0.00	6.90	80.90	12.20
23B	8.05	3.36	39.47	0.00	0.00	88.10	11.90
24	8.03	na	na	0.00	0.00	87.30	12.70
26	7.80	4.89	34.94	0.00	0.00	87.70	12.30
29	7.85	7.30	18.41	0.00	5.80	86.20	8.00
31	7.88	na	na	0.00	0.00	84.00	16.00
32A	7.99	8.10	13.23	0.00	0.20	87.30	12.50
33	7.95	8.80	14.60	0.00	9.40	80.40	10.20
34	8.00	10.02	12.29	0.00	1.20	88.00	10.80
35	7.95	9.09	10.27	0.00	2.30	86.60	11.10
36	7.71	9.34	10.37	0.00	6.80	83.30	10.00

Table S5 Excavated finds, Emo Square A.

XU	Non-Land Snail Shell	Shell Burnt (by weight)	Bone	Egg Shell		Crab		Coconut Fragments		Fish Otoliths		Human Teeth Fragments	Rocks >1cm	Charcoal	Undecorated Ceramic Sherds		Decorated Ceramic Sherds	
	(g)	(%)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(g)	(#)	(g)	(#)	(g)
1	217.3	0.0	7.37					1	0.80	4	0.81		1636.9	0.94	14	18.34		
2	353.3	0.2	4.29										1048.6	0.51	32	41.34	1	3.87
3	766.5	0.3	12.61							2	0.93		3065.8	1.35	25	49.34	1	2.57
4	977.5	0.2	20.71	1	0.04					4	0.44		4264.9	1.01	27	28.88		
5	732.6	0.2	6.64	38	0.61								1782.0	1.23	10	10.97	1	0.45
6	1610.5	0.3	17.02	7	0.10					4	0.76		3780.2	1.88	14	18.83		
7	1327.5	0.4	5.37	73	1.31					2	0.22		1710.0	0.50	15	9.96		
8	1675.9	0.3	3.42							1	0.20		709.6	1.03	13	5.82	1	1.89
9	1634.4	0.3	7.37	2	0.41					2	0.50		666.1	0.56	19	10.08		
10	2644.0	0.5	8.55	3	0.17					5	1.21		291.2	0.25	10	4.60		
11	2864.3	0.3	6.85							3	0.76		73.5	0.47	13	3.53		
12	2797.3	0.4	8.44	9	1.05					4	0.68		76.1	0.31	3	0.44		
13	2643.7	0.4	5.64							1	1.03		14.9	0.04	3	1.54		
14	2938.3	0.4	8.23							3	1.30		12.1	0.28	11	3.13		
15A	3217.7	0.6	10.36	2	0.07					3	1.87		21.1	0.01	30	39.11	7	5.48
15B	259.6	0.1	0.13							1	0.11			0.02				
16A	4236.6	0.4	8.55			1	0.04			2	0.54		4.5	0.32	22	5.90	9	2.47
16B	124.4	0.7	0.53							1	0.12			0.01	2	0.33	2	0.07
17	1598.6	0.3	1.27	1	0.03								4.2	0.06	3	0.98		
18	3858.3	0.4	4.99	1	0.19					1	0.60	4	1.3	0.17	13	6.37	2	0.88
19	2394.3	0.4	12.8	1	0.01								7.7	0.06	5	0.89	2	1.57
20	3286.0	0.5	12.89	1	0.01					2	0.37	1	104.8	0.12	20	7.60		
21A	3744.5	0.2	9.82	1	0.18					2	1.57			0.03	6	4.85		
21B	1150.7	0.4	1.89										4.3		10	2.36		
22A	2994.1	0.1	0.97							1	0.76		1.6	0.13	3	5.58		
22B	977.3	0.2	3.32												5	1.96		
23	808.7	0.1	0.44												2	0.53		
24	4836.2	0.3	3.58										42.1	0.21	5	5.00		
25	2624.0	0.2	2.42	2	0.13					1	0.49	1	5.9	0.08	9	2.65		
26	4659.8	0.2	8.48										21.3	0.07	5	2.28		

XU	Non-Land Snail Shell	Shell Burnt (by weight)	Bone	Egg Shell		Crab		Coconut Fragments		Fish Otoliths		Human Teeth Fragments	Rocks >1cm	Charcoal	Undecorated Ceramic Sherds		Decorated Ceramic Sherds	
	(g)	(%)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(g)	(#)	(g)	(#)	(g)
27A	2669.0	2.6	2.81										61.8	0.10	1	2.86		
27B	402.4	7.5	0.02															
28A	1552.9	28.5	3.22										31.7	0.32				
28B	267.9	17.3	0.02											0.02				
29	2886.8	36.7	12.49							1	0.65			0.17	3	0.55		
30A	2176.2	27.1	18.74							2	1.31		6.5	0.08	1	0.06		
30B	74.1	3.8												0.01	2	0.22		
30C	676.6	10.6	1.48										2.8	0.01				
31A	1681.5	13.0	21.37							4	1.47		1.2	0.05				
31B	40.3	4.2	0.33											0.07				
31C	1443.1	4.1	3.04							1	0.15			0.26	2	0.54		
32A	1510.9	7.5	6.98							1	0.42			0.04				
32B	504.2	2.8	1.56	1	0.13								10.9					
33A	1091.4	3.3	1.65										0.3		2	0.23		
33B	480.8	1.5	0.49							1	0.08		5.8	0.49	1	0.06		
34	143.6	3.3	0.75										16.4					
35	17.0	58.9	0.05										25.5	0.06				
36	0.7	21.4											9.0					
Total	**81,573.3**	**3.7**	**279.95**	**143**	**4.44**	**1**	**0.04**	**1**	**0.80**	**59**	**19.35**	**6**	**14,854.9**	**13.33**	**361**	**297.71**	**26**	**19.25**

Table S5 Excavated finds, Emo Square A (cont.).

