Curves, tines, scutes and Lapita ware

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The ware

The distinctive decoration on Lapita pottery is most notable for the strictness of the impressed designs, usually with dentate stamps, and the care with which they are executed. This can be contrasted with the rather poor quality of the materials used in its manufacture, where a porous low temperature fired pottery is the usual product (Ambrose *n.d.*). The striking external appearance of the typical Lapita vessel has commanded more attention from archaeology than the basic pottery fabrication technology but even so the particular technology of the decorative technique has received relatively minor attention. Exceptions have been the work of Siorat (1990) using detailed inspection and measurement of design elements, and Basek (1993) with her replication studies, where both endeavoured to identify the materials and methods used to produce the intricate designs. The standard candidates for stamp materials include a selection of naturally occurring raw materials that have the desired curved surfaces such as shellfish, plant shell husks, sections of bamboo and animal bones. Siorat's study of New Caledonian Lapita wares indicates that no two pots share the same stamp impressions (Siorat 1990:59), the inference being that the tools were discarded after each pot was made. For this reason there is the suggestion that the pottery was made for some ceremonial purpose that required the tools to be discarded or destroyed. The tools used for the dentate stamping technique have not been found in any excavation, although bone multi-pronged tools suited to tattooing have been found in early Lapita sites. Basek suggests that a rouletting action using a short arcuate spatula could account for the various design elements found on Lapita stamped pottery and that various implements could be made from common materials such as shell, coconut husk, wood or even fingernail (Basek 1993).

An inspection of the stamped impressions on Lapita potsherds from the Ambitle site may be informative in identifying possible materials that could be fashioned into prepared stamps. When repeating impressions are compared they show that a fixed form has been used to produce a composite shape built up as a series of lines from an identical stamp (Fig. 1). This repetitive unit construction also occurs with straight or less than perfectly straight elements that replicate without variation. The unvarying replication indicates that the less controllable rouletting technique suggested by Basek (1993) has not been employed in producing the Ambitle designs. This view is supported by the further observation that identical irregularities are found in repeated linear sections where spacing between individual lines is very small and where rouletting the same irregularity is highly improbable.

There are two aspects which may narrow the selection of materials suited to the task. These are the geometry of the impressions, and the particularities of the tooth impressions. A inspection of sherds from the Ambitle Lapita collection for these two aspects may help to determine the method used to produce the dentate stamped designs.

