

The Pacific's earliest painted pottery: an added layer of intrigue to the Lapita debate and beyond

Stuart Bedford*

Lapita pottery, the herald of the settlement of the wider island Pacific, turns out to have been painted with lime and clay, to give a red and white finish over the decorated surface. The find of a pot in Vanuatu, its sherds in different states of deterioration showed why painted Lapita has previously gone unrecognised. The author suggests that it was widespread from 1000 BC and reminds us that pottery was painted in China 7000 years ago.

Keywords: painted pottery, Lapita, Vanuatu, taphonomy

Introduction

Human colonisation of the Pacific began in the far west of Near Oceania, at least 40 000 years ago (Allen & Gosden 1991; Leavesley & Chappell 2004; Wickler & Spriggs 1988) and progressed as far as the end of the Solomons chain along a route of mostly intervisible islands. However, further movement eastward out into a region, now known as Remote Oceania, with substantially larger water gaps separating smaller islands, did not occur for more than 30 000 years. Once it did occur it appears to have been a very rapid, even explosive event which saw people colonise eastwards as far as Tonga and Samoa over a period of several hundred years (Kirch 1997; Spriggs 1997). This expansion has been associated with Austronesian language speakers who carried with them horticultural plants, domestic animals, a distinctive suite of material culture and heterarchical or ranked social organisation (Kirch & Green 2001; Green 2003). Of all the items of material culture that are excavated, it is the distinctively decorated pottery, named after the eponymous site of Lapita on the island of New Caledonia (Gifford & Shutler 1956), which has received most attention.

Although the pottery was first reported in 1909 (Meyer 1909), it was another forty years before it was recognised as having direct parallels over large areas of the Western Pacific (Avias 1950: 131) when it began to be identified as being present in a number of regions. As more sites were uncovered it was argued that this represented some sort of 'community of culture' (Golson 1961), now generally referred to as the Lapita Cultural Complex. The geographical spread of the Lapita Cultural Complex (Figure 1) has now been extended from Aitape on the north coast of New Guinea to Samoa and Tonga in the east along with numerous islands in between (Anderson *et al.* 2001; Kirch 1997: 55). Decades of archaeological research

* *Research Fellow, Department of Archaeology and Natural History, Research School of Asian and Pacific Studies, Australian National University, Canberra, ACT 0200, Australia (Email: stuart.bedford@anu.edu.au)*

Received: 19 May 2005; Revised: 9 November 2005; Accepted: 23 January 2006

ANTIQUITY 80 (2006): 544–557

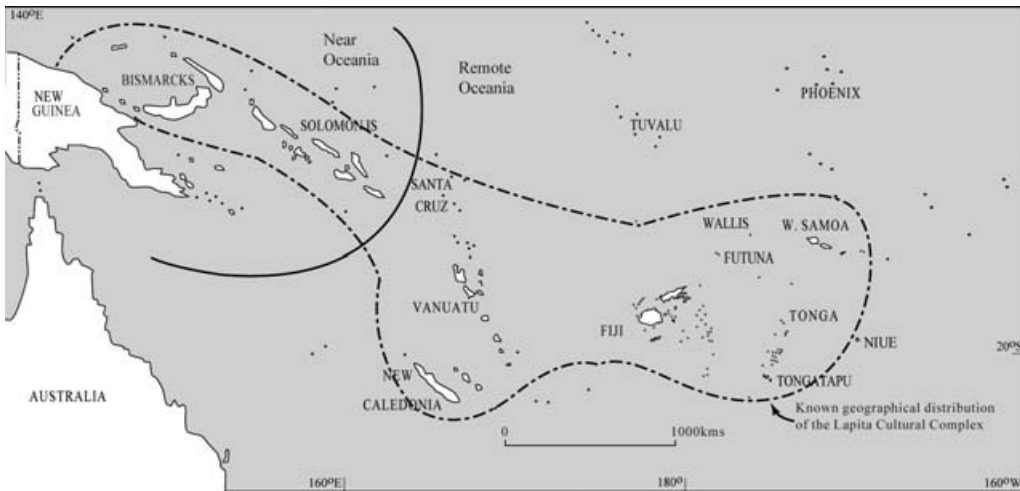


Figure 1. South-west Pacific.

have established that there was a clinal west-east pattern of settlement with accompanying 'distance decay' in ceramics (Green 1978, 1979; Kirch 1997). The ceramics in the west are generally characterised by a greater variety of vessel forms than those in the east and the earliest of them (Far or Early Western) are often decorated with very fine, almost 'needle point', dentate-stamping. Although this pattern is to a certain extent influenced by chronological factors, western Lapita motifs are generally more complex and tightly spaced than those in the east (Anson 1983; Burley *et al.* 2002; Clark & Anderson 2001; Sand 2001; Summerhayes 2000).

Decorative techniques

There is a variety of decorative techniques utilised or applied prior to the firing of the Lapita earthenware vessels. The most distinctive and widespread is dentate-stamping (Figure 2). The comb-like tools, which have never been recovered archaeologically, comprised both a set of linear and curved varieties of varying lengths and also circular tools (Ambrose 1999). The motifs were applied following a highly structured process with certain rules governing the sequence and structure of motif production (Siorat 1990), although this varied enormously through time and space. Other decorative techniques that are associated with Lapita ceramics, which were sometimes used in combination with the dentate-stamping, were incising, excising, appliqué and shell impression. Evidence of a red slip has also been noted across much of the Lapita spectrum ([Mussau] Kirch 1997: 154; [Watom] Specht 1968: 127; [Buka] Wickler 2001: 96; [Santa Cruz] Donovan 1973: 69; [Vanuatu] Hedrick *nd*; [New Caledonia] Smart in Golson 1971: 70; [Fiji] Palmer 1968: 20; [Tonga] Kirch 1988: 174; Poulsen 1987: 358).