XU	Flaked Stone Artefacts		Cut Bone Artefact		Shell Beads		Set of small bones in closed *B. violacea* in closed *B. violacea*	Glass		Plastic		Metal	
	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(#)	(g)	(#)	(g)	(#)	(g)
1								1	0.44	4	2.73	2	2.98
2	1	0.66								1	0.01		
3	1	0.20	1	0.14									
4	2	0.67											
5	1	0.07											
6	1	1.96											
7	2	0.37											
8													
9													
10													
11													
12	1	0.09			2	0.05							
13													
14	3	0.22			1	0.03							
15A													
15B													
16A													
16B													
17													
18	3	0.95			1	0.09							
19	2	0.93											
20	1	11.00			1	0.08							
21A	1	0.31											
21B													
22A													
22B													
23													
24													
25													

XU	Flaked Stone Artefacts		Cut Bone Artefact		Shell Beads		Set of small bones in closed *B. violacea* in closed *B. violacea*	Glass		Plastic		Metal	
	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(#)	(g)	(#)	(g)	(#)	(g)
26													
27A													
27B													
28A	1	0.20											
28B													
29													
30A													
30B													
30C	4	0.87											
31A													
31B													
31C	1	0.31											
32A							1						
32B													
33A													
33B													
34													
35	1	0.42											
36													
Total	**26**	**19.23**	**1**	**0.14**	**5**	**0.25**	**1**	**1**	**0.44**	**5**	**2.74**	**2**	**2.98**

Table S6 Excavated finds, Emo Square B.

XU	Non-Land Snail Shell	Shell Burnt (by weight)	Bone	Egg Shell		Fish Otoliths		Human Teeth Fragments		Rocks > 1cm	Charcoal	Undecorated Ceramic Sherds		Decorated Ceramic Sherds	
	(g)	(%)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(g)	(g)	(#)	(g)	(#)	(g)
1	360.0	0.0	12.88			4	0.95			970.7	0.76	21	51.32	5	7.24
2	389.3	0.1	10.11							615.0	1.38	21	15.60		
3	320.8	0.4	5.32					1	0.24	1899.6	2.71	7	35.12	1	4.12
4	465.3	0.4	11.10							3612.4	2.00	17	11.73		
5	679.4	0.3	13.73	1	0.03	2	0.78			3252.0	2.75	20	46.84	1	0.49
6	1231.4	0.4	12.00			1	0.16			6599.0	4.07	44	35.40	2	2.11
7A	855.6	0.2	5.33							1945.2	0.72	7	8.66		
7B	287.4	0.1	7.35			1	0.26			1126.9	0.52	12	27.99		
8	807.7	0.4	2.54	4	0.13	1	0.17			1655.4	1.51	4	6.35		
9	1033.6	0.4	4.43							728.9	1.00	15	9.75	4	2.56
10A	2116.6	0.6	8.09			5	0.74			669.1	1.62	6	5.82		
10B	21.9	3.7	0.21							7.8	0.03	1	0.25		
11	1239.6	0.6	5.18			4	1.06			171.0	0.77	3	2.42	1	3.69
12	3170.0	0.4	13.30	3	0.19	5	0.90			0.0	0.81	11	1.71	1	0.24
13	494.1	0.3	2.79			1	0.09			0.0	0.28	3	1.18		
14	1867.5	0.4	5.14	2	0.05	2	0.23			114.3	0.43	4	0.48	1	5.16
15	2474.4	0.4	20.75			3	0.85			23.3	0.21	9	4.04	5	4.40
16A	2146.9	0.7	5.69	4	0.12	2	0.24			0.0	0.31	5	2.42	1	0.99
16B	269.2	0.3	1.35							10.0	0.02	2	0.12	1	0.42
17A	2727.0	0.4	6.19							19.5	0.16	4	0.64		
17B	269.5	0.6	0.74							0.0	0.07	1	0.90		
18	1478.6	0.3	4.04			1	0.15			0.0	0.10	2	0.15		
19	1543.3	1.9	7.34							117.1	0.03				
20	2874.6	0.4	6.35							38.9	0.11	10	5.34		
21	2968.5	0.6	15.01	1	0.15	4	1.09	1	1.27	95.7	0.18	10	3.91		
22A	1969.2	0.7	6.50			4	2.25			0.0	0.03	6	0.44	1	0.23
22B	992.8	0.7	2.13							0.0	0.01	3	1.60		
23A	2278.1	0.5	12.41			2	0.48			0.0	0.24	19	5.07		
23B	1601.8	0.3	2.50			2	0.48			12.3	0.25	3	0.16	1	0.31
24	4862.2	0.1	1.52	2	0.27					67.6	0.28	2	0.31		
25	3182.6	0.1	12.59			1	0.21			39.3	0.20				

XU	Non-Land Snail Shell	Shell Burnt (by weight)	Bone	Egg Shell		Fish Otoliths		Human Teeth Fragments		Rocks > 1cm	Charcoal	Undecorated Ceramic Sherds		Decorated Ceramic Sherds	
	(g)	(%)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(g)	(g)	(#)	(g)	(#)	(g)
26	2730.7	0.6	4.37							5.7	0.53				
27	1703.4	5.6	3.78							157.0	1.13				
28	2856.9	7.6	10.84							10.3	0.39	5	4.88	1	0.11
29	1733.2	5.3	11.35							65.1	0.06	2	0.30		
30	3037.7	0.0	9.73							0.0	0.60	1	0.70		
31	3223.2	0.6	8.11							18.5	0.06				
32	2485.5	0.4								5.6	0.01				
33	1649.6	0.0	0.45							38.1	0.03				
34	418.0	0.3	0.24							345.3	0.32	6	2.57		
35	66.2	7.4	0.07							107.3	0.48	5	3.71		
36	0.6	49.2	0.03							52.5	0.04				
Total	**66,883.5**	**1.0**	**273.58**	**17**	**0.94**	**45**	**11.09**	**2**	**1.51**	**24,596.0**	**27.21**	**291**	**297.88**	**26**	**32.07**

Table S6 Excavated finds, Emo Square B (cont.).

