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– ARTICLE –

New Data from Oposisi: Implications for the Early Papuan Pottery Phase

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ABSTRACT

An apparent colonisation of the Papuan south coast by pottery-making villagers about 2000 years ago led in the 1970s to the development of a regional sequence of first millennium AD decorated pottery styles now known as Early Papuan pottery (EPP). Important in defining this style horizon is the Yule Island site of Oposisi first excavated by Ron Vanderwal in 1969. As part of an on-going re-appraisal of pottery production along this coast by two of us (see Summerhayes and Allen 2007) we took advantage of an opportunity to re-sample the site in 2007. A paper proposing a much earlier starting date for EPP based on dates for sherds in Torres Strait (McNiven et al. 2006) meant that we could also take advantage of this visit to acquire further dating samples. A coherent set of seven new AMS dates strongly supports the Oposisi sequence beginning at *c.* 2000 BP. Beyond this our sample produced much more obsidian, imported from Fergusson Island 600 km to the east, than had previously been recorded for the site. This attests to stronger and more continuous eastern links than had been previously supposed. Lastly the paper reviews EPP in the light of recent pottery finds that suggest pre-EPP pottery will occur on the south Papuan coast.

Keywords: Oposisi, EPP, AMS dating, obsidian transfer

INTRODUCTION

Oposisi is a village site on Yule Island *c.* 110 km northwest of Port Moresby (Figure 1). The site sits on a limestone ridge at *c.* 125 m.a.s.l., one of the highest points on Yule, with commanding views over the island and the adjacent mainland. Oposisi was extensively excavated in 1969 by Ron Vanderwal, who opened up 30 m² of the site and produced not only a pottery sequence containing the full range of known styles of Early Papuan pottery (EPP), but also in its earliest levels the widest yet known array of associated bone, shell and ground stone artefacts and ornaments, including a decorated child burial (Vanderwal 1973). Beginning around the birth of Christ, the EPP phase was characterised by the rapid succession of pottery decorative styles that moved from elaborate to less elaborate. Parts of this EPP sequence were duplicated in sites hundreds of kilometres apart along the coast. This connected system appears to have contracted over time, suffering final disruption around 1200 BP.

EPP is a term coined by Summerhayes and Allen (2007: 100) as a gloss for a range of previous terms applied by a variety of archaeologists to specific decorated pottery types seen to occur in stratigraphic sequence in individual sites and between distant sites along the *mainland Papuan south coast* between *c.* 2000 BP and *c.* 1200 BP. While we are aware that EPP is widely recognised to occur now in the southern Massim (e.g. Irwin 1991; Negishi and Ono 2009) the early ceramic industries of the Massim are in need of a fuller review than we can undertake here. We use EPP in this paper with the same geographical constraints as when we first used it. We thus reject the notion of Negishi and Ono (2009: 47) that its use masks post-Lapita ceramic variability such as eastern Melanesian Mangaasi pottery. In our terms EPP does not include Mangaasi or any other immediate post-Lapita ceramic tradition in Melanesia beyond the Papuan coast, whatever relationships with EPP may be demonstrated in the future.

REVISITING OPOSISI

In 2007 an opportunity presented itself for the authors to return to Oposisi in company with students from the University of Papua New Guinea. While the limited time available was further constrained by flooded roads, we were able to reach Yule Island, relocate Vanderwal's excavation pits (now in heavy regrowth forest), clean up

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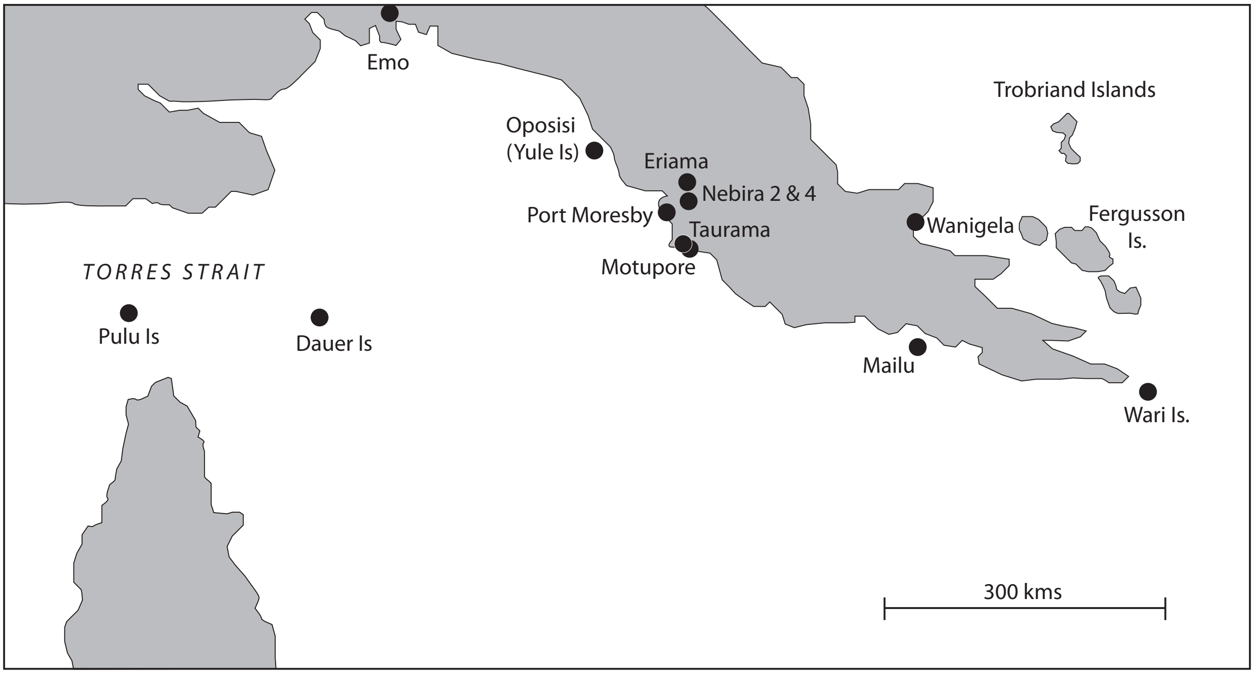

Figure 1. Map of Papua showing sites and places mentioned in the text.

sections and remove two small column samples. We had three primary aims:

1. To collect new ceramic samples for chemical and fabric analyses to expand a Papuan pottery production study begun by two of us (Summerhayes and Allen 2007). This work currently forms the subject of a Master of Arts degree that will be reported elsewhere.
2. To test a previous suggestion (Summerhayes and Allen 2007: 106) that the two pieces of obsidian previously reported from Oposisi underestimated the amount of obsidian imported into the site.
3. To take new dating samples from the site to refine the known chronology of EPP.

