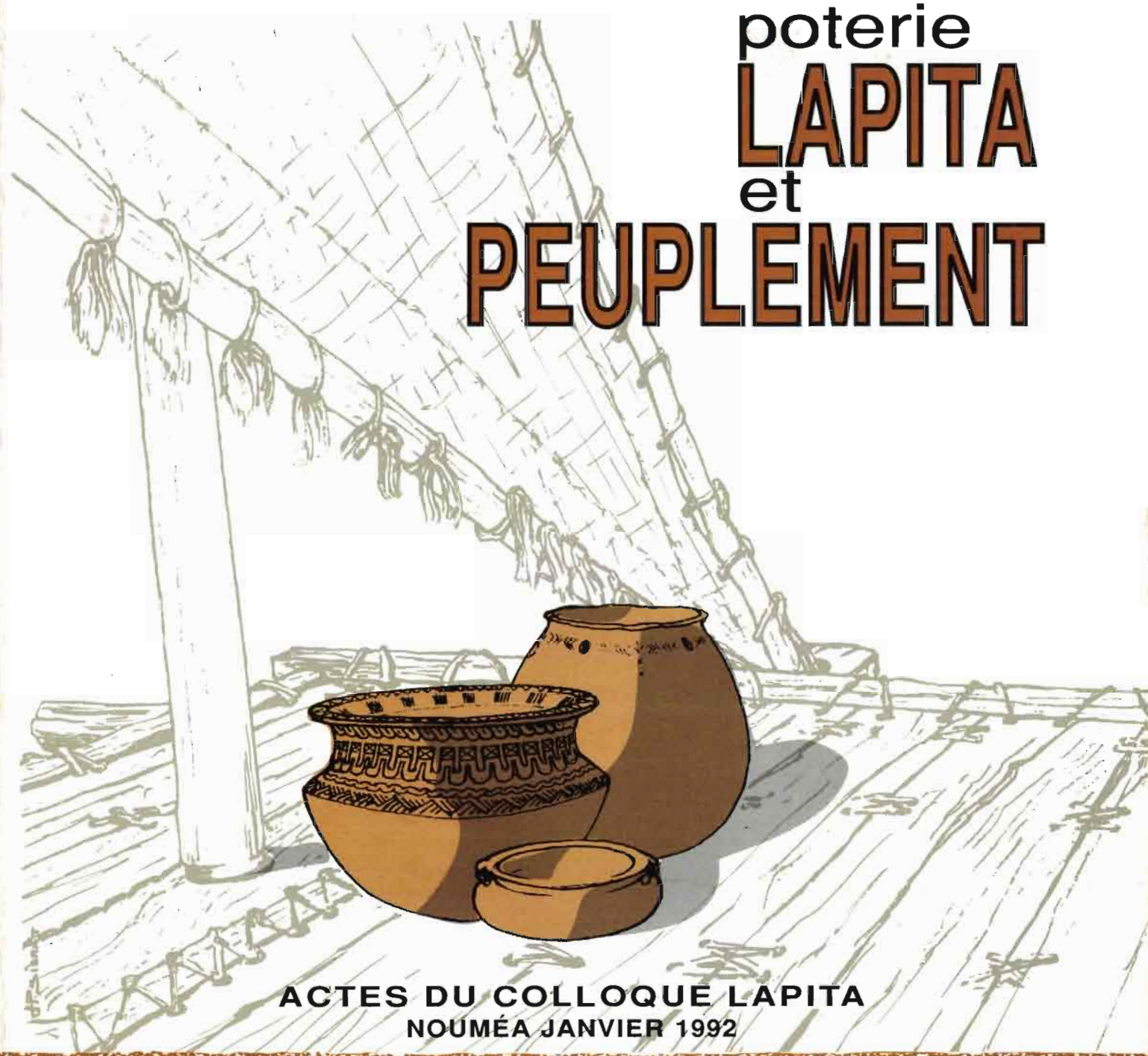
poterie LAPITA et PEUPLEMENT



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NOUMÉA JANVIER 1992

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SOMMAIRE

AVANT-PROPOS

Voici rassemblés dans ce volume les articles des communications du second atelier de travail sur le Lapita qui s'est tenu à Nouméa au mois de Janvier 1992.

Les sujets abordés sont très divers et reflètent bien l'atmosphère informelle et ouverte qui a prévalu pendant la durée de cette conférence. On retrouve néanmoins dans cette diversité le thème initial de l'atelier, à savoir :

"La place du complexe culturel Lapita dans la genèse des sociétés anciennes du Pacifique"

La variété et la multiplicité des thèmes abordés nous rappellent, s'il en était besoin, la richesse de cette société ancienne du Pacifique. S'agissant cette fois-ci de la discussion de la notion même de "complexe culturel" et non plus simplement de "poterie" Lapita, une grande place a été réservée à l'étude des objets de la culture matérielle associés au Lapita, en particulier le lithique. La poterie n'a néanmoins pas été oubliée mais c'est la diversité des styles anciens plutôt que l'homogénéité du Lapita qui est présentée.

Les articles ont été groupés en fonction de leurs affinités et non par thèmes. L'introduction revenait naturellement à Roger Green, qui a su tout au long des débats veiller au cap et présente ici la synthèse nécessaire de l'évolution du concept "Lapita". Cette introduction est suivie d'une revue de la situation autour du "foyer" mélanésien et en marge du développement du Lapita. Les résultats récents de l'analyse du matériel lithique et de la céramique sont ensuite présentés avec les réflexions qu'ils suscitent. Une série d'articles en forme de point d'interrogation concluent le volume.

Ce séminaire n'aurait jamais eu lieu sans l'aide financière apportée par l'ORSTOM, tant pour l'organisation que pour la publication des résultats et je veux remercier au nom de tous les participants, le Département SUD et la DIST qui ont bien voulu croire à l'intérêt d'une telle rencontre et s'en sont partagés les frais. A Nouméa, Michel Fromaget, responsable de la DIST pour le Pacifique, et son épouse, ont assuré le soutien logistique dans des conditions souvent difficiles et n'ont pourtant pas eu peur de nous accompagner sur le terrain lors de la visite des principaux sites de l'île. Patricia a assuré avec constance et bonne humeur le secrétariat de l'atelier. En brousse, l'aide chaleureuse du Lion's Club de Bourail nous a permis de visiter le site archéologique de l' îlot Vert et le collège de Né-Divin à Houaïlou a accepté de nous loger. Je ne peux nommer tous ceux qui de près ou de loin ont participé au succès de ce séminaire, ils sont trop nombreux, mais je les remercie tous très sincèrement pour l'aide apportée et la bonne humeur partagée.

Mes derniers remerciements s'adressent à Jean Pierre Mermoud qui, derrière la console, a patiemment mis en forme ce manuscrit.