XU	Flaked Stone Artefacts		Cupuled Anvil Stone		Deeply Cut Rocks >1cm		Cupuled anvil Stone with Deep Cuts >1cm		Shell Beads		*B. violacea* valve in closed *B. violacea*		Glass		Metal	
	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	Inner *B. violacea* (g)	Outer *B. violacea* (g)	(#)	(g)	(#)	(g)
1					23.4	1							2	0.42	6	8.54
2	1	0.42											1	0.04	4	0.20
3	4	18.39														
4																
5	1	0.19	1	95.2												
6	5	196.04	3	246.1												
7A	2	6.21	1	86.8												
7B																
8	1	0.18					1	30.5								
9																
10A																
10B																
11																
12																
13	1	0.12														
14																
15	1	0.08														
16A	1	0.09							1	0.03						
16B																
17A									1	0.02						
17B											0.74	19.54				
18	1	0.04														
19																
20																
21																
22A																
22B																
23A																
23B																
24	1	0.09														
25	1	0.77														
26																

XU	Flaked Stone Artefacts		Cupuled Anvil Stone		Deeply Cut Rocks >1cm		Cupuled anvil Stone with Deep Cuts >1cm		Shell Beads		*B. violacea* valve in closed *B. violacea*		Glass		Metal	
	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	Inner *B. violacea* (g)	Outer *B. violacea* (g)	(#)	(g)	(#)	(g)
27																
28																
29	1	0.29														
30																
31																
32																
33	1	1.17														
34	3	0.27														
35	2	0.23														
36																
Total	27	224.58	5	428.0	23.4	1	1	30.5	2	0.05	0.74	19.54	3	0.46	10	8.74

Table S7 Details of stone artefacts from Emo.

ID	Sq.	XU	Phase	Type	Raw Material	Fragment	Weight	Length	Width	Thickness	Platform Area	Cortex	Heat Affected	Edge Damage	Elongation
							(g)	(mm)	(mm)			%			
21	B	2	IV	Flake	Volcanic		0.4	10.44	9.98	2.96	34.35	0			1.05
46	A	2	IV	Flake	Chert	Marginal	0.6	13.12			0	100			
9	B	3	IV	Flake	Volcanic		17.9	34.56	31.52	15.69	464.74	90			1.10
23	B	3	IV	Flake	Chert	Marginal	0.2	10.70			0	0		Yes	
24	B	3	IV	Flake	Chert	Right	0.2	10.29		6.14	0	0	Yes	Yes	
45	A	3	IV	Flake	Chert	Marginal	0.2	7.22			0	0		Yes	
49	A	4	IV	Flake	Weathered Stone		0.5	13.76	10.21	4.13	0	0			1.35
50	A	4	IV	Flake	Volcanic		0.1	5.67	6.95	2.24	0	0			0.82
22	B	5	IV	Heat Fragment	Chert	Heat Fragment	0.1	7.49			0	0	Yes		
2	B	6	IV	Ground Fragment	Volcanic		184.9	77.82	67.01	41.62	0	40			1.16
30	B	6	IV	Flaked Piece	Chert		0.2	7.52			0	0			
31	B	6	IV	Flake	Volcanic		1.8	12.83	27.25	3.78	79.04	0			0.47
32	B	6	IV	Flake	Volcanic	Medial	0.1	8.96	7.43	1.72	0	0			1.21
33	B	6	IV	Flake	Weathered Stone		8.9	35.31	22.33	9.81	0	60			1.58
38	A	6	IV	Retouched Flake	Chert	Marginal	1.9	19.62			0	0		Yes	
43	A	7	III	Flake	Volcanic		0.3	8.99		2.30	0				
44	A	7	III	Flake	Chert	Marginal	0.1	8.24			0	0			
10	B	7A	III	Ret Flaked Piece/ Core	Chert		5.0	25.31	17.83	12.10	0	0			1.42
27	B	7A	III	Flaked Piece	Chert		1.1	15.02			0	0			
11	B	8	III	Flake	Chert	Marginal	0.1	8.99			0	0			
39	A	12	III	Flaked Piece	Volcanic		0.1	13.29			0				
16	B	13	III	Flake	Chert	Distal	0.1	7.47	8.90	1.57	0	0			0.84
6	A	14	III	Flake	Chert		0.1	7.28	3.32	1.44	2.40	0			2.19
7	A	14	III	Flake	Chert		0.1	5.49	7.80	2.51	1.98	0			0.70
28	A	14	III	Flaked Piece	Chert		0.1	6.77			0	0			
17	B	15	III	Flaked Piece	Chert		0.1	8.34			0	0			
19	B	16A	III	Flake	Chert		0.1	5.09	2.79	3.33	4.86	0		Yes	1.82