This last objective derived firstly from the fact that the six original radiocarbon dates from Oposisi showed stratigraphic reversals possibly indicating site disturbance or sample contamination (see below). Secondly, McNiven *et al.* (2006) had reported the recovery of 16 plain body sherds (one might be part of a handle) from Mask Cave, a granite rock shelter on Pulu, a small island off Mabuyag Island (aka Mabuiag) in Torres Strait. Two sherds were surface finds from a lag deposit, eight sherds came from an occupation phase dated to 1500–1700 BP and the other six sherds were assigned to an earlier phase between 2400 and 2600 BP. All sherds are said to exhibit a red or reddish-brown slip on the external surface, although the three illustrated sherds appear very worn. The petrographic analysis of three sherds showed them to be similar to each other in composition but 'geologically unrelated' to pottery from multiple sites on the Papuan coast or from eastern Indonesia. Thus McNiven *et al.* suggested a local production centre in Torres Strait, pointing to the presence of 23 further plain sherds, six with a reddish-orange slip, from a site on Dauar Island in the eastern Torres Strait (Carter 2002, 2004; McNiven *et al.* 2006: 67–8) where with one possible exception the sherds appear to date no older than 2000 years ago.

McNiven *et al.* ultimately argued that the EPP was the precursor to the 2400–2600 BP Torres Strait pottery. They thus needed to confront the problem that no EPP site had produced an acceptable date older than the Oposisi date of 1920±180 BP (ANU-727) and the Eriama rockshelter date of 1930±230 BP (GaK-2670). They developed an argument suggesting that the *c.* 2000 BP starting date for EPP reflected a widespread dating error based on relatively few carbon dates from the excavated EPP sites on the Papuan coast and the technical limitations of 1970s carbon dating. They concluded that pottery probably dated sufficiently earlier in Papua to be the precursor of the Torres Strait ceramics. We were sceptical about this argument and decided to test it at Oposisi.

THE 2007 COLUMN SAMPLES

Our first column sample T1/A, began as a 50 cm by 100 cm cut into the cleaned-up western section in the south-eastern corner of Vanderwal's T1 trench. The T1 trench had not been backfilled and the walls are badly eroded, but we were able to position our excavation adjacent to the southern face of Vanderwal's square 11 in Trench 1 (Vanderwal 1973: Figure IV-3). Because of shortage of time this column sample was reduced to a 50 cm by 50 cm square at the beginning of Spit 7, where a stratigraphic break was apparent. The excavation was continued to Spit 16, the last containing artefacts.

Our second column sample, T6/EXT, was a 25 cm by 25 cm square cut into the western wall of Vanderwal's Trench 6, *c.* 10 m west of our excavation at T1/A. The T1/A excavation employed 10 cm deep spits throughout, but in T6/EXT Spit 6 was reduced to a 5 cm deep spit, and Spits 7–10 to 3 cm spits, mostly to achieve better resolution for dating purposes. Thus there are volumetric differences between these excavation units. T6/EXT was c. 67 cm deep onto bedrock and T1/A *c.* 160 cm deep onto broken limestone above bedrock. All excavated material was sieved through 7 mm mesh sieves.

Both column samples were placed adjacent to the two squares that provided Vanderwal's radiocarbon dates, again to facilitate dating comparisons.

ANALYTICAL UNITS

We chose to relate our excavated data to the analytical units developed by Vanderwal, who divided the deposits into two zones (= phases) with each of these further subdivided into zones (= analytical units) IA, IB and IIA, IIB and IIC (the oldest). Some of Vanderwal's stratigraphic divisions rest on soil colour, others on the degree of shell content. Vanderwal's site division appears to have been determined mostly from Trench 1 then applied to other trenches by comparisons of ceramic styles. Thus his trench T6 contained only zone IIB deposits overlying zone IIC deposits.

For both our 2007 squares we subsequently aligned our spits to Vanderwal's five zones using two unrelated approaches. The first was to establish comparisons between our stratigraphy and Vanderwal's stratigraphic descriptions. For our square T1/A, distinct changes were recorded between Spits 3 and 4 and between Spits 6 and 7. The first change was thought to correlate on relative depths with Vanderwal's division of zones IA and IB and the second, also on relative depths, with the change between Vanderwal's two major zones, I and II. For T6/EXT we could not identify any clear stratigraphic break.

The second approach was to compare the diagnostic (rim and decorated) sherds recovered from our excavations with Vanderwal's ceramic style types, which were seen by him to represent his stratigraphic zones. He had defined a sufficient number of types with restricted temporal spans to allow this. This comparison was carried out in the laboratory by two analysts (Jim Allen, Matt Hennessy) separate from each other and without reference to the 2007 stratigraphy. When the two results were compared they were very similar and correlated directly with the stratigraphic changes just described for T1/A. We thus believe that the correlations in Table 1 are quite robust.

Table 1. *Correlation of 2007 excavation spits with Vanderwal's analytical units.*

Vanderwal 1973	2007 excavation spits square T1/A
IA	1–3
IB	4–6
IIA	7–11
IIB	12–13
IIC	14–16
Vanderwal 1973	**2007 excavation spit square T6/EXT**
IIB	1–4
IIC	5–10

RADIOCARBON DATING

Vanderwal obtained six dates from Oposisi (Table 2). He rejected ANU-726 on the grounds of possible contamination. Other possible date reversals may relate to the large errors; the four dates from IIB and IIC all overlap at two standard deviations and those from IIC at one standard deviation. Vanderwal argued initial occupation at about 2000 BP or slightly earlier.

Table 2. *Radiocarbon dates from Oposisi from the 1969 excavation.*

Vanderwal zone	ANU sample number	C^{14} date BP	Trench / square / spit
IB	ANU-725	1180 ± 200	T1/11/5
IIA	ANU-726	940 ± 180	T1/11/9A
IIB	ANU-727	1920 ± 180	T6/2/4
IIC	ANU-729	1530 ± 160	T6/2/6
IIC	ANU-728	1600 ± 210	T6/2/7
IIC	ANU-425	1890 ± 305	T1/11/14

Seven new AMS C14 dates were obtained for Oposisi (Table 3). All are in stratigraphic order and show convincingly that Vanderwal's estimate of a *c.* 2000 BP starting date remains accurate. These dates give better chronological resolution to the central layers of the site but again fail to encapsulate the latest period of occupation reflected by the presence of the most recent EPP pottery decoration style identified in the disturbed upper layer IA at Oposisi and also the most recent layers of EPP sites in Port Moresby (e.g. Style A at Nebira 4 (Allen 1972: Fig. 6)).

Whether *in situ* deposits of this most recent phase are present at Oposisi is uncertain. Vanderwal did not locate any in 30 m² of excavation, and attributed this to primary occupation being along the top of the ridge, with earlier materials dumped down the slope and a mixture of ridge top deposits subsequently eroding down the slope to form zone IA after abandonment. Our T1/A column sample supported this interpretation, with the upper 30 cm containing a mixture of early and late pottery decorative styles.