PRÉFACE

J. Garanger

Un premier colloque sur l'étude des différents styles du décor céramique "Lapita" s'était tenu à Canberra en Décembre 1988 dans le cadre du Département de Préhistoire de la "Research School of Pacific Studies" (Université Nationale Australienne : ANU). Malgré le thème précis de cette réunion, beaucoup de communications et de débats ont concerné l'ensemble de la Préhistoire du Pacifique occidental. On peut s'en rendre compte en lisant les actes de ce colloque (1). Cet élargissement du sujet était inévitable, si l'on considère la place primordiale que tient depuis longtemps cette tradition céramique dans les essais de compréhension de la préhistoire des Océaniens (2). Dans le passé, plusieurs essais d'analyse des décors lapita avaient été tentés au niveau régional, puis des tentatives de comparaisons inter-régionales (cf. note 2). Roger C. Green, en 1976, dans une communication présentée à Nice au IXème Congrès des Sciences Préhistoriques et Protohistoriques (3), démontra combien pouvait être fructueuse l'étude comparative des styles de d écor Lapita à travers le temps et l'espace, pour mieux comprendre les processus et la chronologie de la colonisation du Pacifique Occidental par les populations porteuses de la poterie Lapita et du "complexe culturel Lapita". Il mit aussi en évidence l'existence de réseaux de relations inter-insulaires. De tels travaux se révélaient d'autant plus intéressants que beaucoup pensaient, et depuis longtemps (et beaucoup le pensent encore), que les "populations Lapita" étaient les ancêtres uniques et directs des Polynésiens. La recherche et l'étude des sites Lapita, déjà nombreuses depuis les débuts des années 1960, s'intensifièrent dans les décennies suivantes (en négligeant quelque peu la recherche et l'étude des sites non Lapita en Mélanésie, comme je l'ai déjà écrit ailleurs et comme le souligne, dans cette publication, Paul Gorecki). Les découvertes furent abondantes, les investigations de plus en plus exhaustives en s'intéressant, entre autres, aux aspects socio-économiques de ces implantations Lapita... et tous les résultats et théories qui en pouvaient découler suscitèrent de nombreuses controverses, ce qui est naturel et même nécessaire, la science ne pouvant progresser que par la confrontation des idées. Ceci explique et justifie que le thème initial de ce premier colloque n'ait été que partiellement abordé, le problème de l'analyse des décors Lapita en vue de leur étude comparative, par traitement informatique sur ordinateur en particulier, n'en restait pas moins à résoudre. Il fut alors envisagé de se réunir à nouveau afin que chacun puisse rendre compte de ses dernières recherches en ce domaine. Daniel Frimigacci suggéra de le faire à Nouméa, dans le cadre du Centre ORSTOM où, chercheur du CNRS (4) il avait été détaché pendant plusieurs années. Ayant rejoint son laboratoire CNRS à Paris quelques temps après, et un jeune chercheur de ce même laboratoire : Jean-Christophe Galipaud, ayant alors été recruté par l'ORSTOM au Centre de Nouméa, c'est lui qui prit en charge l'organisation de cette nouvelle rencontre, sous l'égide de l'ORSTOM.

Ce second "Lapita Design Workshop" se tint donc en Nouvelle-Calédonie, au Centre ORSTOM de Nouméa, du 22 au 29 Janvier 1992. Cette fois encore, le thème proposé fut largement dépassé et seules deux communications y furent strictement consacrées : celles de Nancy Sharp et de Jean-Pierre Siorat. Mais ceci était, cette fois encore, inévitable et nécessaire, d'autant plus que de nombreux résultats concernant l'ensemble de la Préhistoire du Pacifique Occidental avaient été obtenus et diffusés depuis, notamment dans le cadre du "Lapita Homeland Project" (5). Les participants, à la fin de ce second "Workshop",

souhaitèrent la publication de ces actes, l'ORSTOM l'accepta, Jean-Christophe Galipaud devant assumer la responsabilité de la mise au point de cette publication.

A la fin de cette seconde rencontre également, les participants émirent le voeu qu'elle soit suivie d'une troisième et l'on suggéra qu'elle se tienne à Honolulu avec pour thème : "Le monde mélanésien à 6000, 3000 et 2000 BP", thème plus large et plus conforme au réel contenu des deux premières réunions.

NOTES

(1) - SPRIGGS, M. (ed.), 1990 : "Lapita Design Form and Composition". Proceedings of the Lapita Design Workshop, Canberra, Dec. 1988, Canberra : ANU. *Occas. Pap. Prehist.*, n°19.

(2) - J. GARANGER, 1974. "La poterie Lapita : essai de bibliographie", *J Soc. Océanistes, Paris*, XXX, 42-43, 17-24.

(3) - GREEN, R.C., 1976. New sites with Lapita pottery and their implications for an understanding of the Western Pacific. *In* : J. GARANGER (ed.), *La Préhistoire Océanienne*, Colloque XXII du IXème congrès de l'UISPP, prétirage, 55-87.
(Cf. également, ci-après, la communication, et sa bibliographie, de R.C GREEN)

(4) - Centre National de la Recherche Scientifique, laboratoire d'Ethnologie Préhistorique du CNRS et de l'Université de Paris I, Paris. ORSTOM : Institut français de recherche scientifique pour le développement en coopération.

(5) - Jim ALLEN et Chris GOSDEN, (eds.), 1991. "Report of the Lapita Homeland Project". Canberra : ANU. *Occas. Pap. Prehist.*, n°20.

DEFINITIONS OF THE LAPITA CULTURAL COMPLEX AND ITS NON-CERAMIC COMPONENT

Roger C. Green

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RÉSUMÉ

Définition du complexe culturel Lapita et des ses constituants non céramique.

Cet article reprend les énoncés de ce que le complexe culturel Lapita peut englober et les évalue. Le terme "complexe culturel" a été préféré car il rend compte de la diversité reconnue tant spatiale que temporelle ou dans le contenu. On développe ensuite l'argument selon lequel si le Lapita ne peut être qu'un complexe culturel fondateur en Océanie lointaine, les sites avec un contenu similaire en Océanie proche peuvent aussi représenter un phénomène similaire. Il ne s'agit pas simplement de l'intrusion d'unités céramiques caractéristiques ou même d'un complexe céramique, mais bien de l'apparition de nouveaux types de sites dont les assemblages comprennent un certain nombre de nouveaux éléments. Ceux-ci dont l'origine est plus à l'ouest, sont intégrés à de nombreux éléments ayant des antécédents en Océanie proche ainsi qu'à quelques innovations largement corrélées aux assemblages contenant de la poterie Lapita. Les dimensions spatiales et temporelles de ce complexe culturel sont ensuite brièvement évoquées et les problèmes d'un contenu non céramique sont envisagés dans le détail.

ABSTRACT

Statements of what the Lapita cultural complex might comprise are reviewed and assessed. The term "cultural complex" has been preferred because of a demonstrated geographic, temporal and content diversity. An argument is then presented that if Lapita in Remote Oceania can only be a founding cultural complex, sites with much of that same content in Near Oceania may also represent a similar phenomenon. It is not simply a case of trait unit intrusion of pottery, or even a pottery complex, but of site unit intrusion in which assemblages reflect a number of new elements which have origins farther west, integrated with a fair number of elements that have antecedents in Near Oceania, plus some innovations that are very largely confined to assemblages with Lapita pottery. The spatial and temporal dimensions of the complex are then briefly discussed and the problems of a non-ceramic content considered at greater length.

Definitions of the Lapita cultural complex have never been formulated in overly explicit terms. Instead, use of the concept as an archaeological unit was developed by a few writers and then adopted by others with little further discussion when it suited their purposes. Still others have preferred the seemingly simple term Lapita, or spoken of a Lapita culture or even a Lapita people. Finally, a few have doubted the utility of any of these concepts, believing they tend to obscure the issues.

Some historical background

Recognising the likelihood of some kind of historical relationship in the similarity of collections of potsherds in what by 1967 Golson (1959 : 38,1962 : 176,1972 : 555) was calling the Lapita style, he initially spoke of some early community of culture widespread over the area from the Bismarcks to West Polynesia. By 1969 Golson was addressing the question "What is Lapita?", and arguing that in discussion he had "advanced the frame of reference of Lapita from a distinctive style of ceramic decoration to a cultural complex" (Golson 1971 : 73). The points he made about this transformation were :

1.The integrity of the decorative style from Watom to Tonga and its association with distinctive vessel forms.