ID	Sq.	XU	Phase	Type	Raw Material	Fragment	Weight	Length	Width	Thickness	Platform Area	Cortex	Heat Affected	Edge Damage	Elongation
							(g)	(mm)	(mm)			%			
18	B	18	III	Retouched Flake	Chert	Marginal	0.1	4.74			0	0	Yes		
40	A	18	III	Flaked Piece	Chert	Heat Fragment	0.6	16.87			0	30	Yes		
41	A	18	III	Flake	Weathered Stone	Distal	0.2	9.95		3.09	0	0			
42	A	18	III	Flaked Piece	Chert		0.1	6.20			0		Yes		
51	A	19	III	Flaked Piece	Chert	Heat Fragment	0.9	14.47			0		Yes		
52	A	19	III	Flaked Piece	Chert	Heat Fragment	0.1	6.93			0	0	Yes		
1	A	20	III	Flake	Chert		11.0	32.40	23.56	13.14	43.12	50			1.38
47	A	21A	III	Flake	Weathered Stone		0.3	7.72	8.68	3.36	24.81	0			0.89
29	B	24	II	Flake	Chert	Marginal	0.1	6.41			0	0			
20	B	25	II	Flaked Piece	Chert		0.7	13.31			0	0		Yes	
48	A	28A	II	Flake	Volcanic	Marginal	0.2	10.91			0	0			
15	B	29	II	Flake	Quartz		0.3	6.46	6.42	2.52	0	100			1.01
34	A	30C	II	Flake	Volcanic		0.5	9.51	11.88	2.96	0	0			0.80
35	A	30C	II	Flake	Volcanic		0.3	9.01	8.48	2.93	0	0			1.06
36	A	30C	II	Flake	Volcanic		0.1	5.15	7.28	1.54	5.76	0			0.71
37	A	30C	II	Flaked Piece	Volcanic		0.1	7.41			0				
3	B	33	I	Flake	Chert	Proximal	1.1	8.23	15.75	4.53	96.10	0			0.52
4	B	34	I	Flake	Chert	Distal	0.1	8.28	6.41	1.35	0	0			1.29
5	B	34	I	Flake?	Chert		0.1	6.50	6.31	1.69	12.16	0			1.03
14	B	34	I	Flake	Chert		0.1	5.08	5.88	1.35	19.50	0			0.86
8	A	35	I	Flake	Chert	Medial	0.5	6.48	11.47	4.95	0	0			0.56
25	B	35	I	Flaked Piece	Quartz		0.2	6.55			0	0			
26	B	35	I	Flaked Piece	Quartz		0.1	6.64			0	0			

Table S8 Details of use-wear and residue analyses, Emo stone artefacts, Squares A and B. See Table S7 for details of Artefact ID #.

ID	Used?			Function	Description
	Yes	No	Possibly		
1	x			Scraping wet bone	*Wet bone working*. The left proximal margin of this piece exhibits some edge fracture and is the origin point for large deposits of a characteristic translucent, 'greasy' proteinaceous residue associated with working wet bone. As well as this, multiple bone pieces were identified as associated with this edge. The clear correlation between these bone working residues and an edge displaying early stage use-wear indicates that this tool had a short use-life.
2	x			Grinding plant, ochre and bone	*Grinding plant, ochre and bone*. Slides were taken from this piece to investigate function. This piece has been ground, with use concentrated on one of the margins indicating that it was likely a top-stone or the upper piece of two when in use. Residues present on slides taken from the use area include plant tissue, ochre and bone pieces, indicating that this tool was used on a range of materials.
3			x	Unknown	
4	x			Working resinous wood	*Working resinous wood*. Both lateral margins of this tool have been utilised, the left margin for slightly longer. The presence of edge damage with some rounding, combined with resin aligned at approximately 45° from the edge, indicate work on resinous wood.
5		x		-	
6	x			Unknown	
7		x		-	
8		x		-	
9			x	Unknown	
10		x		-	
11	x			Bone working	
18	x			Working resinous wood	*Working resinous wood*. This marginal fragment of a retouched flake has a high degree of edge rounding on the retouched used edge as well as edge damage. Resin is scattered on the surface of the tool, as well as found in clear alignment with the working edge, indicating that the tool was used to work resinous wood.
19			x	Unknown	
20	x			Scraping plant	*Plant working.* The tip of this flaked piece exhibits polish and edge rounding. Edge damage present on the same section includes feather and step termination scars. Plant tissue is associated with the same area, indicating that this piece was used to work plant material.
21	x			Unknown	*'Shaped'*. Present on this piece are a range of residues including resin, plant tissue, charcoal and ochre. While any or all of these may indicate the worked material, none can be conclusively tied to function due to their location on the piece and lack of correlating use-wear. The artefact has, however, been clearly shaped by grinding.
23	x			Skin working	*Skin working*. This flake fragment exhibits clear evidence for use as part of a skin-working tool. The high degree of edge rounding (Figure 18) and polish, combined with heavy striations perpendicular to the use edge (Figure 19), indicate that the tool was used to scrape skin. Experimental skin working consistently reveals the same characteristic yellow residue as found on this tool. The use-wear resulting from skin working is very specific and clearly evidenced here.
24			x	Resin related	
28	x			Unknown	

ID	Used?			Function	Description
	Yes	No	Possibly		
29	x			Cutting plant	*Cutting plant*. This marginal piece of a flake retains traces of the larger tool used. The used edge has edge damage with bending initiated micro-flake removals and slight rounding producing a semi-serrated edge characteristic of use in a cutting or sawing action. A translucent sap associates the used edge with plant working.
30		x		-	
38	x			Scraping plant	*Scraping resinous wood*. The retouched edge of this artefact is rounded and damaged, with resin pushed back into the flake scar margins. Desiccated plant tissue is also found in association with the worked edge, indicating that this was part of a tool used to scrape resinous wood.
44	x			Bone and plant working	*Bone and plant working*. This marginal piece shows evidence of having been part of a multifunction tool. Evidence of both bone and plant working are visible. Micro-scars are apparent along the edge, which also exhibits a fairly high degree of rounding with some possible crushing. A bone piece as well as trace amounts of vivianite associated with the edge indicate bone working. Plant processing may be indicated through the presence of a gum residue also associated with the used edge, although this could not be conclusively determined.
45			x	Unknown	
46	x			Plant working	*Soft plant working*. The distal edge of this marginal piece has been used to work soft plant material. The use-wear evidence for this is some edge damage, comprised of very small micro-scar removals, coupled with slight rounding. Residues present on the tool include cellulose, resin and desiccated plant tissue. Combined, these offer strong evidence for working soft plant.
53		x		-	

Table S9 Details of the Emo excavated decorated pottery sherds.