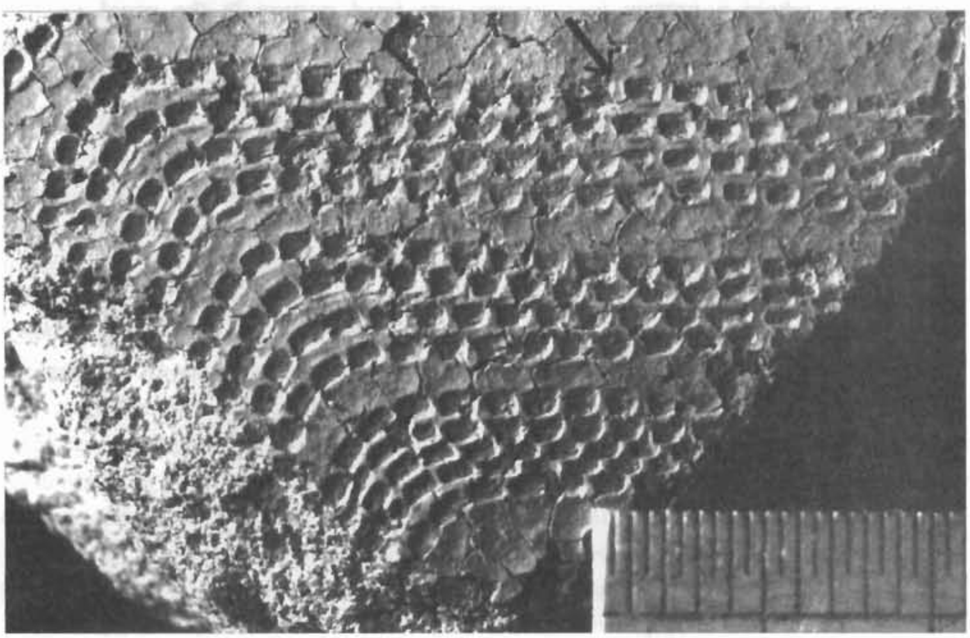

Figure 1

A composite of four closely spaced identical stamp impressions forming wider curved design elements. It appears that two stamps were employed, overlapping a curved and straight stamp sections at the arrow indicator. Scale is in mm. (The basic curve is also presented in Figure 2j).

Geometric aspects

The smallest design elements can consist of circles or arcs of circles but these are typically less than 5 mm in diameter and could be easily produced by sections of reed or bird long bones. Curved impressions for all but these smallest design elements are non-circular, with most curves following parabolic and hyperbolic forms of conic sections. True circular form arcs are absent from the Ambitle collection apart from the smallest items. Curved stamp decorations on Lapita sherds show some examples of typical conical section forms as shown in (Fig. 2). The single line in the illustration is produced from enlarged photographs of sherd decoration where a flexible curve was superimposed on the image and then used as a pattern to trace the line drawing. The general hyperbolic equation for these curves is ($Y=a/X$) with a computed example in Figure 2a with a close approximation in the sherd non-dentate stamp of Figure 2b; a computed parabolic curve ($Y^2=4aX$) is shown in Figure 2p with a close approximation to a dentate stamp line curve in Figure 2o. In the case of the Ambitle sherds these range from a relatively gradual curve (Fig. 2b) to one more abrupt (Fig. 2n). A feature of some of these curves is a slight distal limb inflection (Fig. 2 d, g, j, m). It is not always possible to differentiate between hyperbolic and parabolic curves but all curves appear to be in the range of non-circular conic sections. This family of relatively narrow range geometric curves would not be expected if they were produced from stamps individually manufactured from rigid materials such as shell, bone or wood where more complex curves could be formed at will.

Tine shape

The second aspect which can give clues to the material used for making stamped impressions lies in the characteristics of the tine shape within the dentate designs. Dentate impressions from a rigid material such as bone or wood would follow the stamp curvature with regular rectangular intervals but single tine impressions that would be trapezoidal (Fig. 3a). This follows from incising parallel intervals on the curved edge of a bent strip. Intervals incised on the edge of a straight strip would also be rectangular as would the tines (Fig. 3c). If on the other hand the stamp is bent from a straight strip of flexible raw material that had regularly cut intervals, the tines would remain rectangular but the intervals would be distorted to trapezia (Fig.3b). This latter circumstance would be a good indication that bending had occurred after tine formation with the example of Figure 3b shown photographically in Figure 4, where the major interval distortion occurs at the crest of the curve. An examination of Lapita sherds from Ambitle shows that for curved sections both trapezoidal and rectangular segments are present. From this it can be concluded that serrations were sometimes made on straight plastic strips before they were bent to the desired curvature. The evidence is sometimes ambiguous as in cases where the interval cuts are not parallel, as they appear in Figure3c, but by being incised at an angle to the plane of the stamping edge they appear as wedged shaped even in straight stamp sections (Fig. 3d). This effect should be differentiated from the case of curved sections where the trapezoidal intervals occur only at the crest of the bent section as seen in Figure 2b and Figure 4. In bending short strips it would