Table 3. *Radiocarbon dates from Oposisi from the 2007 excavation. Calpal calibration after Weniger and Jöris 2008.*

Spit	Vanderwal zone	Waikato sample number	C^{14} AMS date (BP)	Lab calibration at 95% confidence (calBP)	Calpal calibration at 95% confidence (calBP)
T1/A					
6	IB	Wk-21610	1573 ± 33	1390–1540	1382–1554
7	IIA	Wk-21611	1607 ± 33	1410–1560	1387–1632
10	IIA	Wk-21612	1639 ± 30	1480–1620	1418–1622
13	IIB	Wk-21613	1834 ± 30	1700–1870	1666–1822
15	IIC	Wk-21614	2004 ± 30	1880–2010	1890–2042
16	IIC	Wk-21615	2041 ± 30	1920–2070	1917–2093
T6/EXT					
6	IIC	Wk-21616	2022 ± 30	1890–2060	1906–2050

MARINE SHELL AND VERTEBRATE FAUNA

Vanderwal (1973) offered a non-quantitative listing of species recovered from Oposisi and surrounding sites. In addition to humans, he listed pig, dog, wallaby, cassowary, turtle, dugong, crocodile, flying fox, bat, shark, stingray and a range of reef and estuarine fish. As far as can be determined most of these occurred at Oposisi, and suggest a mixed fishing/collecting/horticultural economy. Vanderwal did not analyse the midden shell but in dealing with the artefactual shell identified *Trochus*, *Conus*, *Tridacna* and 'pearl shell'.

In 2007 marine shell and bone were collected from the sieves and bagged. These pieces were examined for tools and ornaments and 9 such items were identified. From the top of zone I (T1/A spit 2) two pieces of a carved bone spatula were recovered, apparently broken after deposition; four shell beads were recovered, two from zone IB (T1/A spits 4 and 6), another from zone IIB (T6/EXT spit 2) and another from zone IIC (T1/A spit 15). One piece of a *Conus* shell armband and an *Anadara* net sinker were also found from zone IB (T1/A spit 6). The top of a cowrie was recovered from zone IIC (T1/A spit 14) which may have been used as an octopus lure. A bone point was also found in this bottom zone (T6/EXT spit 7) (see Figures 2–4).

Since our shell and bone samples were too small to

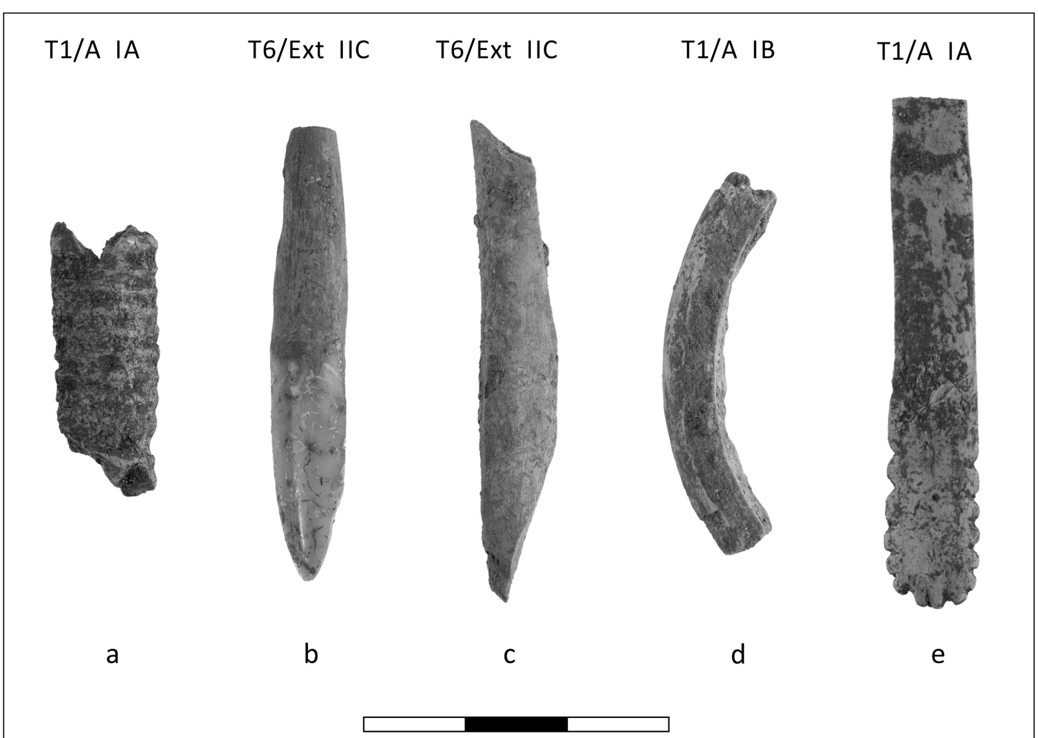

Figure 2. Bone and shell artefacts from Oposisi. Scale in cm. See text for details.

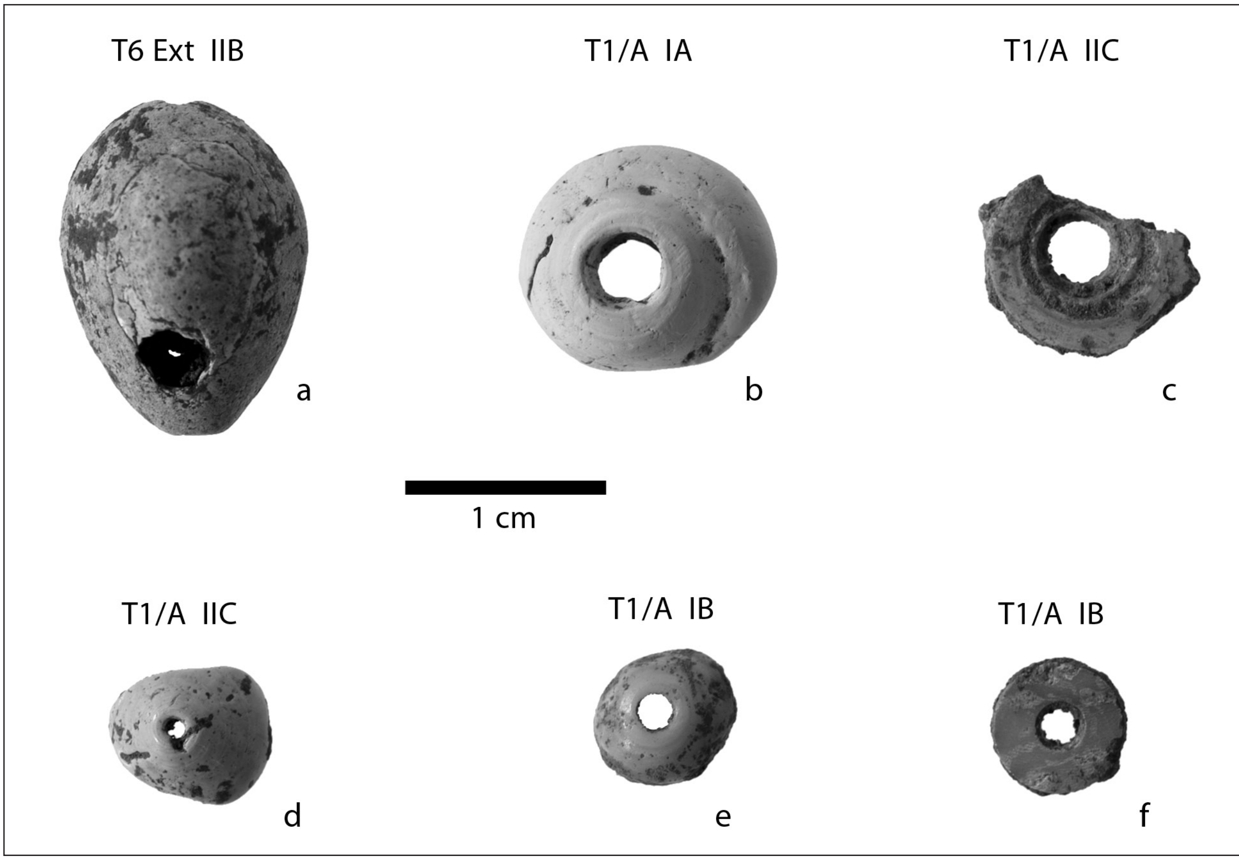

Figure 3. Shell beads from Oposisi. See text for details.