XU	Red-Slipped Sherds		Red Painted Sherds		Red-Slipped or Painted Sherds		Red-Slipped and Painted Sherds		Incised Sherds		Incised or Impressed Sherds		Red-Slipped and Incised Sherds		Red-Slipped or Painted and Incised or Impressed Sherds	
	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)	(#)	(g)
Square A																
2									1	3.88						
3									1	2.58						
5					1	0.45										
8			1	1.89												
15A					7	5.48										
16A					9	2.47										
16B					2	0.07										
18					2	0.88										
19	2	1.57														
Square B																
1	2	2.91			1	1.55					2	2.78				
3											1	4.12				
5					1	0.49										
6	2	2.11														
9	1	0.48			2	0.73							1	1.35		
11															1	3.69
12	1	0.24														
14							1	5.16								
15	1	1.46			4	2.94										
16A					1	0.99										
16B	1	0.42														
22A	1	0.23														
23B	1	0.31														
28					1	0.11										
Total	**12**	**9.73**	**1**	**1.89**	**31**	**16.17**	**1**	**5.16**	**2**	**6.46**	**3**	**6.90**	**1**	**1.35**	**1**	**3.69**

Table S10 Excavated shells, Emo Square A.

XU	Unidentified Shell Fragments	*Batissa violacea*			*Neritina* sp. A		*Neritina* sp. B		*Nerita* sp.		*Pythia scarabaeus*		*Melanoides* sp.		*Cypraea annulus*	
	(g)	(MNI)	(g)	Paired (MNI)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
1	17.7	39	183.0				2	1.2			2	0.0	39	15.3		
2	31.9	89	294.0				6	2.4					102	25.0		
3	67.0	173	591.8				38	16.9				0.1	343	90.7		
4	104.4	239	677.2				79	37.9			5	0.5	627	157.6		
5	65.4	147	455.5				134	47.7			6	1.5	648	162.5		
6	92.8	252	937.8				236	93.9			21	10.0	1816	476.0		
7	44.3	136	519.0				276	108.0			56	22.4	2267	633.8		
8	101.1	137	568.1				251	149.3			67	21.6	2789	835.8		
9	53.9	111	524.0	2			251	147.3	1	0.08	159	45.4	2701	863.7		
10	72.0	180	771.8				371	183.8			511	89.9	4656	1526.6		
11	93.6	158	820.4	1			303	178.9			475	80.8	4128	1690.5		
12	99.7	150	738.3				266	160.6			553	90.0	4132	1708.6		
13	82.3	168	1040.2				170	89.1			406	65.5	3545	1366.2	1	0.4
14	165.0	222	1089.2				179	111.6			454	62.8	4031	1509.6		
15A	143.7	383	1629.5	2			202	133.1			565	113.8	3015	1197.5		
15B	2.8	24	137.7				16	7.5			20	4.0	240	107.6		
16A	237.9	609	2689.6	8			164	102.4			434	104.5	2629	1102.2		
16B	3.4	16	55.0				13	9.8			18	4.5	143	51.8		
17	83.8	253	1179.3	1			54	30.8			104	28.8	660	275.9		
18	289.7	590	2661.0		1	0.08	134	93.3			426	87.1	1427	647.1		
19	126.7	386	1619.1	5			127	74.6			316	68.8	1149	505.1		
20	146.2	572	2433.2	7			128	77.4			480	86.5	1199	541.8	1	0.9
21A	234.8	618	2558.4	1			152	88.8			345	90.9	1814	771.6		
21B	68.1	196	778.9	1			38	20.6			138	27.1	639	256.1		
22A	216.5	460	1621.2				196	117.2			169	59.4	2409	979.8		
22B	100.9	160	475.0	1			63	37.7			89	15.5	840	347.1	2	1.1
23	48.3	118	397.5				64	37.6			32	21.0	773	304.4		
24	290.6	641	2209.0				346	228.1			396	168.1	4947	1940.4		
25	178.8	295	992.2	2			261	178.6			259	121.6	2818	1152.8		
26	176.4	852	2959.4	1	1	0.05	373	255.7			389	206.6	2547	1061.6		
27A	161.1	509	1803.7				301	150.9			233	117.6	1168	435.7		

XU	Unidentified Shell Fragments	*Batissa violacea*			*Neritina* sp. A		*Neritina* sp. B		*Nerita* sp.		*Pythia scarabaeus*		*Melanoides* sp.		*Cypraea annulus*	
	(g)	(MNI)	(g)	Paired (MNI)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
27B	29.4	94	275.5				54	27.6			38	20.2	123	49.6		
28A	133.9	321	1004.8	3			223	92.7			126	39.8	693	281.8		
28B	16.7	60	180.8				31	15.6			25	8.7	110	46.1		
29	135.0	517	1987.5	3			340	162.7			170	68.6	1289	532.9		
30A	112.6	261	1674.2	1			181	70.4			85	37.8	721	281.3		
30B	7.9	20	36.3				10	6.9			3	1.8	54	21.2		
30C	42.4	140	464.2				65	34.4			50	23.3	262	112.3		
31A	71.0	245	1392.4	2			122	37.5			101	39.8	376	140.9		
31B	4.4	12	22.3				3	1.0			4	0.9	40	11.7		
31C	56.6	233	1089.1				88	47.6			98	40.0	471	199.8		
32A	95.6	302	1196.7	5			80	27.6			255	34.0	350	157.0		
32B	27.5	102	310.3	1			39	22.5			43	14.7	311	129.3		
33A	119.3	277	820.2				29	13.9			73	9.7	260	128.4		
33B	45.6	108	284.6				49	24.9			12	8.4	277	117.3		
34	28.7	41	103.3				1	0.3			7	1.2	24	10.1		
35	2.2	5	14.2				1	0.1			1	0.3	2	0.3		
36	0.0		0.6									0.0				
Total	**4529.5**	**11,621**	**46,266.9**	**47**	**2**	**0.13**	**6,510**	**3,558.0**	**1**	**0.08**	**8219**	**2165.7**	**65,604**	**24,960.4**	**4**	**2.4**

Table S10 Excavated shells, Emo Square A (cont.).