Identification of additional decoration, which is applied only post-firing, has been largely restricted to lime or clay infill of the dentate-stamped or incised motifs. The use of lime infill has long been recorded and again it appears to be present throughout the Lapita distribution ([Mussau] Kirch 1997; [Watom] Anson 1983: 31; Specht 1968: 130; [Santa

The Pacific's earliest painted pottery



Figure 2. Detail of dentate decoration on a Lapita vessel from Teouma.

Cruz] Donovan 1973: 69; [Vanuatu] Hedrick nd; [New Caledonia] Avias 1950: 131; [Fiji] Best 1981; [Tonga] Burley *et al.* 2002: 219, 223; Poulsen 1987). Although not always in evidence and most often only representing a small percentage of any collection, this infill has generally been interpreted as having been a standard and widespread decorative technique designed to highlight the dentate decoration (Golson 1971: 70). A variation on the lime infill technique was a 'white coating', reported by Poulsen, on a total of 116 sherds from Tonga. He noted '*a deliberate coating of a whitish or very light greyish substance on these sherds which came from two different Lapita sites*'. The coating was described as '*normally very thin, the exceptional cases with greater thickness not exceeding 1mm*' (Poulsen 1987: 134-5). The white coating was generally applied to the outside of the sherds although in one case it was on the interior of one decorated shoulder sherd. A number of sherds was examined using

X-ray diffraction and the coating was identified as either calcium phosphate or calcite. It was not determined whether the 'white coating' on the sherds in Tonga was associated with or obscured any dentate decoration. Although not widely noted, it would seem that similar sherds have also been found on Malo in Vanuatu and the Santa Cruz Islands. Hedrick (nd) noted '24 sherds decorated with a hard grey surface' from the Naone site on Malo and at the SZ8 site on Nendo, Santa Cruz Islands, Donovan (1973: 69) recorded seven sherds with a 'muddy grey' slip.

Painted Lapita

The only hints to date that Lapita might have been painted come from an unpublished report by Galipaud (1998) from a site on the island of Malo, northern Vanuatu. Galipaud noted that several sherds from Atanoasao, a site he excavated in 1997, had deliberate lime infilling of dentate motifs and that a 'dark red slip' had been applied between the lime filled decoration. He also noted that a painted sherd had been previously recovered from the site of Koumac in New Caledonia and he speculated that it might well have been a widespread technique (Galipaud 1998: 6). Further signs of painting began to be uncovered in 2001 and 2002 during excavations undertaken by the author on three Lapita sites on the islands of Uripiv, Atchin and Vao in northern Vanuatu (Figure 3) as part of a research and training programme carried out in collaboration with the Vanuatu Cultural Centre (Bedford 2003; Bedford & Regenvanu 2002, 2003). The sherds were generally not large, some 3 to 4cm² or smaller and in variable states of preservation, but parts of the sherds had clearly been painted. The painting, either red or white or a combination of both, initially appeared to be restricted to delineated areas between the dentate-stamping as observed on Malo. Lime infill was also relatively frequent.

Painted Lapita on Vao

In 2003 larger areas of the Lapita site on Vao were excavated to determine the extent of the site, identify activity areas and collect a larger midden sample. The site, like all those on the small islands of north-east Malekula, is located on the sheltered western side of the island some 6-7m above current sea level above a coral sand beach. Both tectonic uplift and regular falls of volcanic ash from the nearby active volcano of Ambrym have ensured that the Lapita site is deeply buried and it, and subsequent occupation levels, are relatively well preserved. Eleven 1 by 1m test pits, along with a larger excavation of 3 × 2m (Area A) were excavated in 2003 (Figure 4). On the last days of the excavation, some 1.4m below the current ground surface in Area A, and just breaking through into the sterile soft sand of the former beach, a large rim sherd was exposed lying face down in the sand (Figure 5). Initial thoughts were that, although it appeared unremarkable, it was likely to be well-preserved in the soft sand and it might well be decorated with large sections of a dentate-stamped design. Once removed from the sand however, it was not the dentate-stamping that was a highlight but rather that the outer surface of the sherd was completely painted.

A total of 20 sherds were finally recovered from the same vessel scattered across three square metres, and there were enough key sherds to enable a reliable reconstruction of its original form and decorative design (Figure 5). It has a globular base, a soft carination and