2.The establishment of a set of non-decorative features for Lapita pottery which enables the recognition of its affiliations in the largely undecorated Erueti and wholly undecorated Samoan ceramics - i.e. the recognition of a characteristic "Lapita plain ware" and its vessel shapes in association with a different set of decorated vessels (Golson 1971 : 70,73).

3.The limited and inadequately defined, though probably sufficient range of evidence associated with Lapita ceramics "to testify to the presence of a dimension beyond pottery to Lapita in the South Pacific" (Golson 1971 : 74). At that time the existence of this cultural complex was most evident in Tonga where its development could be traced through some centuries of continuous change.

4.The expectation of such a cultural complex from the circumstance that the makers of Lapita pottery appeared to be "the pioneer settlers of the further islands of the south-west Pacific, for pioneers carry cultures with them" (Golson 1971 : 75).

5.The recognition that the scale of chronological and geographical distributions of Lapita ware meant it possessed features of both a horizon and a tradition in the American usage of those terms. For this situation Golson (1971 : 75) proposed that the term ceramic series was an appropriate designation. On each of these points Golson has, in my view, been very largely supported by the evidence accumulated over the next two decades.

In the following years these matters were also addressed by Green, who in large part followed the lead provided by Golson. For example, Green (1973 : 332) soon thereafter wrote of "a slowly developing definition of an associated culture or 'cultural complex'", noting that the latter term was often preferred because the assemblage of artefacts recovered from these sites is generally quite varied in contrast to the Lapita dentate-stamped motifs on certain pieces of pottery that provided the initial links in grouping these materials together. By 1974 he was further outlining a ceramic style defined as Lapita that could "be interpreted, along with the cultural complex which accompanies it, as a horizon" (Green 1974 : 250). He went on to define in descriptive terms the Lapita ceramic series, divide it into an Eastern and Western Lapita, specify more precisely the Eastern Lapita vessel forms, and characterise the plain ware component within that part of the series.

While Golson (1971 : 75) had suggested that it was then only feasible to establish a ceramic series, as one part of the parameters of the cultural complex, Green (1971,1974) also attempted to define an associated adze kit, again largely based on Eastern Lapita assemblages. Green (1976,1978) went on to further refine the Lapita ceramic series and its

design system by using various analyses of pottery assemblages from the Reef/Santa Cruz region belonging to the Western Lapita part of the complex. At this time he also discussed the "polythetic" nature of the complex initially commented on by Bellwood (1975 : 13), and described more fully its expanding portable artefact inventory, its origins, and changes within it. These led to a non-ceramically oriented review of Lapita (Green 1979) in which the concept of a Lapita cultural complex was more thoroughly explored. The two points made were that the term "Lapita cultural complex" seemed the most satisfactory way to encompass the dimensions of both a horizon and tradition, and that while the pottery provided the most obvious traits used to identify the cultural complex, a better understanding could be achieved if aspects other than the pottery were summarised more fully. The other aspects then considered in some detail were the characteristics of Lapita settlements, their economy, the associated exchange system, and the non-pottery content in portable artefacts. The concepts of a Lapita ceramic series and design system were mentioned but not developed further.

On reflection what is noteworthy in Green's work is that almost all the data on which his views were based came from Remote Oceania, where Lapita, as Golson anticipated, seemed to represent the material culture of founding inhabitants (cf Spriggs 1984, 1991a). The expectation that this was almost certainly not true for sites in the Bismarck Archipelago was recognised (Green 1979 : 47) but its implication of a great increase in the difficulties of assigning sites with relevant assemblages to the complex was not addressed. Appropriate sherds of pottery were in general still deemed sufficient to provide the linkage.

Progress in these matters over the next decade was slow. As a consequence, when Kirch (1988c : 5-7) came to review the situation, he found the aim of defining the Lapita cultural complex had been advanced in large part through a shift of discussions from Polynesian origins to the Melanesian area and to Lapita itself. The focus was no longer simply pottery but included settlement patterns, the subsistence economy and the nature of Lapita trade and exchange.

In this period Bellwood (1975 : 12-15) began by following Golson in employing the term Lapitoid ceramic series (whose makers were ancestral to Polynesians). In his hands, however, it soon became "the Lapita culture" (Bellwood 1978 : 244) and has retained this designation in most of his subsequent writings (Bellwood 1987). The concept of a "culture" as the appropriate archaeological unit presumably follows common British usage along the lines set out by Childe (1956 : 16,33-34). Lapita as a "people" who engage in similar activities (Rouse 1972 : 68) has been less often talked about, particularly as skeletal materials associated with pottery in that style have been very limited (Green 1989 ; Kirch et al. 1989). Still from Bellwood (1978 : 255) on there have been attempts to assign the people who engaged in making Lapita pottery certain biological and linguistic affinities.

Among those who have questioned the utility of various integrative terms for Lapita are Allen and White (1989 : 142), who see the cultural complex, but not the pottery, as developing in the Bismarcks. Thus for them "the `Lapita cultural complex' is likely to be only the ceramic part of a much longer cultural sequence" (Allen and White (1989 : 143). For Terrell (1989 : 624) too, the new evidence from the Lapita Homeland project implies there is no longer an easy definition of the Lapita cultural complex, at least in Near Oceania. The many trade items in its inventory obscure the picture, the notion of ethnicity that the concept implies is wrong when it becomes the fundamental organising principle, and Lapita was really only "a trade ware in Melanesia" (Terrell 1989 : 625).

Some theoretical considerations

With the above as historical background, it is worthwhile looking in brief elsewhere at the three concepts of culture, horizon, and cultural complex when these have been employed as archaeological units. Several points need to be made first. What is being attempted is the formulation of cultural units and not the classification of artefacts or cultural remains. Most researchers recognise that these two operations need to be kept separate as the problems and procedures are not the same (Rouse 1972 : 78 ; Adams and Adams 1991 : 224). Next, in carrying out cultural classification it is a hierarchy of archaeological units that is being employed, with Lapita, acting as one of the integrative devices. Adams and Adams (1991 : 182-84,224) call this process "formulation", and not classification, and they describe it as "the clustering of pottery, tool, house, and grave types to form `culture' concepts, which themselves may or may not be classified". Finally, the use of Lapita has generally been on Rouse's (1955 : 718-19) genetic level of interpretation, by which he broadly meant "any relationship between discrete units resulting from some form of historical contact" (Willey and Phillips 1958 : 30). To avoid the implication of phylogeny in the use of the term "genetic", Willey and Phillips (1958 : 30-31) used the term "integrative" instead, and strongly defend the use of such culturally determined integrative units in culture-historical archaeology. This points to most of the problems encountered with the use of the term Lapita. It is often seen as implying a strict phylogenetic relationship, where none may exist, and it is frequently regarded as part of an outmoded type of synthesis, the culture-historical, that is no longer acceptable to archaeologists of a processual, post-processual or other persuasion.

Local and regional sequences organising sets of named archaeological assemblages into temporal/spatial classes variously called cultural periods or phases (but not in the Pacific foci) are as typical in Lapita and Pacific archaeology as they are elsewhere in the world. It is also common to divide sets of Lapita assemblages geographically and speak of Eastern, Western, and Far Western Lapita. Little quibble so far has arisen over the process of the formulation of these archaeological units ; rather the arguments here have been about their temporal and spatial details. The main criticism instead has been directed at the higher level integrative units of horizon, cultural complex, and culture.

Willey and Phillips (1958 : 33) define a horizon as "a primarily spatial continuity represented by cultural traits and assemblages whose nature and mode of occurrence permit the assumption of a broad and rapid spread". Thus the lower level archaeological units linked by a horizon are assumed to be approximately contemporary, though it is recognised that independent dating may reveal that they possess a considerable temporal depth with some "slope" to the spread of the elements into adjacent areas. Few would, I believe, therefore dispute the statements in the literature noted above that Lapita is a horizon, or at least in part functions as that kind of archaeological unit. There are, indeed, times when one might wish that suggested usage alone had prevailed.