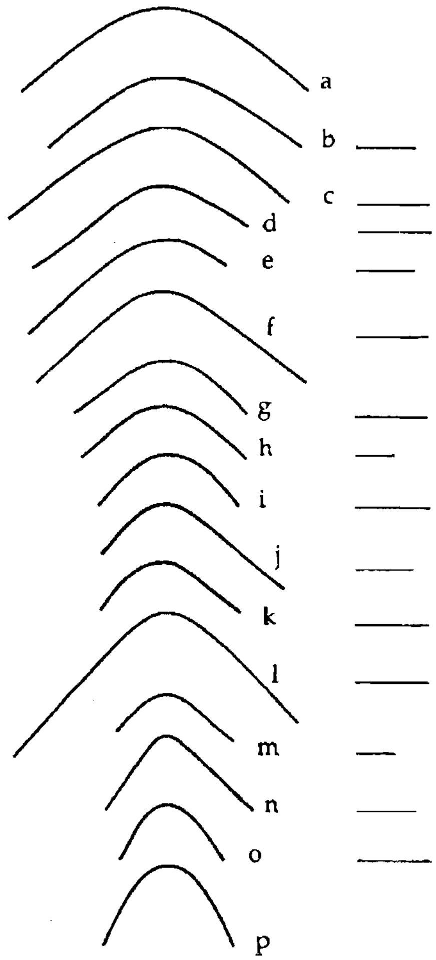

Figure 2
Stamping tool curves abstracted from enlarged photographs of sherds in the Ambitle Lapita collection. The bar to the right side represents 5mm in the original sherd. (a), computed hyperbola conforming to Y=a/X; (b) 2 repeated parallel lines, plain non-dentate stamp - Ambitle catalogue No 1/E 61; (c), 4 closely spaced repeated lines -1/F 60; (d), 3 closely spaced repeated lines -1/K 28; (e), 3 repeated lines, plain non-dentate stamp -1/A 103; (f), 4 closely spaced repeated lines - 1/E 47; (g), 3 closely spaced lines -1/J 20; (h), single and double parallel lines, non-dentate stamp -1/A 52; (i), repeated alternating single unit [see Figure 4] -Nth L5/6; (j), 4 closely spaced repeated lines - 1/E 102, see also Figure 1; (k), 3 closely spaced lines -1/G 51; (l), 3 closely spaced repeated lines -1/K5; (m), 3 repeated lines -1/C 64; (n), 3 closely spaced lines, poorly developed to absent dentate impression - 1/C 25; (o), 1 repeating stamp line series-1/H, I 24; (p) computed parabola conforming to Y2= 4aX.

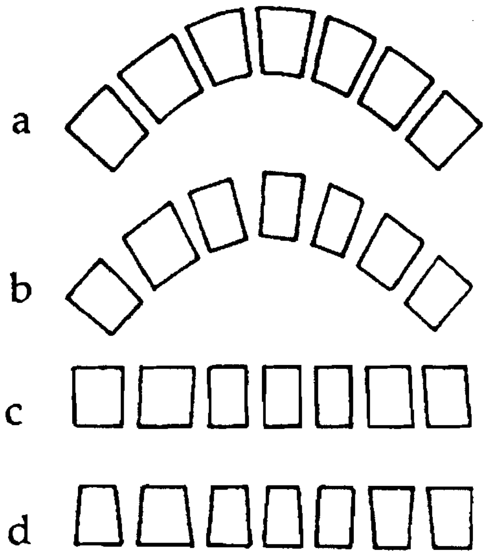

Figure 3
Abstracted and hypothetical curves derived from a consideration of the sherd also presented in Figure 4 and Figure 2i. (a), rectangular spaces between trapezoidal tines when the divisions are incised on a curved form. (b), rectangular tines and trapezoidal spaces when the divisions are incised before the strip is bent. (c), rectangular intervals on a straight edge giving equally rectangular tines. (d), trapezoidal tines and spaces formed by incising the intervals at an angle to the plane of the stamp surface.

be expected that non-circular curves would be produced and indeed in decorated sherds this effect can be seen with the typical conic sections presented in Figure 2. The serrations on the edge of such material are often very fine and fairly evenly spaced; how these are made is unknown but a small sharp obsidian flake would be quite adequate for the purpose.