The Pacific's earliest painted pottery

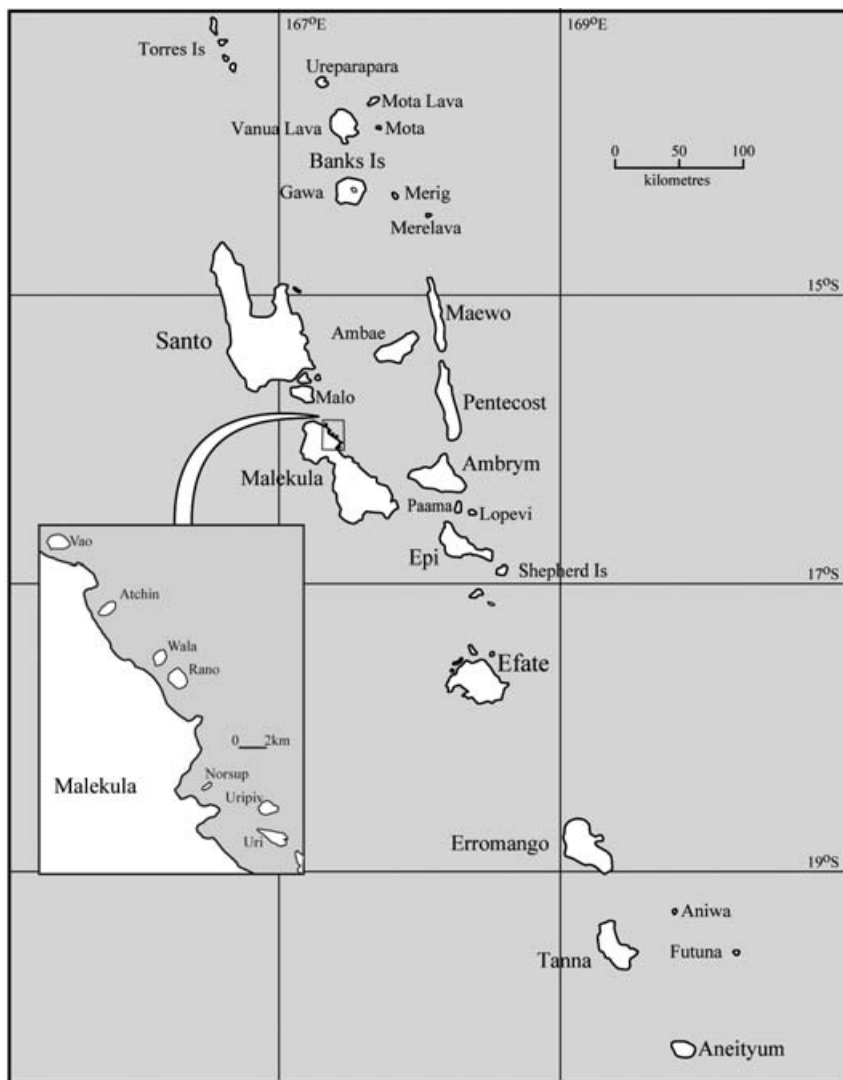


Figure 3. Vanuatu and north-east Malekula.

slightly incurving sides. Decoration, both dentate and painting is restricted to the upper half of the pot only. The dentate-stamped design comprises a series of horizontal zone markers which are variously infilled with either a series of parallel convex lines radiating from a central almond shape or singular triangles. But there are also blank areas amongst the dentate design. It is these blank areas, the vertical almond, the horizontal bands and the rectangular areas that enclose dentate-stamped triangles, that are painted red, although only after the application of a limewash over the whole upper part of the vessel.

Apart from a degraded area of the large sherd, it is clear that the limewash coating has the effect of largely obscuring the underlying dentate-stamped design. This was also in evidence amongst many of the other sherds. Another group of sherds from the vessel was

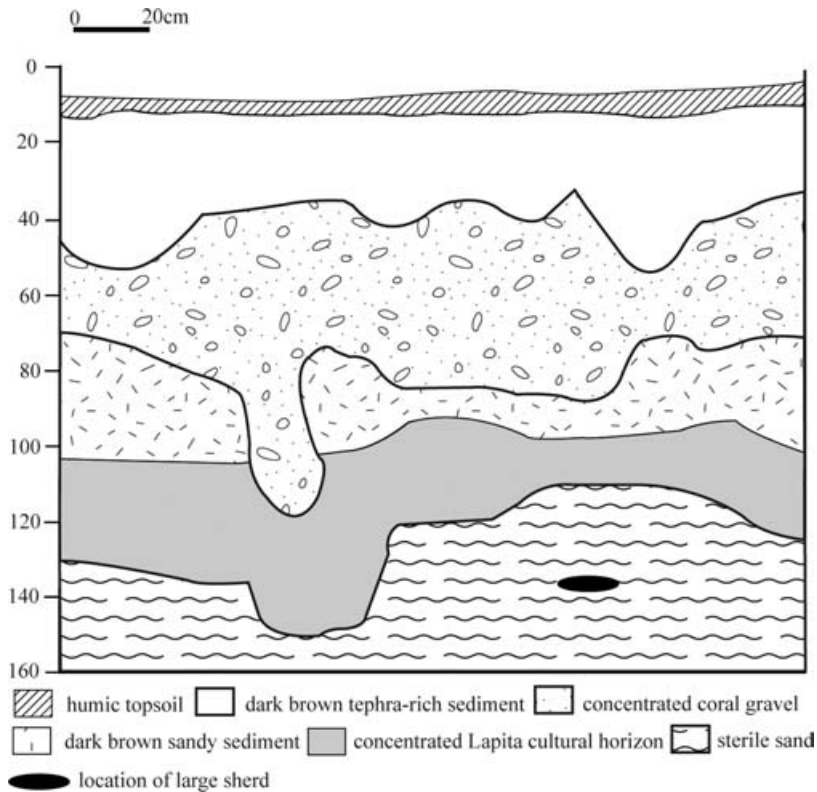


Figure 4. Stratigraphic section of Area A, Vao Island.

recovered from the black cultural matrix above the sterile sand which proved to be a much less favourable environment for preservation. The bands of red and horizontal almonds are still visible on three or four of the sherds but the limewash has begun to deteriorate and is preserved only in the dentate-stamping, effectively giving the impression of a lime-infill rather than a coating. These data suggest that lime-infill, which as outlined, has been identified across the Lapita spectrum, may simply be the remnants of a more general paint over the decorated part of a vessel.

Further evidence of painting being a widespread decorative technique at the site was confirmed during excavations on Vao in 2004. Another 13 test pits and two larger areas were excavated and painted sherds were recovered from the lowest levels of many of the test pits in the stratigraphic layer just above the sterile sand. The sherds were associated with different vessel forms and dentate-motif configurations, although colouring was consistent with only white and red in evidence.

A charcoal sample from the same ten centimetre spit (130-140cm below datum) from where the large sherd was recovered returned a conventional radiocarbon date of 2776 ± 38 BP (Wk 14040) 2948-2782 cal BP. Another charcoal sample from a similar stratigraphic level in a test pit 10 metres further south returned an AMS date of 2839 ± 40 BP (Wk 14041) 3077-2847 cal BP (at two standard deviations using the Calib. Program REV 4.4.2 of Stuiver & Reimer 1993).