Rouse (1972 : 84,274) provides a discussion and possible definition for the term "cultural complex". Cultural complexes he finds are classes of assemblages formed by grouping one's assemblages in terms of patterns of types, and other kinds of cultural norms. Generally, it includes only a portion of these items, usually those considered as diagnostic, or the "common denominator of all assemblages in the class" (Rouse 1972 : 87). Interestingly, he sees "style" as one of its synonyms, and cites Kluckhohn (1962 : 75-76) as making the point that in many cases the classification is made on the basis of a pottery complex or architectural style. This seems fairly close to what Golson and Green were doing in extending the concept of Lapita from a ceramic style to include other commonly

associated non-ceramic elements among the sets of archaeological assemblages with that pottery.

The terms "culture" and "civilization" Willey and Phillips (1958 : 47-48) reserve for their maximal or largest possible context integrative units, used "by students of culture-history when they are referring to events on a world-wide scale". This is how one would see Bellwood's use of the term Lapita culture in his books about Pacific archaeology.

Some possible definitions of Lapita

In the literature, suggestions for possible definitions of Lapita range widely from not a complex at all - just a technological trait (i.e. dentate-stamped pottery) to a meaningful cultural unit based primarily upon commonalities in its ceramic design system (Kirch 1988a : 160), to a ceramic series which included both a design system, vessel shapes, and a plain ware component (Golson 1971 ; Green 1976,1978,1979 ; Spriggs 1990a), to a full cultural complex. In the last definition the ceramic series has nearly always functioned as a diagnostic determinant to which other common non-ceramic traits are slowly being added. In my view, the often made claim that Lapita is only a technological trait tells us very little, ignores entirely Golson's point about a distinctive plain ware component, and denies all the sound work done in establishing a Lapita ceramic series.

Lapita certainly involves more decorative techniques than dentate-stamping ; it also involves the concept of style, design system and rules for its composition. Moreover, analytical frameworks have been developed for specifying its content at various levels from the elements through motifs to patterns (Green 1990). Finally, a whole range of vessel forms which differ regionally has been described, and which among them are decorated and which are plain has been indicated. In this class it is also possible, for example, to identify a number of vessel forms, which in a Pacific context are virtually unique to Lapita, from a range of flat-bottomed dishes to ring-footed and pedestal forms as well as some of the carinated vessel shapes. These definitions, of course, all require the presence of pottery in the various site assemblages.

One claim, however, reminds us that the presence of that element may not always be crucial. This is Spriggs' (1991b : 237-38) Halika Phase, essentially a "Lapita without pots". That example alerts one to the fact that at times Lapita may be more than pots. The difficulty is, as Kirch (1988a : 161) says, "Intra and intersite variability in Lapita ceramics must not be confined to ceramics, but in most cases, analysis of non-ceramic artifacts has not proceeded beyond the level of simple description". The exceptions are shell objects as "exchange valuables" (Kirch 1988b) and the stone and shell adze types usually associated with Lapita pottery (Green 1971,1991). Thus the problem is not that Lapita might be more than pots ; rather it is that beyond pottery the same sophistication in analysis is presently lacking.

This takes us to the Golson and Green position about Lapita being a complex as outlined above. One can define regional periods, phases, or aspects and foci in sequences that group together assemblages containing Lapita pottery. One can also subdivide these into earlier and later temporal intervals, or into broad-scale geographical variants. All of these have been suggested for various regions in the Bismarcks, through the western Solomons, to Fiji and Tonga but not Samoa. So far as I am aware, none of these lower level integrative categories have been proposed as definitions of Lapita ; that term has always been reserved for archaeological units with a broader temporal, spatial and content range. As was noted above, in surveying the evidence there always seemed sufficient

heterogeneity geographically, temporally, and in terms of content, both in the ceramic and non-ceramic elements, to prefer the term "cultural complex" over "culture" because that seemed to stress the intra and inter-site and assemblage variability. Thus in the various Lapita models that have been proposed, under the distribution variable the state of that variable has usually been judged as culturally heterogeneous (Green 1991a). In summary, we currently have a Far Western (or Early), a Western, and an Eastern Lapita. Temporally, in a number of regional sequences, an early period can usually be ceramically distinguished from a later one, while in some of these sequences there are changes in non-ceramic content as well, as for example the adzes of the Eastern Lapita area or the changing ratios of obsidians and chert in the Reef/Santa Cruz region.

In reviewing the literature and for the reasons discussed above, I therefore prefer at present to continue using the term "Lapita cultural complex" as best identifying an overarching cultural entity. Lapita in this sense still usefully stands for something more than a ceramic series, or even a cultural horizon, though it would probably not constitute a culture in the way that all-embracing term is frequently used.

Rather than a classificatory device, a complex is, as Rouse and Adams and Adams observed above, a clustering of a range of types through a grouping of one's assemblages (often in terms of style) to form a useful higher level cultural concept. This leaves the archaeologists of different islands or island groups free to specify periods, phases, and aspects within particular regional sequences which they may then assign (or not) to the cultural complex. The degree and kind of historical connection to Lapita they propose from their evidence will have to be assessed in each particular case, and judgments made as to whether it came about through common origin, intermittent contact between otherwise unrelated cultural traditions, or through extensive trade and exchange, or some combination of these and other processes.

Problems with Lapita as a cultural complex

The definition of Lapita as a cultural complex is certainly more problematic in Near Oceania than in Remote Oceania, simply because in the former area one expects numbers of earlier as well as contemporary site assemblages which have little or no historical relationship with Lapita. Yet there are, in Near Oceania at least, some site assemblages with a cultural content quite similar to that of many sites in Remote Oceania. Therefore, if one defines the Lapita cultural complex on the basis of the patterns and styles found in the site assemblages of Remote Oceania, it should be possible to demonstrate that rather similar site assemblages occur around that time or slightly earlier in Near Oceania. It follows that these too may rightfully be claimed as part of the cultural complex. The problems arise when :

(a) we encounter site assemblages with some of that content, but either without pottery or without any distinctive Lapita style pottery, or even such assemblages containing pottery seemingly unrelated to the Lapita ceramic series in design or vessel shape.

(b) we consider site assemblages where only a few ceramic items appear related to Lapita and the remaining ceramic and non-ceramic content exhibits little to suggest any historical connection.

(c) we assess site assemblages in which the few "Lapita" items present appear to derive solely from prehistoric transfers.

Thus the theoretical variation in assemblage content may run from the simple spread of a trait unit (ceramics) to a trait unit complex (the Lapita style ceramic series) and thence through various combinations with other associated items. Eventually it extends to whole site unit assemblages which are obviously intrusive, possessing little or none of the content of previous periods, and only some items that suggest interaction with other already established cultural entities. Terrell has summed up the situation nicely, although he extends it to all Lapita whereas I would restrict his statement below to Near Oceania. My view, following Golson, is that ethnicity does apply in Remote Oceania (and to a degree Terrell 1989 : 625 concedes that is so for Fiji and Polynesia), and to some sites and assemblages from Near Oceania. None the less Terrell's (1990 : 827) point is worth repeating :

"Therefore, it would be naive to look for a single, ethnically unified Lapita cultural complex if, in historical truth, Lapita pottery played a complicated, varying, and changing role in the material life of Pacific islanders depending on where, when, and with whom they were dealing".