Scutes

Among the possible natural products available to Lapita potters that could satisfactorily be formed into a flexible curved stamp, that would hold a permanent curvature, would support fine dentition, and is unlikely to be preserved in archaeological deposits, there is one fairly obvious material. Sea turtle was an important item for the early colonisers of the tropical southwest Pacific as shown by the persistent archaeological presence of its remains in coastal faunal collections. The plentiful green turtle (*Chelonia midas*) was probably the worlds most valuable species in economic terms up to recent times (Alderton 1988:118) and its thin polished shell, or scute, has been used for ornamental purposes. In the past it would have provided a ready food source either as a plentiful meat supply or as a coastal supply of eggs where the turtles assembled for repeated mass

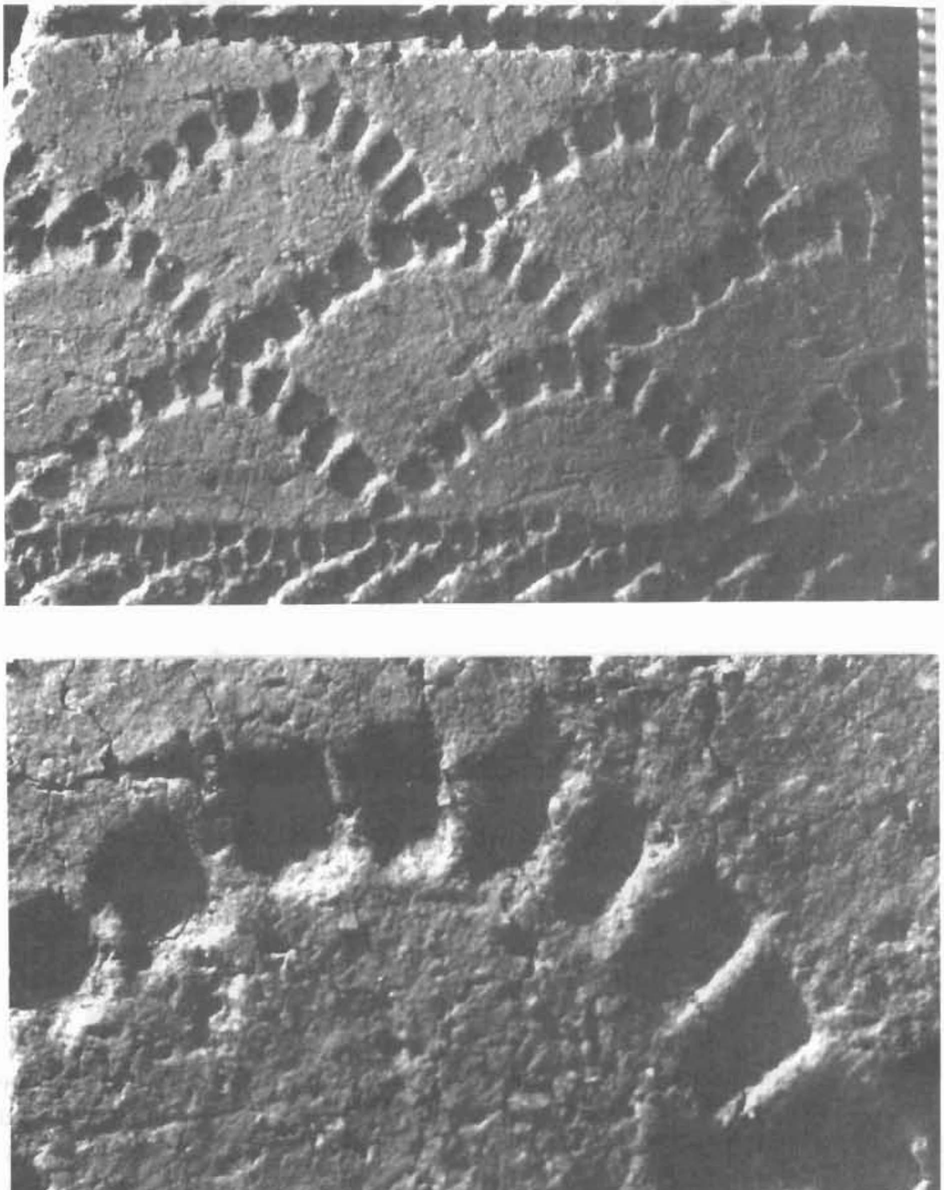

Figure 4
Curved dentate stamp design showing rectangular tines with interval divergences at the crown of the arc in the zone of maximum curvature. The lower enlarged section is from the top left section of the upper photograph. The abstracted curve is represented in Figure 2i. The scale is in 0.5mm intervals.