XU	*Tridacna* sp.		Camaenidae sp. A		Camaenidae sp. B		Assimineidae		*Lamprocystis* sp.		Pupinidae		*Subulina octona*	
	(NISP)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
1													1	0.03
2														
3														
4														
5					1	0.11								
6														
7														
8							1	0.02						
9							1	0.06						
10							1	0.04						
11			1	0.38			2	0.13						
12							6	0.31						
13							1	0.04						
14							1	0.06						
15A							1	0.01						
15B														
16A														
16B														
17							2	0.14						
18	1	80.00					3	0.14						
19														
20			1	0.03			2	0.10						
21A														
21B							1	0.07						
22A							1	0.01						
22B							1	0.04						
23														
24							3	0.15						
25														
26														
27A							3	0.14	1	0.01				
27B							1	0.04						

XU	*Tridacna* sp.		Camaenidae sp. A		Camaenidae sp. B		Assimineidae		*Lamprocystis* sp.		Pupinidae		*Subulina octona*	
	(NISP)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
28A							1	0.12						
28B														
29							1	0.03						
30A			1	0.34										
30B														
30C														
31A											1	0.05		
31B														
31C														
32A											2	0.03		
32B														
33A														
33B														
34														
35														
36														
Total	**1**	**80.00**	**3**	**0.75**	**1**	**0.11**	**33**	**1.65**	**1**	**0.01**	**3**	**0.08**	**1**	**0.03**

Table S11 Excavated shells, Emo Square B.

XU	Unidentified Shell Fragments	*Batissa violacea*			*Neritina* sp. B		*Pythia scarabaeus*		*Melanoides* sp.		*Cypraea annulus*	
	(g)	(MNI)	(g)	Paired (MNI)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
1	43.7	107	284.7		4	2.4	1	0.0	81	29.2		
2	41.9	121	306.2		9	3.6		0.1	141	37.5		
3	33.5	76	251.1		15	5.1			103	28.7		
4	50.4	126	348.5		33	11.8	3	0.2	199	54.4		
5	58.5	153	513.4		60	17.1		0.4	183	90.0		
6	132.1	244	740.1		197	72.5	10	3.6	924	283.0		
7A	53.0	93	411.3		258	99.2	9	7.0	996	285.1		
7B	146.1	24	76.0		35	14.3		0.4	285	50.6		
8	37.1	89	335.8		231	89.9	32	14.0	1248	331.0		
9	80.6	103	376.1		260	114.6	49	13.1	1828	449.2		
10A	160.4	204	728.1		460	219.4	77	31.3	3323	977.4		
10B	0.4	1	3.7		9	5.7	1	0.7	61	11.4		
11	41.9	119	488.7		277	118.6	111	26.1	1846	564.3		
12	99.6	274	1201.0		536	251.9	233	63.8	4017	1553.7		
13	14.2	39	136.4		102	45.1	44	13.0	885	285.5		
14	46.1	174	992.2		220	101.3	121	36.6	1753	691.3		
15	80.5	219	1049.6		260	135.0	189	44.4	3399	1164.9		
16A	76.4	251	893.5		196	83.0	200	45.2	2740	1048.7		
16B	7.3	40	147.0		16	8.6	20	5.6	240	100.6		
17A	168.1	330	1401.5		162	83.7	202	41.2	2708	1032.3	1	0.1
17B	7.2	36	150.3	1	19	9.6	20	5.5	315	96.9		
18	83.8	209	871.6		71	40.0	75	25.2	1251	458.0		
19	60.1	207	960.8		60	35.9	90	27.3	1168	459.2		
20	269.6	447	1797.2		106	63.9	198	43.2	1931	700.7		
21	221.7	510	1830.1		105	63.8	211	36.6	2042	816.3		
22A	259.0	464	1353.2		37	23.7	83	17.3	703	315.9		
22B	74.5	160	615.0		36	19.8	129	20.7	634	262.7		
23A	210.9	475	1251.2		68	40.0	122	23.7	2105	752.4		
23B	175.0	232	728.5		81	45.4	125	26.4	1699	626.5		
24	708.2	729	1776.5		424	252.6	246	99.9	5848	2014.3		
25	444.2	447	1370.0		299	194.1	243	85.4	2554	1089.0		

XU	Unidentified Shell Fragments	*Batissa violacea*			*Neritina* sp. B		*Pythia scarabaeus*		*Melanoides* sp.		*Cypraea annulus*	
	(g)	(MNI)	(g)	Paired (MNI)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
26	181.0	609	2080.2		118	70.0	120	55.7	1029	343.9		
27	206.8	224	1171.5		122	59.4	115	35.6	774	230.1		
28	557.9	433	1924.7		147	70.3	213	31.5	972	272.6		
29	183.6	296	1407.3		63	32.4	222	25.6	281	84.4		
30	398.0	517	2301.9	6	102	50.9	294	63.2	586	223.8		
31	500.2	547	2228.6		100	58.3	358	76.8	708	359.4		
32	238.6	507	1780.6		97	50.6	291	42.1	688	373.7		
33	245.9	336	1125.0		28	32.3	180	14.9	465	231.6		
34	105.4	92	245.6		5	4.8	39	8.4	122	53.7		
35	14.0	13	39.8		1	0.7	16	1.1	23	10.6		
36	0.6					0.0						
Total	**6518.0**	**10,277**	**37,694.3**	**7**	**5429**	**2701.2**	**4692**	**1112.8**	**52,858**	**18,844.2**	**1**	**0.1**

Table S11 Excavated shells, Emo Square B (cont.).