The Pacific's earliest painted pottery

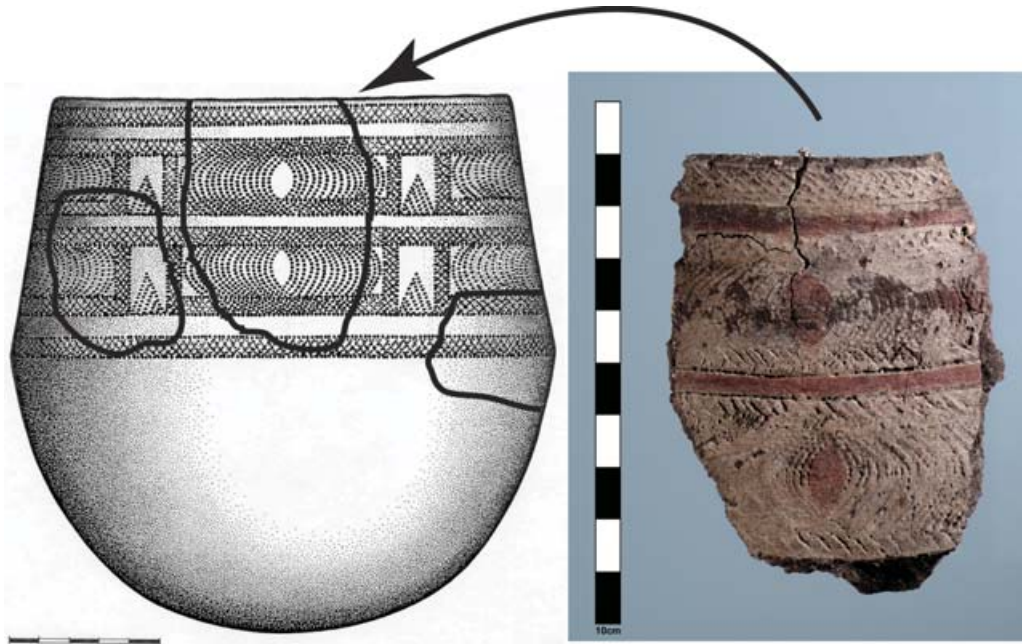


Figure 5. Reconstructed vessel and large painted sherd from Vao Island.

Analysis of the paints

A quick initial test of the white coating was undertaken by applying dilute hydrochloric acid directly to a small painted section of the sherd. The positive reaction was highly suggestive of it being calcium carbonate (Cornwall 1966: 154; Hurlbut 1971: 316). Further more detailed analysis of the composition of the white and red paint has been undertaken using X-ray diffraction. Samples of the white and red paint were removed from the sherd and XRD was carried out with a SIEMENS D501 Bragg-Brentano diffractometer equipped with a graphite monochromator and scintillation detector, using CuK α radiation. Milled samples were mounted on a low-background quartz holder. The scan range was 2 to 70° 2-theta, at a step width of 0.02°, and a scan speed of 1° per minute. The results were interpreted using the SIEMENS software package *Diffracplus* Eva 10 (2003). The results confirmed that the white paint comprises mostly of calcite with small amounts of aragonite, two forms of calcium carbonate [CaCO₃]. The red paint which overlies the calcium carbonate, contains hematite [Fe₂O₃], which gives it the reddish colour, and quartz [SiO₂].

Taphonomic process

The subject of taphonomic process in relation to archaeological sites in tropical environments is extremely complex, diverse and necessarily wide-ranging. It has long been recognised and regularly noted in the Pacific context that stratigraphic disturbance is a major influencing factor on the integrity of archaeological sites (Green 1979; Kirch & Hunt 1988; Specht 1985; Spriggs 1999). However, while there is a general awareness and consideration of the

extensive range of mechanical processes affecting archaeological sites and degradation of recovered remains, inter-related chemical processes are rarely discussed or included as an integral component of the investigation of these same sites.

There is a general tendency to explain the composition of recovered remains and more particularly any absences, in terms of patterns of human behaviour or the excavation strategy, techniques and analysis employed (Kirch & Hunt 1988), rather than any assessment of chemical influence. Despite pioneering research and early calls from Ambrose (1970, 1973) for empirical studies of chemical processes and their effect on a range of materials such as bone, wood, shell and stone, it is an area of research that has remained largely neglected in Pacific archaeology. The chemical weathering of obsidian is the lone example that has been researched in any detail (Ambrose 2001).

The rare survival of paint found on the Lapita sherds from Vanuatu and the associated remnant paint in the form of lime-infill found across the western Pacific is a sharp reminder of chemical processes and their effect on archaeological remains (Bedford & Fankhauser in prep.). In this case we are dealing with a relatively simple chemical reaction and explanation. Generally, the survival or stability of calcium carbonate in archaeological sites will be directly related to pH levels (Pickering 1989: 273-5) with an alkaline environment favouring stability. If, as would have been the case with the vast number of Lapita sites, painted sherds were exposed to regular rainfall which is acidic (Cornwall 1966: 77; Goffer 1980: 247), there is little chance of a thin layer of lime-wash paint surviving over a 3000 year period. Sites with shallow mixed stratigraphy are especially prone to saturation from heavy rainfall and associated percolation. At sites where the lime-infill survives it must be in situations where there is a calcium carbonate buffer in the form of coral sand, uplifted reefs or even sea water to raise pH levels (Pickering 1989: 273-5).

Another point to note is that if the normally robust mineral-based red paint is applied on top of the lime-wash paint, as was the case in Vanuatu, it inevitably disintegrates as the underlying calcium carbonate dissolves. If mineral-based pigments are directly applied to the pottery surface, which is the case in other parts of the Pacific (see below), the chances of preservation are enhanced.

Painted pottery in the wider Pacific and further afield

Painting was and still is a widespread decorative technique across the Pacific which is used on a whole series of different media. The fact that archaeological evidence for paint on pottery is so rarely found in the Pacific is as discussed almost certainly due to factors associated with post-depositional decomposition. Ethnographically, painting of pots is best documented in New Guinea where it was mainly recorded in the Sepik area (May & Tuckson 1982: 49-52). Colours were restricted to red, yellow, black, white and grey and were applied to the pots after firing. Although there was some variation the yellows and red were derived mainly from iron minerals and the white from clay, soft crushed coral or lime made by burning shells (May & Tuckson 1982: 49). Painting was most frequently combined with carving or applied decoration and the pots were used in a variety of ceremonial situations. Rare incidences of painting on pots have also been recorded further east on Buka in the North Solomons where an unusual form of double pot was painted with red stripes (Specht 1972: 132).