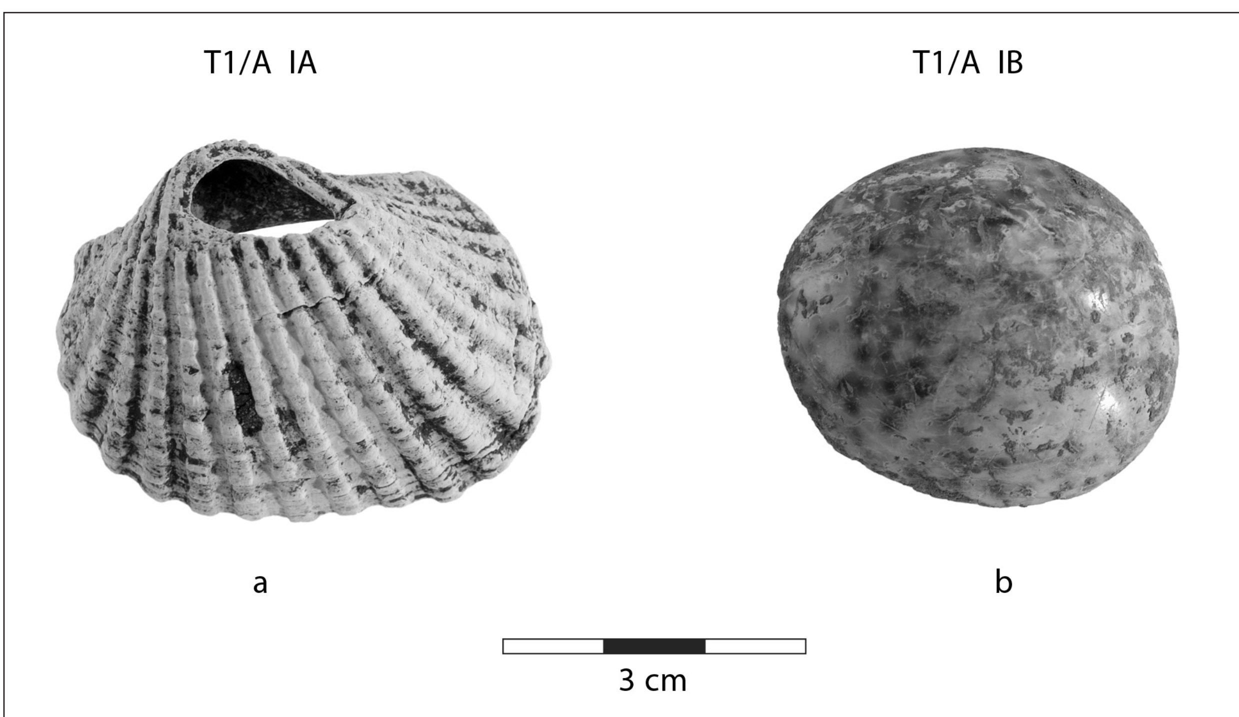

Figure 4. Shell artefacts from Oposisi. See text for details.

provide meaningful quantitative data and did not inform the main research questions, this material was returned to UPNG to be used for student projects prior to being deposited in the National Museum and Art Gallery of Papua New Guinea. However, field identifications included pig, wallaby, turtle, dugong, reef fish (*Scaridae*, *Balistidae*) and shellfish from shallow reef and mangrove environments.

STONE ARTEFACTS

Vanderwal (1973: 127–32) analysed a collection of distinctive trapezoidal stone adzes from several sites including Oposisi IIC, but other stone artefacts and especially flaked stone artefacts received less detailed attention. A typology was offered with some metrical data for small subsets of artefacts but Vanderwal gave no information about raw materials, cortex presence/absence, flaking techniques or correction factors for volumetric differences between analytical units. For example, metrical data for utilised flakes is limited to 15 items for each of the four analytical units (1973: Table VII-4; zone IA is excluded) where the total claimed number for these artefacts in these units in Table VII-2 is 581.

From the 2007 excavations 1284 stone artefacts were collected from T1/A and T6/EXT and subjected to an analysis that is summarised here; there are 1273 flaked stone artefacts with the remainder comprising four limestone oven stones, a quartz hammerstone and three small ground adzes assumed to be woodworking tools from zones IA, IIA and IIC (Figure 5). Three further ground fragments were assumed to also be from adzes.

Overall, this is a very unprepossessing stone artefact collection. While the flaked component contains cores, flakes, broken flakes and flaked pieces, it yielded only seven possibly retouched artefacts and only 13 further items considered to show usewear.

Chert

The stone assemblage is dominated by 96% chert, of which 87% is mid-brown in colour. Smaller proportions of grey chert occur in all analytical units. Cherts with excellent flaking properties (including finer dark brown/black and red material) as well as geologically related chalcedony, occur mostly in the upper units of T1/A (zones IIA to IA). It is unclear whether this is a product of a growing knowledge of better source(s), procurement of tool stone over a wider region or higher densities of stone in the upper units of the site encompassing a wider range of materials. Overall, raw materials range from excellent tool stone to material with poor flaking properties. Much of it has been reduced using a bipolar flaking technique that has yielded a disproportionally high percentage of flaked pieces.

The chert assemblage raises as many questions as it answers. Given that artefact-quality chert does not seem to occur on Yule Island, it is assumed to source at least to the adjacent mainland, if not further afield. The high number of stone artefacts present at Oposisi suggests that much time and energy was spent procuring and transporting this raw material to the site. We thus assume that either