In reality, then, neither of the above extremes seem to apply, i.e. either a simple trait unit or full site unit intrusion with little or no interaction with already existing cultures. Rather, as Gosden (1989 : 53) and others have remarked, neither a stark immigrant model nor one of largely local development with minimal outside stimulus seems satisfactory ; even now such marked distinctions appear too sharp for what is admittedly still fairly limited information. A balance more in line with the evidence seems to require that along with a fair number of intrusive items, including many components of the ceramic system, one also has to allow for many elements that have antecedents in Near Oceania, and at least a few that are innovations very largely confined to the Lapita cultural complex. In this light, definitions of the Lapita cultural complex in Near Oceania are going to have to embrace even more variation than is already indicated by the evidence from Remote Oceania. As usual, considerations of time, space, and full content will all be crucial, and the early site assemblages of Remote Oceania will provide some of the most useful guides as to what was initially assembled in Near Oceania to form that particular cultural complex.

The reason I say this is, as Golson long ago observed, that in Remote Oceania Lapita represents the founding cultural assemblages for most of its regional sequences, and these comprise a broad range of ceramics, non-ceramic and ecofactual elements. One may claim, on a few pieces of evidence from here and there in the area, the possibility of people exploring in advance of any permanent settlement (Gosden in press), but there is as yet little sound evidence for sustained occupation before Lapita in Futuna, Uvea, Samoa, Tonga, Fiji, Vanuatu or the Outer Eastern Islands of the Solomons. Instead, Lapita sites appear at the base of sequences on former beach lines, at the base of caves with 2 to 4 metres of deposit, often in association with bird and other animal extinctions, and, in a few instances, at a time when major vegetation changes occur in the still limited number of pollen sequences (Enright and Gosden 1992). My position is that this is also the case in New Caledonia. I do not believe in tumuli lacking other cultural associations, but I do find suggestive extinct giant megapods, saurins, and snails in Lapita middens but not in later ones. Finally, there are, I argue, good theoretical reasons for a significant pause in Oceanic settlement confined to Near Oceania, before Remote Oceania was rapidly colonised (Green 1991b).

Strategies for defining the Lapita cultural complex

Taking space, time, and content as the principal considerations, on present evidence the spatial distribution of full-blown Lapita site assemblages is not as widespread as some

have claimed. Thus in my view it cannot as yet include the quite restricted evidence from the Siassi Islands (Lilley 1988 : 513), or depend on a surface sherd from Aitape in the Sepik, nor should it attempt to take in the Indonesian assemblages with decorated vessels probably derived from Lapita at Bukit Tengkorak, Madai, or Kalumpang far to the west of the Bismarcks. Their ceramics and other content are sufficiently different and they date later than most Lapita assemblages (after 2300 BP) to be excluded from consideration. Like Spriggs (1989 : 607) I would assess them as evidence of continuing contact with and influence from Lapita sites much farther east. It is also my view that site assemblages of the Lapita cultural complex, as found extensively in West Polynesia, do not extend into East Polynesia along the lines of conjecture by Kirch and Hunt (1988 : 17). Again temporal considerations and the already fully Polynesian content of the known site assemblages are against it. The possibility of appropriate site assemblages in the Admiralties is raised by the ceramic content of one test excavation on Mouk Island in that group (McEldowney and Ballard 1991), but sites confidently assigned to that cultural complex are otherwise not yet in evidence and the probability of such sites or of Lapita influence is not easily assessed from existing information (Ambrose 1991). So far only transfers from that island group through exchange of Lou obsidian and perhaps some pots in Mussau Lapita sites from Admiralty sources (Hunt 1989) are known. Thus a minimal spatial distribution for site assemblages of the Lapita cultural complex from the Bismarck Archipelago to West Polynesia can be specified, and strong claims for the presence of the complex, rather than the horizon, outside that area will require solid documentation.

Temporally, definitions of the Lapita cultural complex will have to be from the first appearance of a set of traits characteristic of those site assemblages to the first appearance of a new set of traits in assemblages which serve to identify the next phase or period. The complex may not be defined simply from the first appearance to the last appearance of a trait (or even a set of related traits), especially if these are conceived largely in ceramic terms. Thus, in time, Lapita as a cultural complex does not necessarily commence with the first appearance of pottery in Near Oceania, or even the first appearance of dentate stamping on pottery. Instead in each region it will date from the first appearance of site assemblages with several components of the full ceramic series from a range of decorative techniques through a design system and plain and decorative vessel forms to elements of an adze kit, a fishing kit, and shell ornament forms, plus a range of settlement types that include caves and rockshelters, small hamlets and medium and large sized villages. In each of these categories there will be some elements which were present earlier (for example caves and rockshelters and perhaps open hamlets), but also others that are new (such as medium and large sized villages).

When the Lapita cultural complex begins is going to form a slightly sloping horizon from circa 1500 B.C. in the west to circa 1200 to 1100 B.C. in the east (Spriggs 1990b). But when it ends is going to vary from region to region, depending on the local set of new traits that define the next period or phase. It has less to do with when things present in the Lapita cultural complex disappear, than with when new elements that serve to mark a different cultural unit of some type first appear. As the complex is not everywhere followed by another horizon of similar breadth and distinctive character, the temporal variation in the ending of the Lapita complex will necessarily be very uneven. Thus various end points for Lapita and the development of something else have been proposed in West Polynesia, in New Caledonia, in Vanuatu and in the Outer Eastern Islands of the Solomons ; in short, for Remote Oceania. These changes have yet to be as thoroughly investigated in Near Oceania, although new phases are explicitly recognised in Buka and Nissan, weakly indicated in the Mussau, New Ireland, and Watom sequences, and hinted at in the Arawe

Islands. In sum, temporal definitions of the Lapita cultural complex are still feasible, although they will have to be more complex than the usual statements of 1500 B.C. to 500 B.C.

This leaves content. What besides components of a reasonably well described plain and decorated ceramic series make up site assemblages assignable to the Lapita cultural complex? Strategies could take one of several standard approaches for arranging data as outlined by Dunnell (1971 : 44 and Fig.3). One might for example, take a paradigmatic approach (Dunnell 1971 : 70-76), and define all potential combinations or boxes of elements that could remotely be related to Lapita, then see in which boxes most sites with the potential for being Lapita are in fact placed. All of the most common combinations would be site assemblages of the Lapita cultural complex. However, the varying richness of the site assemblages and the wide range in cultural content, plus the labour involved in such an analysis are likely to frustrate this rather uncommon approach. More feasible would be the use of numerical taxonomy (Dunnell 1971 : 98-102) where a list of traits for a set of rich sites (such as those of Mussau and the Reef/Santa Cruz region) was generated, and the content of all potential sites was then compared to the list and accepted as Lapita at some given level of similarity. But again, the known variation in site content, without the ability to distinguish between missing occurrences through sampling error and items truly not present, would not recommend this approach as particularly productive.

The most common approach, of course, is taxonomic (Dunnell 1971 : 76-84), in which a set of traits is weighted according to some hierarchical scheme. This, it seems to me, has characterised the way many archaeologists have approached defining the content of the Lapita complex. Pottery, particularly the easily recognised dentate-stamped pottery, has been given an undue significance and weighting, and other components of the ceramic series, especially among the plain wares, assigned little or no significance. Moreover, non-pottery items have been accorded almost no value, particularly in the absence of pottery or in association only with plain pottery or very largely plain pottery. Again this approach and its associated one of key elements as identification devices (Dunnell 1971 : 102-106), simple and definitive though they may be, are not likely to yield new insights into the kinds of integrative historical connections that allow one to speak of a Lapita cultural complex. The historical connections between the site assemblages included within the complex must depend on assessments of a lot more than just the pottery, or even worse only very selected aspects of the potsherds.