Archaeological evidence of painted pottery in New Guinea is known from the Mailu region where it was recovered from several areas of excavation. It is described as comprising 'wide and narrow rectilinear and curvilinear lines' and may date to as early as 1500-1800 BP (Irwin 1985: 110, 112). Similar painted material, ascribed to a similar chronological period has been recovered from the Port Moresby region from both coastal (Bulmer 1971; Cox *et al.* 2001) and inland sites (Allen 1972).

Painted sherds are also recorded, although still comparatively rare, in Palau, Micronesia (Beardsley & Basilius 2002; Osborne 1979; Phear 2003, 2004). Red is the sole colour that has been identified there and it was applied to form blocks of red or diagonal or diamond shapes and leaf-like patterns which were located on both the interior and exterior of the vessels (see Phear 2004: 257-61 for summary). It is a decorative technique that has a lengthy history, probably first appearing at least 2000 years ago and continuing in use up until the last few hundred years. The red painted vessels have been interpreted as being associated with ceremonial activities such as feasting and burials (Phear 2004: 261). X-ray diffraction was used to identify the composition of the paint as predominantly haematite (Phear 2004: 253). In other regions of Micronesia, evidence of lime-infilling and painting on pottery has been reported from the Marianas (Spoehr 1957; Butler 1994; Amesbury *et al.* 1996).

Pottery is a Southeast Asian introduction into the Pacific and archaeological research in that region indicates there is widespread evidence of painting on pots (Bellwood 1997: 221, 229, 239). Lime-infill is also regularly noted and although there are no specific chemical analyses that have been undertaken in relation to this decoration, we may well be seeing similar chemically induced degradation of a painted surface. Certainly similar climatic and stratigraphic conditions are present in many of the open sites. The best preserved examples of painted pottery are the 'three colour ware' (black and red on a cream base) which has been found in cave sites from contexts dating to approximately 3000 BP (Bellwood 1997: 239; Chazine 2003: 49). Again detailed research focusing on the composition of the paints has yet to be instigated.

Discussion

Caution is essential in the interpretation of archaeological remains and in the case of Lapita one has to be doubly cautious when data sets restricted to a particular region are then interpreted as being representative across the entire Lapita distribution over space and time. However, despite the fact that the identification of the painted Lapita sherds from north-east Malekula, Malo and New Caledonia are the first to be claimed as such in over 50 years of research, they are very unlikely to simply represent a regional decorative technique. Lime or clay infill, which here it is argued is remnant of a white coating, is found amongst collections of dentate-stamped sherds right across the Lapita distribution from the earliest sites such as Mussau in the west to Tonga in the east, along with instances of a white coating at least from the Santa Cruz Islands across to Tonga. The series of sherds from the single vessel on Vao are particularly instructive and reveal the various stages of deterioration – from a fully painted and largely obscured dentate motif to what subsequently appears to be only lime-infill of the dentate-stamping. The data from Vanuatu provide robust evidence that it

is taphonomic process that has stripped Lapita pottery of its added colour and extra motifs. As Green noted some time ago ‘*the integrity of deposits in Lapita sites represents a major and continuing problem*’ (Green 1979: 31). The vast majority of the more than 200 Lapita sites that have been recorded are generally poorly preserved as the stratigraphy is often shallow, has been heavily mixed and saturated by tropical rainfall over millennia. Most Lapita sites have been identified through surface survey where collections of sherds have been exposed on the ground surface. The painted sherds from Vanuatu come from stratigraphic contexts that have been formed through a combination of geomorphological process (primarily tectonic uplift and tephra deposition), local geography (soft sandy beach), and a good deal of chance, which have provided rare conditions for preservation. The large painted sherd, for example, appears to have remained *in situ*, undisturbed in the soft sand, since initially being discarded some 3000 years ago.

There is a strong case to argue for painting having been a standard decorative technique associated with Lapita pottery, albeit no doubt with considerable variation. Different materials were certainly used for the white coating (at least calcium carbonate, phosphate and clay) as may have been the case for the red colouring. There may well have been other colours that were also utilised. Variation in the level to which the dentate-stamped motifs were obscured is also likely, as was variation in the format of the painted motifs (as already evidenced from other sherds on Vao) and the overall percentage of a vessel that was painted.

General consensus amongst researchers regarding the function of decorated Lapita vessels is that they were associated with ceremonial activities rather than domestic cooking or storage. This is further confirmed with the evidence for paint being used as an additional layer of decoration. The wide variety of decorated vessel forms may have been used in an equally varied range of ceremonial activities. Prominent amongst the dentate-stamped motifs are a whole series of anthropomorphic representations, which have been identified right across the Lapita distribution. These have variously been interpreted as ancestor figures or ‘Lapita gods’ (Best 2002; Kirch 1997: 132–40; Spriggs 1990, 1993, 2002) which, it has been argued, are likely to have played a central role in the social life of Lapita people and been considered high value or prestige objects (Kirch 1997: 140). The interpretation of the social role of this pottery will be an on-going challenge for archaeologists, but the evidence from Vao, where the dentate motifs are partly obscured with paint, might suggest that the different stages of production may well have been at least as socially or culturally important as the finished product.

Conclusion

Kirch and Green (2001: 164) have calculated that in most open site archaeological contexts in Polynesia less than 20 per cent of the full range of traditional items of material culture are likely to have survived. The same can be said for most sites in the Pacific and as emphasised by the painted sherds from Vao, even those artefacts that are recovered are often far from the complete picture. The painted Lapita sherds from Vanuatu are an extraordinarily fortuitous find that provides a rare glimpse of the layered decoration, of which archaeologists had previously been unaware, that was present on Lapita pots produced three millennia ago. At the same time they also add a further layer of complexity to the interpretation of the meaning and rituals associated with their use.