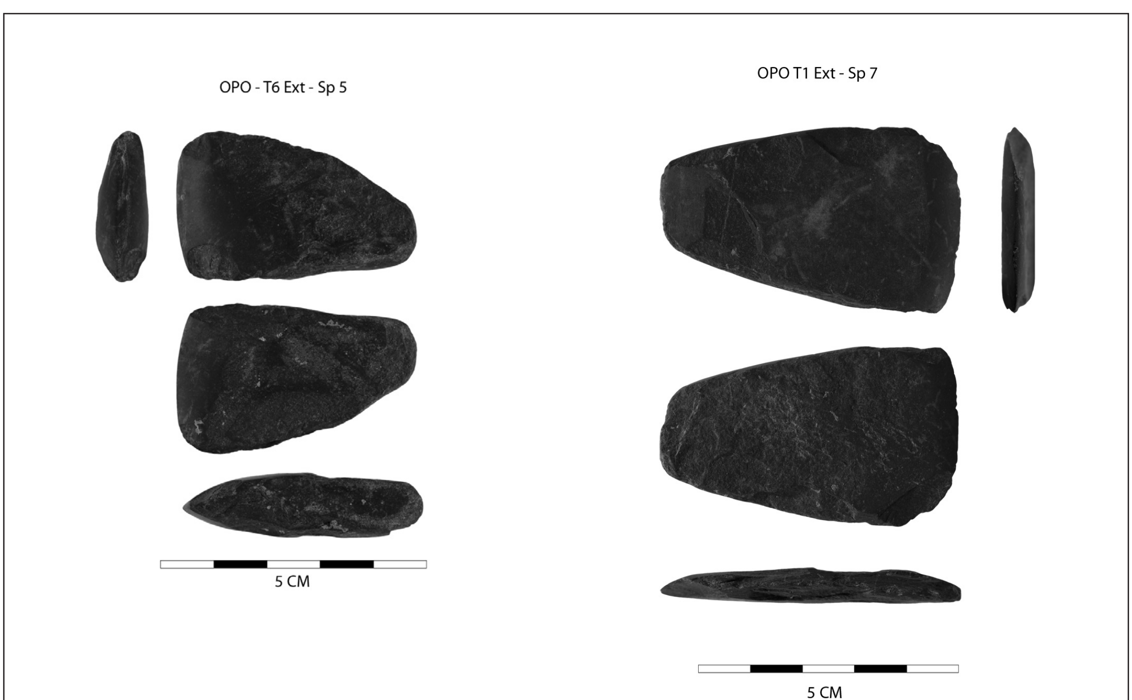

Figure 5. Two volcanic stone edge-ground axes from Oposisi.

many stone tools made on-site were used and discarded off-site or that our sample was too small to reflect tool presence in any number. Since ground stone artefacts were recovered in our small excavation (in addition to much pottery, bone and shell) it seems improbable that a sample of about 1300 pieces of stone would not produce more retouched tools if these were commonly present on the site.

Table 4 shows the distribution of stone artefacts according to raw material.

Obsidian

After chert, obsidian is the most common raw material and the only other material to occur in all analytical units. Even though it comprises only 1.3% of the assemblage it is known to have been imported over a distance of 600 km (see below) and represents evidence for exchange and social connectivity.

Fifteen pieces of obsidian were recovered from T1/A and a further two pieces from T6/EXT. They were found in small quantities from the top to the bottom of the site (Table 4).

Given that zone IA is argued by both Vanderwal and us to be disturbed, there may be less obsidian at the top of Oposisi than at the bottom, but with pieces distributed in all spits of T1A from T1/A/6 to T1/A/16, with the single exception of Spit 15, it can be accepted that obsidian reached Oposisi for most of the life of the settlement.

CHARACTERISATION ANALYSIS

Samples of obsidian and chert were selected for characterisation analysis using PIXE-PIGME. Sourcing obsidian is straightforward for most parts of the western Pacific (see Summerhayes 2009). On the other hand, identifying the origin of chert using chemical techniques is more difficult and properly requires extensive chert samples from different source locations, something we do not have at present. Even so, a chemical characterisation can allow the definition of groupings (called Chemical Compositional Reference Units – CCRUs), based on chemical similarity. This will at least allow the identification of separate CCRUs at any given period, and their use over time. Knowing the number of chert sources in a site and their distributions through time can be useful in modelling social and economic interaction, even if we cannot yet identify the source locations for the chert.

The analysis used the multi-purpose SIBA1 beamline with the Tandetron STAR accelerator at the Australian Nuclear Science and Technology Organisation in Sydney. Elements used in the statistical analysis included: F, Na and Al on PIGME and Si, KI, Ca, Ti, Nm, Fe, Cu, Fe, Zn, As, Rb, Sr, Y, Zr, Nb, and Pb on PIXE. These elements have proved the most useful in discriminating between sources – see Summerhayes *et al*. (1998) for a description of the development of PIXE-PIGME by the late Dr Roger Bird.

Obsidian

A sample of 11 from the 17 available obsidian samples was selected for PIXE-PIGME analysis. This sample covers all analytical units apart from zone IB (Table 5).

The PIXE-PIGME results demonstrate that all samples originate from West Fergusson Island. These results are significant and suggest that trade or exchange of obsidian from this source to Oposisi continued throughout the full period of occupation, perhaps lessening but not disappearing in zone I.

Chert

Chert is a microcrystalline silicate (Rapp 1985: 360; Leudtke 1978: 414). It is sedimentary rock composed mostly of quartz and various impurities, depending on local geologies and formation processes. It is chemically heterogeneous and in most cases found with inclusions. Studies have shown that chemical differences between chert outcrops are greater than within outcrops (Leudtke 1978,

Table 4. *Distribution of stone by raw material, Oposisi 2007.*

	Chert (brown)	Chert (grey)	Chert (red)	Chert (brown / black)	Chert (other)	Obsid.	Quartz	Q'tzite	Chalced.	Unid. volcanic	Lime-stone	Unid.	Total
T1/A													
Zone IA	260	11	22	6	6	2	1		3	1		2	**314**
Zone IB	325	8	8	4	3	1	1		1	6	2		**359**
Zone IIA	362	33	10	8	10	5	3		5	4	1		**441**
Zone IIB	54	10		3		3	1		1				**72**
Zone IIC	38	5		1		4		1					**49**
T6/EXT													
Zone IIB	14	3											**17**
Zone IIC	17	9				2	1	2			1		**32**
Total	**1070**	**79**	**40**	**22**	**19**	**17**	**7**	**3**	**10**	**11**	**4**	**2**	**1284**

Table 5. *Locations of obsidian pieces sampled by* PIXE-PIGME in this study.

Vanderwal Zone	Square/spit	Obsidian total	Sampled
T1/A			
Zone IA	1–3	2	1
Zone IB	4–6	1	0
Zone IIA	7–11	5	4
Zone IIB	12–13	3	2
Zone IIC	14–16	4	3
Total		**15**	**10**
T6/EXT			
Zone IIB	1–4	0	0
Zone IIC	1–10	2	1
Total		**2**	**1**

Table 6. *Locations and numbers of chert pieces sampled by* PIXE-PIGME *in this study.*

Vanderwal Zone	Square/spit	Chert total	Sampled (no. and %)
T1/A			
Zone IA	1–3	305	8 (6.5)
Zone IB	4–6	348	18 (5.2)
Zone IIA	7–11	423	23 (5.4)
Zone IIB	12–13	67	20 (29.9)
Zone IIC	14–16	44	10 (22.7)
Total		**1187**	**79 (6.7)**
T6/EXT			
Zone IIB	1–4	17	6 (35.3)
Zone IIC	1–10	26	11 (42.3)
Total		**43**	**17 (39.5)**

1979). The choice of elements of course depends on the underlying geology, however for this study the same suite of elements used for obsidian were used with much success.

Ninety-seven chert samples were selected for PIXE-PIGME analysis. They were selected from each layer to provide approximately comparable sample numbers that incorporated a range of chert colours. This resulted in proportionally larger samples from zones IIB and IIC, especially when samples from T6/EXT were included, because of the overall lower numbers in these units (Table 6).

Six CCRUs were identified based on chemical similarity of chert using Correspondence Analysis (Figure 6). Their distributions according to analytical unit are shown in Table 7.