We are left then with cluster analysis or statistical clustering as Dunnell (1971 : 95-98) terms it. Here one takes the main traits of potential Lapita sites, and without pre-assigning some elements more value than others in expressing some kind of historical connection, seeks to see which sites cluster reasonably closely together on a variety of grounds. It is then necessary to assess the probable kind of relationship involved and use that to assign a particular site assemblage to the Lapita cultural complex or not. On those grounds the early largely plain ware site assemblages of Samoa, Tikopia, Anuta, and Taumako, or the non-pottery ones of the Nissan Halika phase are as justifiably part of the Lapita cultural complex as any site with quantities of highly decorated pottery from Mussau or the Reef/Santa Cruz area.

Inadequacy of definition for the non-ceramic component

Statements assessing the situation for the non-ceramic components of the Lapita cultural complex are only now beginning to appear. I record here some of my impressions also discussed in other papers (Green 1991a, in press).

In the realm of ecofacts, arboriculture appears to start prior to Lapita and to have been incorporated within it. Gosden (in press) evaluates the plant evidence, indicating that while a number of items may well be earlier New Guinea domesticates, others are likely to be new additions from Southeast Asia. Among the domesticated animals the pig seems to enter Near Oceania prior to Lapita, but the dog and chicken are again probably Asian imports first appearing at this time. Fishing and shellfishing have deep roots in the Bismarcks prior to Lapita, but the Lapita technology of jabbing and rotating shell fish-hook, and later of lures, are additions that probably have their origins farther west. Two or more kinds of rats are present in many Lapita assemblages as far west as the Reefs and Tikopia, and one of them, the Polynesian rat from Southeast Asia initially occurs in early Lapita sites and is clearly associated with their spread into Remote Oceania (Roberts 1991). The others are Bismarck and Solomon's rats already being exploited well before Lapita.

Related to these economic concerns is the technology for processing, cooking and serving food. There is a possibility that pottery occurs before Lapita (Gorecki, this volume) but assemblages attributable to the Lapita ceramic series, and especially the elaborate and sometimes distinctive vessel shapes of these assemblages differs from most others that follow, and probably any that came before. Earth ovens too seem to occur prior to Lapita in the Bismarcks and are very likely an old Near Oceanic innovation, not usually identified with Southeast Asia, taken into Remote Oceania with the spread of the Lapita cultural complex. Large and small underground store pits, some of them probably for breadfruit paste, may also prove to be a Lapita innovation.

In unpublished assessments of the non-ceramic portable artefacts typically associated with pottery of the Lapita ceramic series (Jephcoate n.d.), two things stand out : one is the bias towards their definition on the basis of sites from Remote Oceania (with only a few in Near Oceania on which to draw), and the second is that in comparison to the pottery, analysis and classification of these items beyond rather broad descriptive categories is often minimal. The early and detailed work of Poulsen (1987) has seldom been followed up. Where it has, as in the adzes by myself, and in the shell ornaments by Kirch, it has proved quite productive. Again a few types of adzes and shell ornaments appear prior to Lapita, but many types make their first appearance then and some of them are certainly Lapita innovations, often quite different to the adzes and shell ornaments of later phases and periods.

This is not the place to go into detail over the fishing gear, shell scraper forms, or composition and technology of Lapita lithic assemblages (cf. Fullagar, Sheppard or Torrence, this volume). Rather it is to stress the point that more than just pottery makes up Lapita site assemblages and in assessments these other items may also act as suitable integrative entities revealing close historical connections between the various site units that are seen to cluster together as part of the overall cultural complex. Its elements were assembled in Near Oceania between 3500 and 3200 years ago from three main sources (local, intrusive and innovative) and shortly thereafter they occur together in Remote Oceania with sufficient frequency to justify their recognition as forming a higher order kind of cultural unit beyond the regional phase or period.

CONCLUSION

Recently Terrell (1990 : 827) asserted that the Lapita cultural complex had "become a scholar's white elephant". Lapita in reality, he claims, is nothing more than a trade ware in

Melanesia (i.e. all the way from the Bismarcks to New Caledonia). And certainly some pots in nearly all Lapita sites prove to be exotic, perhaps more in sites where local clay sources were limited than in others. But a great deal of Lapita pottery was in fact locally produced, and items in Lapita site assemblages transferred from afar are usually readily identified as in the Reef/Santa Cruz or Lakeba examples. To me the problems do not seem as great as Terrell supposes.

In contrast, Golson's carefully evaluated points when he first proposed the use of the term "cultural complex" still seem to have considerable merit. In particular, the concept of Lapita as a horizon seems fairly well justified and could prove quite useful when scholars wish to avoid making claims for some kind of a strong historical connection between their sites and others more confidently assigned to the cultural complex. Lapita as a cultural tradition, on the other hand, does not seem to possess the same cogency or utility. This could be developed, however, if researchers were prepared to look at elements of the Lapita cultural complex and ascertain not only those that had roots in Near Oceania or Southeast Asia, but also how many of those traits carried over into much later periods and phases. This would strengthen the claim, for example, that Lapita in Remote Oceania was the foundation cultural complex for many of the later cultural developments throughout that whole area and not just for Polynesia.

Finally Lapita as a ceramic series, possessing both decorated and plain ware components, now seems quite securely established. The same outcome may be anticipated for an expansion of that concept through use of associated non-ceramic items into a full cultural complex in Remote Oceania. Where a much fuller, more detailed and careful analysis of historical connections between potential Lapita site assemblages is required is in Near Oceania. At present, in that area, only those rich sites with elaborate pottery and numerous other items (which duplicate what is found in the sites of Remote Oceania) may be assigned to the Lapita cultural complex with some confidence. There will continue to be argument over most other sites until assessment of their historical connection with Lapita relies on much more than the decorated pottery and include at a minimum many non-ceramic elements as well. In short, it is no longer enough to find a few dentate-stamped decorated sherds and declare on that basis alone one has found a site belonging to the Lapita cultural complex. We are now able to do much better than that, and in Remote Oceania have been doing so for some time. The new information from Near Oceania just makes the issue a little more complicated and rules out restricted hierarchical classificatory approaches which favour only certain types of evidence.

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DYNAMIC TRADITIONALISM : LAPITA AS A LONG TERM SOCIAL STRUCTURE

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RÉSUMÉ

Conservatisme dynamique : Le Lapita vu comme une structure sociale à longue échéance.

Cet article présente et développe la notion de 'conservatisme dynamique' appliqué aux ensembles Lapita. La situation à la période Lapita est paradoxale. D'un coté, elle est caractérisée par de nombreux changements, avec la colonisation de nouvelles régions et un accroissement de l'utilisation des terres dans les zones occupées précédemment. D'un autre côté, on observe de nombreuses similarités dans la culture matérielle sur de vastes étendues, à l'intérieur desquelles les changements sont coordonnés sur une longue période de temps. La notion de 'conservatisme dynamique' est utilisée pour explorer le lien entre ces deux éléments des documents archéologiques et pour préciser, en particulier, l'idée que la stabilité de la culture matérielle a aidé les hommes à supporter les ferments du changement après 3500 BP.

ABSTRACT

This paper presents and develops the notion of 'dynamic traditionalism' as applied to Lapita assemblages. The situation in the Lapita period represents a considerable paradox. On the one hand there is tremendous change, with new areas colonised and new intensities of land use in long settled areas. On the other hand, there is tremendous similarity of material culture over large areas, changes in which occur in co-ordinated fashion over a long period of time. The idea of dynamic traditionalism is used to explore the link between these two features of the archaeological record and in particular the idea that stability in material culture helped people cope with the ferment of change after 3500 BP.