The Pacific's earliest painted pottery

The recovered painted sherds from Vanuatu are 1000 years earlier than the previously earliest known painted pottery from the Pacific but they perhaps should not be unexpected. Research in Island and Insular Southeast Asia has shown that both painted and lime-filled pottery occurs in the archaeological record throughout that region from sites that are both contemporary with and younger than Lapita. Further to the north painted pottery has been recovered from archaeological contexts from sites in both southern China and Hong Kong that have been dated to as early as 7000 years ago (Bellwood 1997: 208). There is increasing evidence across the region to suggest that the painting of pots was a widespread standard decorative technique which has been practised for millennia across the Austronesian-speaking region. The evidence from Vanuatu has the same clear implications for the interpretation of lime-filled pottery in Southeast Asia as it does in Oceania.

The previous absence of painted sherds in the Lapita record is largely to do with taphonomic process, but may also be related to the fact that it was not expected. Closer inspections of recovered collections and/or reinterpretations of white or muddy coatings, lime-infill and patches of red slip might well reveal further evidence of painted sherds and their distribution. While the study of the dentate-stamped motifs will remain central to future research, the recovery of these painted sherds adds yet another layer of intrigue to the complex Lapita story and certainly adds support to Kirch's recent sentiments on Lapita research (2003: 407), that even after more than five decades of research '*things are only just beginning to get exciting*'.

Acknowledgments

A great debt of gratitude is owed to the Chiefs and landowners of Vao who both gave permission and provided support for extensive excavations on their island. Crucial collaboration also came from Numa Fred, curator of the Malekula Cultural Centre, Ralph Regenvanu, Director of the Vanuatu Cultural Centre (VCC), Richard Shing, Willy Damelip and Andrew Hoffman of the Vanuatu Cultural and Site Survey (VCHSS) and a large number of VCC Fieldworkers. Geoff Hope, Yoko Nojima, Warren Gumbley and Christophe Sand participated in the fieldwork in 2003 as did Hallie Buckley and Matthew Felgate in 2004. Helen Crawford drew Figure 3 and Tim Mackrell took the photo of the painted sherd. Wal Ambrose, Judith Cameron, Jack Golson, Roger Green, Jean Kennedy and Matthew Spriggs read earlier drafts of the paper. Matthew Felgate and Jean-Christophe Galipaud provided informative discussion and useful references. Wal Ambrose and Barry Fankhauser clarified chemical reactions and provided essential references. Comments from an anonymous referee were also productive. Dr Ulrike Troitzsch of the Department of Earth and Marine Sciences, Australian National University carried out the XRD analysis of the paints. Funding came variously from the Sasakawa Pacific Island Nations Fund, the Royal Society of New Zealand (Marsden Faststart), a National Geographic Scientific Research Grant (7738-04) and the Australian Research Council (DP 0556874).

References

- ALLEN, J. 1972. Nebira 4: An early Austronesian site in Central Papua. *Archaeology and Physical Anthropology in Oceania* II(2): 92-124.
- ALLEN, J. & C. GOSDEN (ed.). 1991. *Report of the Lapita Homeland Project*. Occasional Papers in Prehistory 20. Canberra, Department of Prehistory, Research School of Pacific Studies, Australian National University.
- AMBROSE, W. 1970. Natural causes in the deterioration of buried archaeological materials, in F. McCarthy (ed.) *Aboriginal Antiquities in Australia. Their Nature and Preservation*: 109-13. Australian Aboriginal Studies No. 22. Canberra.
- 1973. Appendix 1. Weathering rate experiments at Urouirina, Opposisi and Kakuba Cave, in R.L. Vanderwal, *Prehistoric Studies in Central Coastal Papua*: 238-42. Unpublished PhD thesis, Australian National University, Canberra.