The CCRU data for chert shows a varied pattern through time. In zone IIC five of the six CCRUs are represented even though this unit produced the fewest chert pieces, even when corrected for volumetric differences (Figure 7). In contrast, zone IIA, with four CCRUs, produced the most chert (Table 4) and by far the most chert when volumetric differences were corrected (Figure 7). In this case the wider spread of CCRUs may not be simply a product of more chert being present in zone IIA, because in zones IA and IB chert is still very common (Table 4) but the distribution across the CCRUs is restricted, with 83% and 75% of chert in these zones grouping in CCRU 1. With zone IIB on the other hand, the predominance of CCRU 1 chert may reflect either the lower frequency of chert in

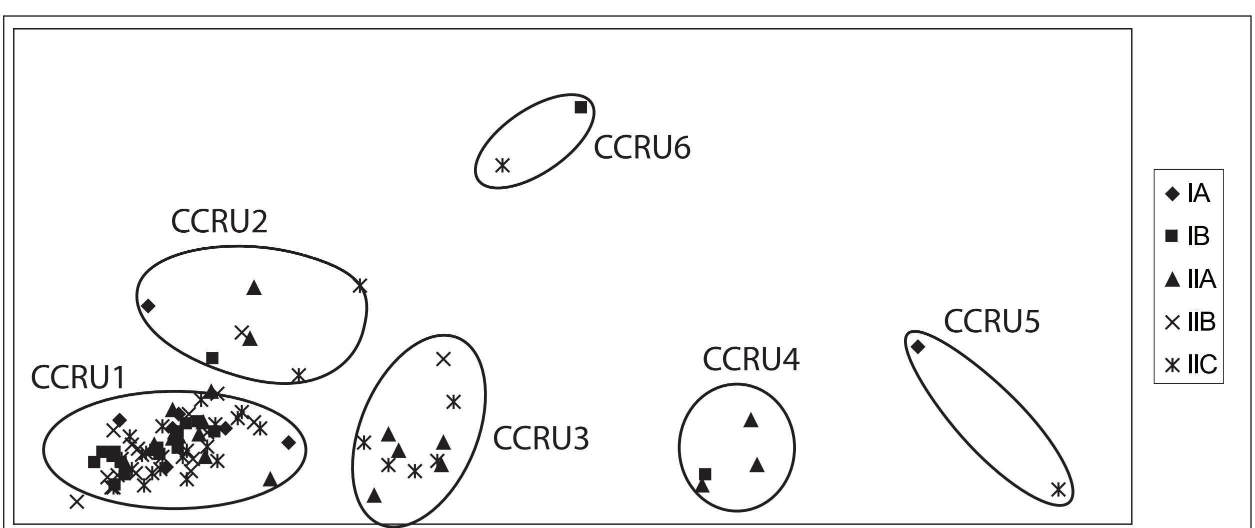

Figure 6. Correspondence Analysis plot of cherts analysed using PIXE-PIGME.

Table 7. *The distribution of chert samples according to CCRUs and analytical units.*

Zones	CCRU 1	CCRU 2	CCRU 3	CCRU 4	CCRU 5	CCRU 6
IA	6	1			1	
IB	15	1		1		1
IIA	14	2	4	3		
IIB	14	1	1			
IIC	21	2	5		1	1

this zone or a different pattern of use when compared to the zones immediately preceding and following it.

At a wider level chert from CCRU 1 is the predominant source of this material throughout the life of the settlement, with CCRU 2 chert a minor but constant addition. Chert from CCRU 3 is temporally restricted to the earlier phase of occupation.

Of interest is the presence of black chert (Figure 8) from this site. In hand inspection, many of the samples could be confused with obsidian and were only conclusively identified as chert through chemical analysis. Sixteen such pieces were selected for chemical analysis and were found widely distributed in most CCRUs, with eight allocated to CCRU 1, three each to CCRU 3 and 4, and a single sample each in the outlying groups of CCRU 5 and 6. This result makes evident the weakness of identifying chert sources on the basis of colour alone. Chemically the black cherts group with other cherts that vary in colour from red to brown.

Summary of the chert analysis

The chemical variability in cherts (CCRUs) in zones IIC and IIA could relate to periods of high mobility or intensity of interaction. This would be expected in the initial colonisation *c.* 2000 years ago (see Summerhayes and Allen 2007 for discussion). The variability seen in the later zone IIA might be signalling later changes to the intensity or nature of regional interaction/movement of people or ideas. Zone IIA did witness a major increase in chert entering the site compared with previous units, even after correcting for artefact densities per cubic metre (Figure 5). We would expect these changes to be reflected in other classes of material culture, such as pottery production. We await the analysis of pottery production currently being researched separately as a MA project.

Summary of the wider lithic analysis

Our combined excavations totalled only 0.59 cubic metres, suggesting that the site might contain more than 2,000 stone artefacts per cubic metre of deposit. The vast major-

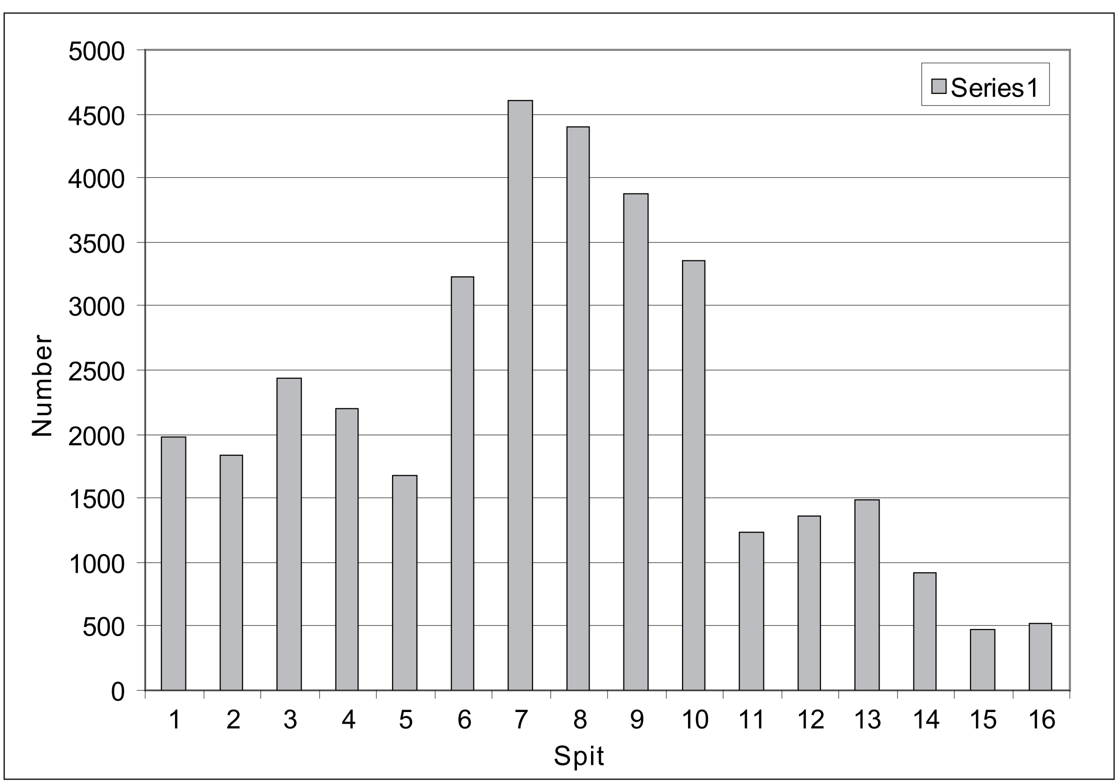

Figure 7. Total number of stone artefacts from T1/A by spit, corrected to number per cubic metre of sediment. Zone IA = spits 1–3; IB = 4–6; IIA = 7–11; IIB = 12–14; IIC = 15–16