In this paper I want to look at the most obvious and impressive aspects of the Lapita phenomenon : the size of its distribution and its longevity. Lapita is big both spatially and temporally and what is becoming increasingly apparent is that changes in material culture and other aspects of life may take place contemporaneously at widely separated spots. Although all those working on Lapita sites have recognised these features, we have not succeeded so far in uncovering the mechanisms underlying this temporal and spatial structure. The purpose of this paper then is to present some ideas which will allow us to understand the sorts of long term social forces that Lapita represents. I will start by making some general points concerning time and space before looking at some of the evidence from Lapita sites.

Most of the attempts to understand prehistoric social forms through archaeological evidence are based on the pretence that social forms in the deep past, those that existed

thousands or tens of thousands of years ago, can be studied in the same manner as societies in the present. The difficulty of using models drawn from the present is highlighted when we think that the minimum unit of chronological resolution for Lapita sites is 100 years, all dates having a standard deviation of at least 50 years. The passage of centuries and millennia expunge any mark of individual human experience and wipe out our usual notions of social structure, political economy, gender relations and forms of power. Once we have excluded the individual or group as the basis of our analysis the problem we face is how to understand a past with human features, but from which all the familiar markers of humanity have disappeared. Removing the individual and group, plus the ways these are studied by anthropology, sociology, psychology or history seems to leave a canvas blank of human traces, but this momentary disorientation is caused by the fact that all familiar human landmarks are removed. Disorientated in this way we should not lapse into ethological, ecological or economistic approaches but should search instead for other markers of humanness.

In attempting to understand long term social structures I take material culture as a starting point, which includes not just artefacts but also the landscape as shaped under human influence. Things are more enduring than people and form the medium whereby long term elements of society are created and transmitted. People are socialised within particular physical settings and these become part of their bodily responses to the world. The sedimentation of material settings into the human body means that even in the short term our actions are generated by more than conscious patterns of meaning and experience. Long term processes can only be understood on the basis of how people and the world are involved in producing the other in forms of mutual interaction.

Moving from these most general points we can say that the material world is ordered by people in both time and space. Social processes do not occur on the head of a pin, they always have spatial extent and character. Social processes also have a temporal structure and different social groups create varying forms of time in which action unfolds. Space and time are not abstract qualities which pre-exist social action, but rather are dimensions created through the concrete operation of social forms. From these points of view Lapita is a particularly long lasting ordering of time and space.

Although starting from these very abstract notions, what I am looking for is a concrete sense of the historical process as a mutual interaction between people and things. People shape the world in two ways. First of all, people pattern their activities across the surface of the earth. These patterns include both relatively static features like demographic structures, settlement patterns and land use. They also include forms of mobility, such as the movement of people and things across both time and space . Secondly, we alter the shape of the world, restructuring ecosystems, plant and animal communities and the very surface of the earth itself. Over centuries and millennia this creates a humanly shaped environment, into which future generations are socialised. We are born into and shaped by landscapes transformed by the labour of countless past generations.

Having introduced these ideas I will now apply them briefly to the evidence from Lapita sites. As noted above, the Lapita phenomenon displays similarity over a wide area and maintains this similarity for a long time. Although by no means denying this similarity I also want to stress that there is a considerable amount of variation in the evidence from Lapita sites. The main point of this paper is that we need to have means of modelling the unfolding of both similarity and difference throughout the Lapita period. As similarities have been most stressed in past work I shall dwell here on diversity.

The first area of difference we must consider is that the colonisation of the remoter Pacific east of the Solomons was not all of a piece. Earlier moves than those dating to Lapita may have been made and not all movement within the Lapita period was necessarily connected with Lapita assemblages. There are tantalising hints that further to the east colonisation may also have been a complex process. In Bonotoa Bog on the Rewa Delta, Vanua Levu, Fiji a pollen core has been taken which goes back 4,300 years. At the base of the sequence there is charcoal perhaps indicating human interference some 1,000 years before the first Lapita occupation. The first major evidence of clearance, however, falls within the Lapita period at 3,000 years ago (Southern 1986). Elsewhere there is the possibility of exploratory moves prior to the main settlement, although this time within the Lapita period. The earliest date from Tikopia is 3360 ± 130 (UCR-965 - Kirch and Yen 1982 : table 50). This comes from calcareous dune sand with scattered charcoal and a few sherds lying below the main midden layer with the earliest evidence for full occupation of the island. The excavators themselves raise the possibility that this may be evidence for an initial use of the island before permanent settlement (Kirch and Yen 1982 : 312, 314).

Further to the east on the small island of Lakeba in the Lau group, Fiji , Best has put forward the idea that the earliest settlement, around 3,000 years ago, was not permanent. The evidence he adduces is that the earliest settlement is purely coastal and most of the bone is from wild birds and turtles, there being no evidence of domesticates in the earliest levels (Best 1984 : 641). A few centuries later there is increased evidence of permanent settlement, a greater range of material culture and the possible growth of horticulture, although pig is not present in the first thousand years of Lakeba's prehistory (Best 1984 : 650). The earliest dates from the Toaga site on Ofu island, Manu'a, American Samoa (Kirch, Hunt and Tyler 1989) (3820 ± 70 - Beta 25035 ; 3620 ± 80 - Beta-25673) may also provide evidence of an early use of the island prior to the main occupation.

We must recognise that colonisation is a process of exploration and experiment that may have had a number of phases before full scale settlement was established. Colonisation also established spatial patterns of settlement and connectedness within the western Pacific that affected the temporal structure of society.

A further emerging set of evidence for the variety of response found during the process of colonisation comes from the landscape itself. Over the last decade it has become strikingly obvious that people have reshaped the landscapes of the Pacific during the last 3000 years (Best 1984, Kirch 1984, Kirch 1988c, Kirch and Yen 1982, Spriggs 1984). It has not so far been recognised that humanly caused erosion and deposition has taken place at different times in different areas. Within the Bismarck Archipelago there is evidence of considerable erosion starting early in the Lapita period. In the Arawe islands on the south coast of West New Britain we have found evidence for the erosion of clays from the higher slopes of all small off-shore islands and their subsequent deposition on beach flats. Erosion starts at least by 3000 BP and finishes around 1000 years ago (Gosden 1989). Similar erosional phases with similar periodicities have been found in the Kandrian area, Nissan and on Watom. In these sites the appearance of Lapita assemblages seems to be correlated with a greater intensity, or at least destructiveness, in the use of the landscape.

Data on erosion, although dramatic where it is found, is patchy in its distribution. On Aneityum in southern Vanuatu Spriggs (1986) has noted evidence of burning and consequent erosion going back to around 3000 years ago (2890 ± 60 BP - ANU 2421B). As I have noted, Southern (1986) has seen pollen evidence for widespread vegetation clearance at the same time on Viti Levu, although there is no direct evidence for erosion as yet.

Smaller islands have later dates for the onset of erosion. The million cubic metres of soil moved on Tikopia under human influence does not seem to have started eroding until about 1000 years ago, caused by the firing of vegetation on the upper slopes (Kirch and Yen 1982 : 329). On Futuna, northeast of Fiji, a similar date has been obtained for the onset of soil degradation (1315 ± 175 - I-9942) (Kirch 1981 : 131). On Lakeba environmental degradation started earlier, around 2000 BP and this is connected with the first movement of sites inland from the coast and evidence of burning on a large scale (Best 1984 : 642-3). Various parts of New Caledonia have suffered massive erosion, although its onset is not well dated. The plain of Moindou has at least 9 metres of alluvium covering it. Paddle impressed pottery, dating to at least 2000 years ago, has been found 6.5 metres down (Spriggs 1984 : 193). This indicates that erosion may well have started within the Lapita period.