- 1999. Curves, tines, scutes and Lapita ware, in J.-C. Galipaud & I. Lilley (ed.) *The Pacific from 5000 to 2000 BP: Colonisations and Transformations*: 119-26. Noumea: Éditions de IRD.
- 2001. Obsidian Hydration dating, in D.R. Brothwell & A.M. Pollard (ed.) *Handbook of Archaeological Sciences*: 81-92. New York: J. Wiley & Sons Ltd.
- AMESBURY, J., D. MOORE & R. HUNTER-ANDERSON. 1996. Cultural adaptations and late Holocene sea level change in the Marianas: Recent excavations at Chalan Piao, Saipan, Micronesia, in I. Glover & P. Bellwood (ed.) *Indo-Pacific Prehistory: The Chiang Mai Papers*, Vol. 2: 53-70. Canberra: Australian National University.
- ANDERSON, A., S. BEDFORD, G. CLARK, I. LILLEY, C. SAND, G. SUMMERHAYES & R. TORRENCE. 2001. An Inventory of Lapita Sites containing dentate-stamped pottery, in G. Clark, A. Anderson & T. Sorovi-Vunidilo (ed.) *The Archaeology of Lapita Dispersal in Oceania: Papers from the Fourth Lapita Conference, June 2000, Canberra, Australia*: 1-14. Terra Australis 17. Canberra: Centre for Archaeological Research and Department of Archaeology and Natural History, RSPAS, ANU.
- ANSON, D. 1983. *Lapita Pottery of the Bismarck Archipelago and its Affinities*. Unpublished PhD thesis, University of Sydney.
- AVIAS, J. 1950. Poteries Canaques et poteries préhistoriques en Nouvelle Calédonie. *Journal de la Société des Océanistes* 6: 111-40.
- BEARDSLEY, F. & U. BASILIUS. 2002. Sengall Ridge, Belau: burials, spirit walks, and painted pottery. *The Melaka Papers, Bulletin of the Indo-Pacific Prehistory Association* 22(6): 147-51.
- BEDFORD, S. 2003. The timing and nature of Lapita colonisation in Vanuatu: the haze begins to clear, in C. Sand (ed.) *Pacific Archaeology: assessments and prospects. Proceedings of the Conference for the 50th Anniversary of the First Lapita Excavation, Kone-Noumea, 2002*: 147-58. Les Cahiers de l'archéologie en Nouvelle-Calédonie 15, Noumea.
- BEDFORD, S. & B. FANKHAUSER. in prep. Dissolving data: calcium carbonate and its manifestations in the archaeological record of the Pacific.
- BEDFORD, S & R. REGENVANU. 2002. *Summary Report to the Vanuatu Government on Distance Education in the South-West Pacific: Cultural Heritage Training 2001-2003*. Workshop and Training Program on Uripiv and Wala Islands, Malakula 2001. Unpublished report to the Vanuatu Government.
- 2003. *Summary Report to the Vanuatu Government on Distance Education in the South-West Pacific: Cultural Heritage Training 2001-2003*. Workshop and Training Program on Uripiv, Uri, Atchin and Vao Islands, Malakula 2002. Unpublished report to the Vanuatu Government.
- BELLWOOD, P. 1997. *Prehistory of the Indo-Malaysian Archipelago*. Honolulu: University of Hawaii Press.
- BEST, S. 1981. *Excavations at Site VL 21/5, Naigani Island, Fiji. A Preliminary Report*. Anthropology Department, University of Auckland.
- 2002. *Lapita: A View from the East*. New Zealand Archaeological Association Monograph No. 24.
- BULMER, S. 1971. Prehistoric Settlement Patterns and pottery in the Port Moresby Area. *Journal of the Papua and New Guinea Society* 5(2): 29-37.
- BURLEY, D., A. STOREY & J. WITT. 2002. On the Definition and Implications of eastern Lapita Ceramics in Tonga, in S. Bedford, D. Burley & C. Sand (ed.) *Fifty Years in the Field: Essays in Honour and Celebration of Richard Shutler Jrs Archaeological Career*: 213-26. New Zealand Archaeological Association Monograph No. 25. Auckland.
- BUTLER, B. 1994. Early prehistoric settlement in the Marianas Islands: New Evidence from Saipan. *Man and Culture in Oceania* 10: 15-38.
- CLARK, G. & A. ANDERSON. 2001. The pattern of Lapita settlement in Fiji. *Archaeology in Oceania* 36 (2): 77-88.
- CHAZINE, J.-M. 2003. Rock Art and ceramics in east Borneo: logical discovery or new cornerstone?, in C. Sand (ed.) *Pacific Archaeology: assessments and prospects Proceedings of the Conference for the 50th anniversary of the first Lapita excavation. Kone-Noumea 2002*: 43-52. Noumea: Les Cahiers de l'archéologie en Nouvelle-Calédonie 15.
- CORNWALL, I.W. 1966. *Soils for the Archaeologist*. London: Phoenix House.
- COX, G., A. WATCHMAN, K. BLAKE & S. NESS. 2001. Beyond the Pale: Preliminary Conclusions on Pottery Surfaces from Central Province, Papua New Guinea, in M. Jones & P. Sheppard (ed.) *Australasian Connections and New Directions. Proceedings of the 7th Australasian Archaeometry Conference*: 63-83. Research in Anthropology and Linguistics, No. 5. Auckland: Anthropology Department University of Auckland.
- DONOVAN, L. 1973. *Inventory of Design Elements and Motifs in Lapita Reef-Santa Cruz Island Pottery*. Unpublished manuscript, Department of Anthropology, University of Auckland.
- GALIPAUD, J.-C. 1998. *The Lapita Site of Atanoasao Malo, Vanuatu*. Field Report No. 8. Port Vila, ORSTOM.
- GIFFORD, E.W. & R.J. SHUTLER JR. 1956. *Archaeological Excavations in New Caledonia*. Anthropological Records 18 (1). Berkeley & Los Angeles: University of California Press.
- GOFFER, G. 1980. *Archaeological Chemistry*. New York: John Wiley and Sons.