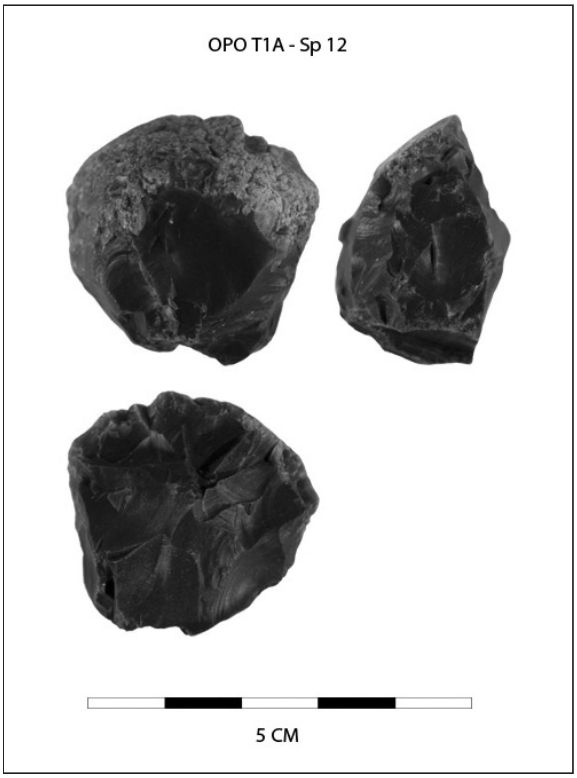

Figure 8. Three views of a black chert core made on a water-worn cobble.

ity of these artefacts are made on chert, suggesting sources on the mainland. This in turn implies that the benefits of carrying this material to Yule Island should have outweighed the costs. If this was so, what these benefits were are not immediately apparent in the collection. Much of the material appears to have been transported as nodules and many had poor flaking qualities, reflected in the high numbers of flaked pieces and the overall large amount of debitage. Retouched and utilised pieces combined only represented 1.6% of the total assemblage. The seven retouched flaked tools are not elaborate and all would be classed as delicate rather than robust tools, more suited to cutting flesh or working shell and bone rather than forest clearance or canoe building.

We note that high-powered microscopic usewear and residue studies might have identified uses to which these apparently unmodified flakes might have been put, and since such studies were not undertaken on our sample this remains possible. We note that David *et al.* (2010) identified such traces on 14 of 25 artefacts tested from Emo, but since only 50 artefacts in total were recovered from the site the role(s) of flaked stone at Emo were apparently different to those of the 1284 flaked artefacts we recovered from less than 0.6 m³ from Oposisi. A better comparison might be with Motupore an island site near Port Moresby. Excavations there by one of us recovered 26,847 flaked artefacts of which 581 were specialised and heavily retouched drill points (Allen *et al.* 1997). A sub-sample from 3 m² of this excavation yielded 9586 flaked artefacts of which 303 were secondarily retouched implements (less than 50% drill points), proportionally about 6 times those from Oposisi. Because of uncertainties about edge damage to the Motupore artefacts in transit, we abandoned identification of 'utilised' flakes; however these consistently exceeded 30% of the trench assemblages across the site. On this comparison we might have expected to see more macro-usewear on the Oposisi stone artefacts.

Just as the Oposisi assemblage is simple, so is it mostly unchanging. Percentages of artefact types remain fairly constant through time as do the major raw materials used to make them. The only clear trend is a significant increase in the density of stone deposition between Spits 11 and 10 in square T1/A, at the beginning of zone IIA, and the suggestion in both 2007 squares that artefact size is more variable in the early history of the site.

Comparisons of the lithic data from 1969 and 2007

Comparisons between the two excavations are more interesting because our results vary so much from those of Vanderwal. We experienced difficulties in comparing like with like because Vanderwal's thesis is frequently short on quantitative data and also in assessing what site areas provided what data, but in the examples used here we have gone to some trouble to ensure that the comparisons are valid.

Table 8 provides raw counts for the squares analysed by Vanderwal constructed from his thesis, together with volumetric corrections developed by us.

Vanderwal's data show lower relative densities in zones IIB and IIC, in keeping with the 2007 results. Overall Vanderwal's square T1-11 has lower densities than T1-9 and T1-6+8, while the latter squares are more similar. There is no apparent explanation for this difference since T1-11 is adjacent to T1-6.

The differences in frequencies between the 1969 and 2007 samples can be judged as follows. The Vanderwal sample of 1538 artefacts derives from 5 square metres of deposit that varies in depth between 1.2 m and 1.5 m. Allowing that the average depth is 1.35 m, the overall average artefact density is 228 per m³. In the 2007 sample from T1/A, 1235 artefacts were recovered from 0.55 of a cubic metre at an overall average density of 2246 per cubic metre, almost exactly 10 times the density of the Vanderwal sample. Comparisons only with T1-11, the square immediately adjacent to the T1/A sample, are similarly aberrant. Allowing that T1-11 is 1.5 m deep the average artefact density is 180 per cubic metre. The average artefact density for the T1/A sample is *c.* 12.5 times greater.

Given that similar sieve mesh sizes were employed we can only assume that not all lithic material was picked from the sieves in 1969.

Table 8. *Stone artefact counts for the Oposisi 1969 excavations for squares T1–6 plus T1–8, T1–9 and T1–11 (Vanderwal 1973) with volumetric corrections developed from data construed from Vanderwal (1973).*

Zone	T1-6 + T1-8	Corrected per cu. m	T1-9	Corrected per cu. m	T1-11	Corrected per cu. m	Total for Columns 1, 3, 5
IA	124	295	194	335	71	108	389
IB	534	1369	78	1300	76	362	688
IIA	154	513	104	385	110	344	368
IIB	30	188	11	73	4	22	45
IIC	17	63	21	70	10	37	48
Total	**859**		**408**		**271**		**1538**

We find a similar result with obsidian. Vanderwal reported two pieces from Oposisi, one from zone IIC and one from the disturbed zone IA. By contrast our tiny excavation recovered 17 pieces, 15 of them from T1/A. Working from this figure the expected sample from the Vanderwal pits T1-6, -8, -9 and -11 would be 184. For the *c.* 21 cubic metres of deposit excavated from Trenches 1, 5 and 6 (the ones for which we have some depth data) the expected number is in excess of 600 pieces. For the site as a whole there are likely to be thousands of obsidian pieces distributed through all intact levels of Oposisi.