XU	*Tridacna* sp.		*Telescopium telescopium*		Camaenidae sp. A		Assimineidae		Pupinidae		Cyclophoridae	
	(NISP)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
1												
2												
3			1	2.33								
4												
5												
6												
7A												
7B												
8					1	2.31						
9												
10A												
10B												
11												
12												
13									1	0.03		
14												
15												
16A												
16B												
17A												
17B												
18							1	0.04				
19												
20											1	0.03
21												
22A												
22B												
23A							1	0.13				
23B												
24	3	10.65					1	0.05				
25												
26												

XU	*Tridacna* sp.		*Telescopium telescopium*		Camaenidae sp. A		Assimineidae		Pupinidae		Cyclophoridae	
	(NISP)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)	(MNI)	(g)
27												
28												
29												
30												
31												
32									1	0.02		
33												
34												
35												
36												
Total	**3**	**10.65**	**1**	**2.33**	**1**	**2.31**	**3**	**0.22**	**2**	**0.05**	**1**	**0.03**

Table S12 Excavated faunal remains (general categories), Emo Square A.

XU	Phase	Mammal (g)	Snake (g)	Turtle (g)	Fish (g)	Unidentified (g)	Other (g)	Type of other
1	4	6.42	0.06		0.89			
2	4				2.23	2.06		
3	4	2.50	0.43	0.35	4.18	5.15		
4	4	1.50	0.25		4.05	14.91		
5	4	3.82	0.28		2.54			
6	4	6.27	0.80		7.38	2.57		
7	3,4	0.48	0.34		3.54	1.01		
8	3,4	0.75	0.06		2.61			
9	3,4	0.44	0.15		3.49	3.29		
10	3,4	0.63			6.76	0.74		
11	3,4	0.95			5.77	0.13		
12	3,4	1.22	0.94		6.28			
13	3,4	0.05			5.32	0.27		
14	3,4	0.29	0.15		6.87	0.92		
15A	3,4	0.62	0.07		9.50	0.17		
15B	3				0.13			
16A	3,4	3.12			5.43			
16B	3				0.20	0.33		
17	3,4				1.27			
18	4	0.86	2.16		1.97			
19	3,4	0.43	4.91		6.50	0.96		
20	3	2.40	3.01		7.09	0.25	0.14	Frog bone
21A	3	1.12	0.38		7.43	0.89		
21B	3	0.03	0.93		0.68	0.25		
22A	2,3				0.58	0.39		
22B	2				1.07	2.25		
23	2		0.19		0.25			
24	2		1.09		2.01	0.48		
25	2,4	1.50			0.92			
26	2,4	0.82			3.75	0.21	3.7	Worked mammal bone (2.0g), bird (1.7g)
27A	2	1.08			1.73			
27B	4				0.02			
28A	2	0.50			2.47	0.25		

XU	Phase	Mammal (g)	Snake (g)	Turtle (g)	Fish (g)	Unidentified (g)	Other (g)	Type of other
28B	4				0.02			
29	2	0.83	1.85		9.02	0.79		
30A	2	9.34	1.29		3.26	4.85		
30C	2,4		0.23		1.12	0.13		
31A	2	16.30	0.25		4.82			
31B	4		0.16		0.17			
31C	2,4				2.97		0.07	Polished mammal bone
32A	2	0.25	0.34		5.81	0.58		
32B	4		0.23		1.26	0.07		
33A	1				1.65			
33B	4				0.49			
34	1				0.75			
35	1				0.05			
36	1							
Total		**64.52**	**20.55**	**0.35**	**146.3**	**43.9**	**4.33**	

Table S13 Excavated faunal remains (specific categories), Emo Square A, by NISP.

XU	Pig	Dog	Ech kalubu	Ech sp.	*Thylogale*	Phal sp	*Spilocuscus*	*Uromys*	*Hydromys*	*Melomys*	Medium Murid	*Rattus*	Small Murid	Pteropodid	Boid	Colubroid	Snake	Gekkonid	Lizard Indet	Varanid	Bird	Non-Ariid Otolith	Ariid Otolith	Ariid Headplates	Plotosidae	Scaridae	Platycephalidae?
1	2					1				1			1		1											1	
2																									1	2	
3	2		1				1								2											1	
4	1					1	1								3		1					1				1	
5	1												1		1												
6	2														3									*	1	1	
7	1									1					3	1								*			
8	1		1			1				1					1							1					
9						1		1						1		1								*			
10				1		2							1											*	1	1	
11									1				2											*		2	1
12			1												1							1		*		2	
13						1																		*		1	
14		1									1				1									*		3	
15A								1							1			1						*		1	
15B																											
16A		1								1			3											*			
16B																											
17																										1	
18												1			3	3								*			
19						1							1		6	5	13									2	
20	1					1									10	6											
21A			1												2									*			
21B		1													2												
22A																											
22B																											
23															2												
24															3											1	

XU	Pig	Dog	Ech kalubu	Ech sp.	*Thylogale*	Phal sp	*Spilocuscus*	*Uromys*	*Hydromys*	*Melomys*	Medium Murid	*Rattus*	Small Murid	Pteropodid	Boid	Colubroid	Snake	Gekkonid	Lizard Indet	Varanid	Bird	Non-Ariid Otolith	Ariid Otolith	Ariid Headplates	Plotosidae	Scaridae	Platycephalidae?
25	1																									1	
26				4											1						1			*			
27A																											
27B																											
28A				1																				*			
28B																											
29															7					1		1		*			
30A	1			1											4									*			
30C															4									*			
31A	1					2									1							1		*			
31B																											
31C																			1					*			
32A															2		1							*			
32B															1												
33A																										1	
33B																											
34																								*			
35																											
36																											
Total	**14**	**3**	**4**	**7**		**11**	**2**	**2**	**1**	**4**	**1**	**1**	**9**	**1**	**65**	**16**	**15**	**1**	**1**	**1**	**1**	**5**			**3**	**22**	**1**

Table S13 Excavated faunal remains (specific categories), Emo Square A, by NISP (cont.).