The Pacific's earliest painted pottery

- GOLSON, J. 1961. Report on New Zealand, Western Polynesia, New Caledonia and Fiji. *Asian Perspectives* 5(2): 166-80.
- 1971. Lapita Ware and Its Transformations, in R. Green & M. Kelly (ed.) *Studies in Oceanic Culture History, Volume 2*: 67-76. Pacific Anthropological Records Number 12. Honolulu: Bishop Museum.
- GREEN, R.C. 1978. New sites with Lapita pottery and their implications for an understanding of the settlement of the Western Pacific. *Working Papers in Anthropology, Archaeology and Maori Studies, No. 51*. Auckland: Department of Anthropology, University of Auckland.
- 1979. Lapita, in J.D. Jennings (ed.) *The Prehistory of Polynesia*: 27-60. Cambridge (MA): Harvard University Press.
- 2003. The Lapita horizon and traditions – Signature for one set of oceanic migrations, in C. Sand (ed.) *Pacific Archaeology: assessments and prospects Proceedings of the Conference for the 50th anniversary of the first Lapita excavation. Kone-Noumea 2002*: 95-120. Noumea: Les Cahiers de l'archéologie en Nouvelle-Calédonie 15.
- HEDRICK, J. nd. *Archaeological Investigations of Malo Prehistory. Lapita Settlement Strategy in the Northern New Hebrides*. Manuscript draft of PhD dissertation, University of Pennsylvania.
- HURLBUT, C.S. 1971. *Dana's Manual of Mineralogy*. New York: John Wiley and Sons.
- IRWIN, G. 1985. *The Emergence of Mailu*. Terra Australis 10. Canberra: Department of Prehistory, Research School of Pacific and Asian Studies, Australian National University.
- KIRCH, P.V. 1988. *Niuatoputapu. The Prehistory of a Polynesian Chiefdom*. Thomas Burke Memorial Washington State Museum Monograph No. 5. Seattle: Burke Museum.
- 1997. *The Lapita Peoples. Ancestors of the Oceanic World*. Oxford: Blackwell.
- 2003. Review of G.R. Clark, A.J. Anderson & T. Vunidilo (ed.) *The Archaeology of Lapita Dispersal in Oceania*, *Journal of the Polynesian Society* 112: 405-7.
- KIRCH, P.V. & R.C. GREEN. 2001. *Hawaiki, Ancestral Polynesia. An Essay in Historical Anthropology*. Cambridge: Cambridge University Press.
- KIRCH, P.V. & T. HUNT (ed.). 1988. *Archaeology of the Lapita Cultural Complex: A Critical Review*. Thomas Burke Memorial Washington State Museum Research Report No. 5. Seattle: Burke Museum.
- LEAVESLEY, M. & J. CHAPPELL. 2004. Buang Merabak: additional early radiocarbon evidence of the colonisation of the Bismarck Archipelago, Papua New Guinea, *Antiquity* 78: <http://www.antiquity.ac.uk/projgall/leavesley/index.html>
- MAY, P. & M. TUCKSON. 1982. *The Traditional Pottery of New Guinea*. Sydney: Bay Books.
- MEYER, O. 1909. Funde prähistorischer Töpferei und Steinmesser auf Vuatom, Bismarck Archipel. *Anthropos* 4: 251-52.
- OSBORNE, D. 1979. Archaeological Test Excavations, Palau Islands 1968-69. *Micronesica Supplement* 1.
- PALMER, J.B. 1968. Recent results from the sigatoka archaeological programme, in I.Yawata & Y.H. Sinoto (ed.) *Prehistoric Culture in Oceania, A Symposium*: 19-27. Honolulu: Bishop Museum Press.
- PHEAR, S. 2003. Painted Pottery in Palau: new evidence challenges past interpretations, *Antiquity* 77: <http://www.antiquity.ac.uk/projgall/phear/phear.html>
- 2004. *The Monumental Earthworks of Palau, Micronesia: a landscape perspective*. Unpublished PhD thesis, 2 Vols., Australian National University, Canberra.
- PICKERING, W. 1989. The Competing Roles of Dissolution, Sorption and Complex Formation in Element Mobilisation, in K.S. Balasubramaniam et al. (ed.) *Weathering: its Products and Deposits. Volume 1. Processes*: 259-306. Athens: Theophrastus Publications.
- POULSEN, J. 1987. *Early Tongan Prehistory*. 2 Vols. Terra Australis 12. Canberra: Department of Prehistory, Research School of Pacific and Asian Studies, Australian National University.
- SAND, C. 2001. Evolutions in the Lapita Cultural Complex: a View from the Southern Lapita Province, *Archaeology in Oceania* 36: 65-76.
- SIORAT, J.-P. 1990. A technological analysis of Lapita pottery decoration, in M.J.T. Spriggs (ed.) *Lapita design, form and composition: proceedings of the Lapita design workshop, Canberra, Australia, December 1988*: 59-82. Occasional Papers in Prehistory 18. Canberra: Department of Prehistory, Research School of Pacific and Asian Studies, Australian National University.
- SPECHT, J. 1968. Preliminary Report of Excavations on Watom Island. *Journal of the Polynesian Society* 77(2): 117-34.
- 1972. The Pottery Industry of Buka Island, T.P.N.G. *Archaeology and Physical Anthropology in Oceania* VII(2): 125-44.
- 1985. Crabs as disturbance factors in tropical archaeological sites. *Australian Archaeology* 21: 11-8.
- SPOEHR, A. 1957. *Marianas Prehistory: Archaeological Survey and Excavations on Saipan, Tinian and Rota. Fieldiana: Anthropology* 48. Chicago: Field Museum of Natural History.

Stuart Bedford

- SPRIGGS, M. 1990. The Changing face of Lapita: the transformation of a design, in M.J.T. Spriggs (ed.) *Lapita design, form and composition: proceedings of the Lapita design workshop, Canberra, Australia, December 1988*: 83-122. Occasional Papers in Prehistory 18. Canberra: Department of Prehistory, Research School of Pacific and Asian Studies, Australian National University.
- 1993. How much of the Lapita design system represents the human face? in P.J.C. Dark & R.G. Rose (ed.) *Artistic Heritage in a Changing Pacific*: 7-14. Honolulu: University of Hawaii Press.
- 1997. *The Island Melanesians*. Oxford: Blackwell.
- 1999. Archaeological dates and linguistic sub-groups in the settlement of the Island Southeast Asian-Pacific Region, in P. Bellwood, D. Bowdery, D. Bulbeck, M. Fiskesjo, R. Green, I. Lilley & B. Maloney (ed.) *Indo-Pacific Prehistory: The Melaka Papers*: 17-24. Bulletin of the Indo-Pacific Prehistory Association 18.
- 2002. They've grown accustomed to your face, in S. Bedford, D. Burley & C. Sand (ed.) *Fifty Years in the Field: Essays in Honour and Celebration of Richard Shutler Jr's Archaeological Career*: 51-9. New Zealand Archaeological Association Monograph 25. Auckland.
- STUIVER, M. & P.J. REIMER. 1993. Extended ¹⁴C database and revised CALIB radiocarbon calibration program. *Radiocarbon* 35: 215-30.
- SUMMERHAYES, G.R. 2000. *Lapita Interaction*. Canberra: Department of Archaeology and Natural History and Centre for Archaeological Research, Australian National University. Terra Australis 15.
- WICKLER, S. 2001. *The Prehistory of Buka: a Stepping Stone Island in the Northern Solomons*. Canberra: Department of Archaeology and Natural History and Centre for Archaeological Research, ANU. Terra Australis 16.
- WICKLER, S.K. & M. SPRIGGS. 1988. Pleistocene Human Occupation of the Solomons Islands, Melanesia. *Antiquity* 62: 703-6.