DISCUSSION

The new result for the presence of Fergusson Island obsidian at Oposisi is important given the key role the trade and/or exchange of obsidian plays in Pacific archaeology. The presence of obsidian in most spits in the tiny T1/A sample presents a new and different view of the continued connectedness of EPP villages right along the Papuan coast for 600 years or longer. That Oposisi in 1969 had yielded only two pieces of obsidian was a focal point in Irwin's (1991: 506) down-the-line exchange model for this material. This model now stands in need of some revision. In Port Moresby Bulmer (1978) reported 14 pieces of obsidian at Nebira 2, an inland hilltop site with some EPP present, but also later pottery and second millennium AD radiocarbon dates in a site stratigraphically disturbed by 46 burials. From the inland Eriama rock-shelter Bulmer reported EPP, two obsidian flakes and a radiocarbon date of 1930 ± 230 BP (GaK-2670); and from the EPP beach site at Taurama, 17 obsidian flakes, a site where the oldest radiocarbon date was 865 ± 140 BP (I-6863). This date appears to be anomalously too young for the accepted age range of EPP elsewhere, but may suggest that the obsidian is associated with the later part of the EPP span at this site. At Nebira 4 obsidian was reported without quantity being specified (Allen 1972) and the data are now lost. These small but consistent amounts of obsidian associated with EPP are contrasted in the data from the Amazon Bay area, where Irwin (1985, 1991) reported several thousand pieces of obsidian through all EPP layers and in the second millennium AD deposits. While a general decrease in the number of obsidian pieces still correlates with distance from source, and while the new Oposisi sample is admittedly small, it now seems that more obsidian reached the Yule Island area than previous evidence from there and Port Moresby indicated. Importantly, it continued flowing through the system long after EPP styles in Mailu and in Port Moresby/Yule Island differentiated. However the absence of obsidian in Port Moresby and Yule Island sites after *c.* 1200 BP (excluding the anomalous date for Taurama) indicates that the flow of this material as far as Port Moresby ceased with the demise of EPP.

The Torres Strait sherds

Oposisi remains one of the two or three major EPP sequences, and the new dates reported here are strong evidence on which to reject the claims of McNiven *et al.* (2006) that EPP is likely to be older than 2000 BP. This is further supported by the re-dating of the Papuan Gulf EPP site of Emo (previously Samoa) thought by McNiven *et al.* to be older than the date of 1850 ± 95 BP (I-6153) obtained in 1971 by Sandra Bowdler (Rhoads 1983). The original date has recently been confirmed by two new basal and identical AMS radiocarbon dates of 1864 ± 33 BP (Wk-23056) and 1860 ± 30 (Wk-23057) (David *et al.* 2010). If the six sherds on Mask Island are indeed 2400–2600 BP then EPP is not the direct or indirect source of this material, and other scenarios to explain 2600 BP pottery in Torres Strait need to be explored. Meanwhile, a recent paper by Wright and Dickinson (2009) reports a single plain sherd from another site on Mabuyag Island dated to 1300–1500 BP and suggests on chronological and petrological grounds that the Mask Island sherds may be considerably younger than their claimed age.

One new data set provides a potential alternative. Negishi and Ono (2009) report undecorated pottery present in the Kasasinabwana shell midden, on Wari Island in the southern Massim, associated with three radiocarbon dates on shell, all in excess of 2000 BP. When calibrated and corrected for the marine reservoir effect the oldest date falls into the range 2570–2790 BP.

The chronological difficulty associated with deriving the six sherds from Mask Cave from EPP also applies to the Wari Island assemblage; however it is geographically much closer to earlier Melanesian pottery producing centres further north and east and does not need to appeal to the Papuan south coast pottery sequence for its validity. Whether this assemblage is the source of the Torres Strait sherds can perhaps be tested with fabric analyses. Both sets of pottery lack decoration and the data suggest they might be of comparable ages.

EPP and the possibility of earlier pottery assemblages on the Papuan south coast

The dates for pottery in Torres Strait and the southern Massim raise the possibility of pre-EPP pottery occurring along the Papuan coast, be it late Lapita or post-Lapita. In the 58 years since Gifford recorded Site 13 on the Foué Peninsula in New Caledonia and the site name Lapita became synonymous with distinctive dentate-stamped decorated pottery believed to be the earliest pottery in both Near and Remote Oceania, no stratified Lapita site has ever been reported on the New Guinea mainland. Although recognition of Lapita influences in EPP has been made by all Papuan south coast researchers – as well as elsewhere in Papua New Guinea, e.g. Kirch (2000: 122) on the prehistoric pedestalled bowls with Lapita affinities from Wanigela – it had become accepted that Lapita sites do not exist on the New Guinea mainland (e.g. Lilley 2008: 79).

The accumulated Papuan evidence continues to point strongly towards there being a sea-borne colonisation of the Papuan south coast by pottery making communities with mixed fishing/hunting and horticultural economies who occupied the area from the Massim to the Gulf of Papua in a time frame considered archaeologically instantaneous about 2000 years ago. They occupied off-shore islands, beaches, inland plains and hilltop sites. Their material culture was 'conspicuously alike' (Irwin 1991: 503). Importantly for this model this material culture included, from the very beginning, significant quantities of obsidian from Fergusson Island that continued to flow through these communities for hundreds of years. This interconnectedness is also reflected in shared decoration styles on pottery over time, even though the pottery appears locally made in each area.

The obsidian evidence in particular suggests that ancestral EPP sites are likely to be found in the general Massim region – the d'Entrecasteaux Islands or the Louisiade Archipelago – or further east. Whether the Kasasinabwana site on Wari Island is one such site is moot on the available evidence, especially given the undecorated ceramics there. On present available evidence it seems improbable that even if Lapita or other pre EPP pottery assemblages occur on the Papuan mainland they will be shown to be directly ancestral to EPP, whose archaeological signature is entirely at odds with any model based on local evolution from earlier pottery traditions on this coast.

Associated historical evidence also highlights difficulties with the idea of ancestral EPP sites on the Papuan south coast. EPP sites have been highly visible from the beginning of systematic surveying. For example, Irwin (1985: Table 17) identified 30 early period (EPP) sites among 120 surface sites he surveyed in the Amazon Bay area in 1973, and between 1968 and 1972 Bulmer (1978: 82) recorded 71 sites in the Port Moresby area, of which 30 were EPP.

In contrast to EPP visibility on the Papuan coast and earlier Lapita visibility elsewhere in the Pacific, more than a dozen archaeologists working along this coast for 40 years have failed to find pre-EPP pottery in perhaps 30 excavations and many hundreds of surface collections. No EPP or later sites, all dug into sterile deposits or onto basal rock, come down onto earlier pottery horizons. Before accepting small numbers of sherds in the Torres Strait or elsewhere in Papua before 2000 BP as ancestral to EPP, alternative explanations such as reflections of exploratory voyaging, or pottery transfer through trade should be explored.

CONCLUSION

Our re-investigation of Oposisi has confirmed the accepted starting date for EPP at *c.* 2000 BP and has shed further light on the inter-connectedness of EPP communities on the Papuan south coast in terms of continued obsidian transfer that compliments some parallel changes in the ceramic sequences, especially between Yule Island and Port Moresby. If the six potsherds on Pulu Island are indeed 24–2600 BP they do not appear to derive from the EPP. Dates for the Kasasinabwana site provide viable chronological alternatives but open up a different set of questions. We dig in interesting times.

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