XU	Lutjanidae	Lethrinidae	Serranidae	Balistidae	Serranidae?	Cassowary Eggshell	Megapode Eggshell	Crab
1								
2	1							
3								
4							*	
5							*	
6		1					*	
7							*	
8								
9						*		
10						*	*	
11	1							
12						*		
13								
14								
15A						*	*	
15B								
16A								*
16B								
17						*	*	
18						*		
19							*	
20							*	
21A						*		
21B								
22A								
22B								
23						*		
24								

XU	Lutjanidae	Lethrinidae	Serranidae	Balistidae	Serranidae?	Cassowary Eggshell	Megapode Eggshell	Crab
25						*		
26								
27A								
27B								
28A								
28B								
29								
30A								
30C								
31A								
31B								
31C								
32A								
32B						*		
33A								
33B								
34								
35								
36								
Total	**2**	**1**						

Table S14 Excavated faunal remains (general categories), Emo Square B, by weight (g).

XU	Phase	Mammal (g)	Snake (g)	Turtle (g)	Fish (g)	Unidentified (g)	Other (g)	Type of Other
1	4	2.91		2.03	7.57	0.37		
2	4	0.46	0.38	0.81	7.45	1.01		
3	4	2.44	0.23		2.18	0.47		
4	4				7.92	3.18		
5	4	0.20	0.12	0.36	5.53	7.52	0.42	Drilled mammal tooth
6	4	1.14	0.36	0.44	9.69	0.37		
7A	4	0.15	0.09		4.19	0.90		
7B	4	2.30	0.13		3.04	1.88		
8	4	0.09	0.03		2.42			
9	3	1.36			2.99	0.08		
10A	3	2.51			5.58			
10B	4				0.21			
11	3	1.90	0.02		3.25		0.01	Frog bone
12	3	1.22	0.61		11.47			
13	3	1.48	0.04		1.27			
14	3	1.48			3.66			
15	3	10.71	0.23		9.81			Drilled dog tooth
16A	3	0.91	0.21		4.57			
16B	3	0.70	0.12		0.53			
17A	3	0.27	0.08	1.47	4.37			
17B	3	0.23		0.16	0.35			
18	3	2.65			1.39			
19	3	3.79			3.55			
20	3	1.88	0.28		4.19			
21	3	4.62	0.35		10.04			
22A	3	1.29	0.13		5.08			
22B	3	0.15			1.98			
23A	2,3	9.07	0.03		3.31			
23B	2	0.22	0.10		2.18			
24	2				1.01	0.51		
25	2	8.59			4.00			
26	2	0.30	1.32	0.37	2.38			
27	2	0.66	0.27		2.85			

XU	Phase	Mammal	Snake	Turtle	Fish	Unidentified	Other	Type of Other
		(g)	(g)	(g)	(g)	(g)	(g)	
28	2	1.46		0.19	8.07	1.12		
29	2	3.16			8.19			
30	2	1.06	0.4	2.41	5.86			
31	2	1.21			6.9			
32	1,2							
33	1				0.45			
34	1				0.24			
35	1				0.07			
36	1				0.03			
Total		**72.57**	**5.53**	**8.24**	**170.19**	**17.41**	**0.01**	

Table S15 Excavated faunal remains (specific categories), Emo Square B, by NISP.

XU	Pig	Dog	Ech kalubu	Ech sp.	*Thylogale*	Phal sp	*Spilocuscus*	*Uromys*	*Hydromys*	*Melomys*	*Rattus*	Small Murid	Pteropodid	Boid	Colubroid	Snake	Varanid	Bird	Non-Ariid Otolith	Ariid Otolith	Ariid Headplates	Scaridae	Platycephalidae?
1	2		1									1								4	*		
2	1		1	1										1							*	1	
3	1					2								2								1	
4																					*		1
5	1								1					1						2			
6		1				1						1					1	1		1	*		
7A				1										1								1	1
7B	1													1						1			
8				1										1									
9	1																						
10A	1				1		1	1												5			
10B																							
11	1													1						4			1
12	1		1											3						5	*	2	
13													1			1				1			
14	1																1			2			
15	3	1								1			1	2						3		2	
16A						1								2						2	*	1	
16B																1							
17A														1								3	
17B																							
18	1	1																		1			
19							1														*	1	
20		1		1			1							2									1
21	1					1	1			1		1								4			
22A	1					1								1						4			
22B		1												1									
23A			1				1	1				2								2	*		

XU	Pig	Dog	Ech kalubu	Ech sp.	*Thylogale*	Phal sp	*Spilocuscus*	*Uromys*	*Hydromys*	*Melomys*	*Rattus*	Small Murid	Pteropodid	Boid	Colubroid	Snake	Varanid	Bird	Non-Ariid Otolith	Ariid Otolith	Ariid Headplates	Scaridae	Platycephalidae?
23B														2						2			
24																							
25	1																			1	*		
26				1				1						5	5						*		
27			1											1								1	
28				1																		1	
29				1																			
30				2										1									
31				1																	*		
32																							
33																							
34																							
35																							
36																					*		
Total	**18**	**5**	**5**	**10**	**1**	**6**	**5**	**3**	**1**	**2**		**5**	**2**	**29**	**5**	**2**	**2**	**1**		**44**		**14**	**4**

Table S15 Excavated faunal remains (specific categories), Emo Square B, by NISP (cont.).

XU	Lutjanidae	Lethrinidae	Serranidae	Balistidae	Serranidae?	Cassowary Eggshell	Megapode Eggshell
1							
2							
3							
4		1					
5							*
6			1				
7A							
7B							
8							*
9							
10A							
10B							
11							
12						*	
13							
14						*	*
15							
16A						*	*
16B							
17A							
17B							
18		1					
19							
20							
21		1				*	
22A				1			
22B							
23A							

XU	Lutjanidae	Lethrinidae	Serranidae	Balistidae	Serranidae?	Cassowary Eggshell	Megapode Eggshell
23B							
24						*	
25							
26							
27							
28					1		
29			1				
30							
31							
32							
33							
34							
35							
36							
Total		**3**	**2**	**1**	**1**		