hatching episodes over several months (Bustard 1972:123). The green turtle is capable of laying several clutches in a season with a total that can exceed 1000 eggs (Moll 1979:323). The nesting behaviour and natural history of the five main species inhabiting the tropical waters differs sufficiently to allow for a range of hunting periods that may have satisfied long seasonal exploitation, or at least until easily accessible animals may have been over-exploited, as with most of the other available fauna targeted by early hunter-settlers. The larger sea turtle species, include the leatherback (*Dermochelys coriacea*), the green turtle (*C. midas*), and the loggerhead (*Caretta caretta*) which can reach weights of several hundred kilograms (Pritchard 1967) would provide a worthwhile food resource for near-shore hunters, while the smaller hawksbill (*Eretmochelys imbricata*) would yield food but most importantly provide valuable scute for manufacture into artefacts. It is most likely that early Oceanic explorers found turtle at many newly discovered islands so that its anticipated availability could be one factor encouraging further exploration, while it could also be captured and carried live as a reliable food store. To the present time turtle and its eggs are regarded as a desirable catch in most coastal societies of the tropical Pacific. Its value as a source of turtle shell for manufacture into striking adornments was found in recent times as intricately fret-worked silhouettes against the stark white background of tridacna plates typically known as the Polynesian *kapkap*. The thin scutes from the green turtle could be used for small fretted items but the most valuable scute source species, also known as the turtle shell species, is the hawskbill turtle (*E. imbricata*) which is commonly found around coral reefs and shallow waters (Alderton 1988:120), making it easily accessible to reef fishing by early Lapita hunters. Its habit of nesting on coral cays as small 'sessile' populations isolated from other groups by only a few kilometres (Bustard 1979:523) would make it more easily located by hunters but could also lead to local population collapse in heavily targeted areas.

Turtle bone is well represented in Lapita faunal collections but no scute artefacts have ever been reported from early archaeological contexts. To judge from its ubiquitous presence in recent collections of ethnographic artefacts from the tropical Pacific, turtle shell was a valuable raw material. It would be remarkable if this material was ignored by Lapita artisans. Heat treatment above 90 °C can make the flexible turtle scute malleable enough to form into various curved shapes. At the same time there are minimum size limits to the curvature that can be achieved before rupture occurs at the sharpest bend; for stamps below these minimum size limits other materials could be employed as seen with the small circular impressions. No natural material other than turtle scute appears to have all the properties necessary to produce the ornate dentate stamps, some of which are shown to have had their stamp edges prepared before being bent into the desired curvature. This rules out the suggested rigid materials of bone, shell or wood as the precursor stamp raw materials. The narrow family of basic curves that result from bending a flat strip is present in the Ambitle Lapita collection as typical conic sections. As this is a relatively early group of pottery on stylistic grounds (Anson 1986:162) it seems clear that the technology of decoration was also an early innovation that imparted a distinctive quality to Lapita pottery that lasted for several centuries. But by any measure the use of scute stamping tools should not be regarded as a major innovation in coastal societies that hunted turtle. What is more interesting is that the stamping tools prevailed over other possible materials for so long so that the restricted nature of the early Lapita designs is matched by a restricted tool kit. It is the plasticity of turtle shell that commends it as a very useful material and one that would be highly suited to forming the curved stamps, both dentate and plain, that ornament Lapita pottery. Turtle scute could be bent while hot into potentially many shapes that do not seem to occur on Lapita pottery designs and this again underlines the very conservative nature of the pottery and its ornamentation, and the need for further study on the decorative technology that was employed.

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