Despite the lacunae in the data on erosion there seems to be a pattern emerging. Larger islands and their associated off shore islands (New Britain, Bougainville, New Caledonia, Aneityum) suffer erosion before smaller isolated islands (Tikopia, Futuna, Lakeba). Indeed, the major phase of erosion in the Arawe islands, New Britain was finishing at the time that major landscape degradation was starting on Tikopia and Futuna. If erosion can be taken as some measure of the extent and/or intensity of land use, then on larger islands a major phase of intensification, or at least land clearance, starts with the introduction of Lapita assemblages. On smaller islands the same degree of land clearance is not seen until Lapita pottery goes out of use.

These variations can be used as further evidence that Lapita was not one homogeneous social system, but a modulated use of the western Pacific islands, with varying intensity of production at different times and places. Further evidence of heterogeneity comes from the material culture itself, particularly from pottery. The small islands with later evidence of erosion are those that have the least decorated pottery. Sherds found on Tikopia in the early phases were mostly plain, with a restricted range of forms (simple bowls and two varieties of jars) (Kirch and Yen 1982 : 327). Futuna shows a similar pattern, with a restricted range of forms and very simple forms of decoration in the early period (Kirch 1981 : 136, Sand 1990 : fig. 7). The Lakeba sherds form part of group of simply decorated sherds found in the Lau-Tonga-Samoa region noted by both Best (1984 : 649) and Kirch (1988c), whilst the sherds on the larger Fijian islands are decorated in a complex manner.

Green (1979) first pointed out that there is a simplification in Lapita designs as one moves west to east. This idea has been pursued by a number of subsequent authors (Anson 1983, 1986, Sharp 1988). There is little doubt this form of distance decay takes place. However, the explanation for this may lie partly in the nature of subsistence production. Larger islands with subsistence systems which were fully functioning by the Lapita period have produced assemblages of pottery with complex decoration. Those on which full occupation and intensive forms of land use do not. Linking subsistence and craft production in this way contains within it a number of hidden implications. The first is that the production of material culture in the Lapita period was determined by food production systems which were put in place in the Bismarck Archipelago and the Solomons before the appearance of Lapita pottery and its attendant repertoire of stone and shell. These production systems were then intensified in the centuries around 3000 BP. On smaller islands, plus possibly Tonga and Samoa to the east, there was at least a millennium lag between the first emplacement of agricultural systems (which may itself have post-dated earlier exploratory moves) and their intensification/extensification which led to large scale soil erosion.

Taking the Lapita distribution as a whole we have a modulated use of time and space deriving from variability in concentrations of population and the intensity of landscape use. Intensity is a compound measure of use of land over time and over space.

One of the most intriguing aspects of Lapita is the co-ordination of changes throughout its distribution. Not only are we seeing changes to the landscape which take place at the same time in different areas, but we can also pick up co-ordinated changes in material culture. The most obvious of these is pottery. In the area from the Bismarck Archipelago to Vanuatu pottery undergoes a similar series of changes from complex dentate stamping to incised and applied wares. Not only is the sequence of change the same throughout the area, it appears to happen at very similar times throughout the region over the period 3500 to 2000 BP. Other aspects of material culture may also undergo co-ordinated change. Albeit in a limited area in New Britain there is a change in source representation of obsidian from the pre-Lapita period to the present, with the Mopir sources used pre-Lapita, the Talasea sources dominating in the Lapita phase and both Mopir and Talasea found after Lapita. How far these changes are due to the availability of sources needs to be answered, and it is also of considerable interest to find out how far these changes extend outside of New Britain. Changes in the structure of shell industries awaits investigation, as do changes in the provenience and use of non-obsidian stone.

How was this co-ordination of change maintained? I can give no full answer but offer the following thoughts. First of all the possession of one pattern of land use which was differentially employed throughout the region gave people a basic similarity of life, narrowing the fundamental choices to be made on how to provision the social system. Secondly it may well be that we are working with a misguided set of models as to social structure and social mobility. Much of the recent writing on trade and hierarchy assume a social world like that of the present, with stable communities living in villages and linked through exchange. Although we have found sites of some considerable permanance it does not mean that the people living in them were unchanging. We are dealing here with colonising societies, which by the time they moved into the area east of the Solomon chain already had a long tradition of sea-borne exploration behind them. We may well be looking at a fluid and mobile social universe in which people moved regularly throughout their lives and although settlements stayed in the same place people did not. Following this argument, the co-ordinated changes we see in material culture were both enabled and necessitated by a degree of social mobility for which we have no modern analogues. Constant movement meant a steady circulation of information allowing changes in one area to be transmitted elsewhere. The general instability of populations made the maintenance of threads of similarity over large areas desirable and led to similar changes in widely separated areas. The basic bed-rock of subsistence similarity also contributed its measure of stability.

The central paradox of the Lapita evidence is that it bespeaks a tremendous sense of tradition combined with enormous diversity and dynamism. I have called this pattern of the creation of time, space and material culture 'dynamic traditionalism'. During the Lapita period people keep up a considerable pace of change, exploring and settling new areas and restructuring the bounds of the world in which they live. At the same time they also maintain solid central threads which give some constant shape and stability to life over hundreds and thousands of years. To stay in motion and yet maintain balance was the problem facing the Lapita social system. Unless our models can throw light on the combination of fluidity and solidity represented by the Lapita social system the central dynamic of the movements out into the western Pacific will remain hidden.

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A LAPITA SMOKE SCREEN ?

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RÉSUMÉ

Un écran à fumée Lapita?

Il est possible que l'intensité des recherches archéologiques sur la culture Lapita en Mélanésie soit devenue telle que cette culture agit aujourd'hui comme un paravent cachant d'autres évènements culturels qui se sont passés avant et pendant son existence. L'étude des grandes frontières culturelles mélanésiennes montre la présence de barrières sociales anciennes et solides à l'encontre du cochon et de la poterie en Australie du Nord, à l'encontre de la poterie dans les montagnes de Nouvelle Guinée, ainsi que du *Phalanger* dans les îles Salomon et du cochon dans le sud du Vanuatu et en Nouvelle-Calédonie. En ce qui concerne la poterie Lapita, une autre barrière sociale d'une large étendue semble aussi être présente: les sociétés anciennes de Nouvelle Guinée, des îles Salomon, du Vanuatu central et du Sud ainsi que de la côte Est de la Nouvelle Calédonie ne semblent pas l'avoir acceptée. Deux hypothèses sont proposées. La première, basée sur les barrières sociales, propose un peuplement du Vanuatu et de la Nouvelle-Calédonie plus ancien que le Lapita. La seconde hypothèse se base sur la présence d'une poterie mélanésienne datée de 5500 ans dans le Nord de la Nouvelle Guinée. Celle-ci pourrait être à l'origine de traditions telles que le Mangaasi du Vanuatu et la poterie de Podtanéan en Nouvelle-Calédonie. Ces traditions céramiques indiqueraient aussi la mise en place d'un peuplement dans cette région plus ancien que le Lapita. Finalement, ces hypothèses peuvent et doivent être vérifiées sur le terrain au cours de campagnes de fouilles d'abris sous roche dans les grandes îles des Salomon, du Vanuatu et de la Nouvelle-Calédonie.

ABSTRACT

It is possible that the very intensity of archeological research on Lapita culture in Melanesia has become such that this culture may act today as a smoke screen hiding other cultural events that took place before and during its existence. A survey of the major Melanesian cultural boundaries shows the presence of ancient and powerful social taboos : against the pig and pottery in northern Australia, against pottery in the highlands of New Guinea, against the `Phalanger' in the Solomon Islands, and against the pig in southern Vanuatu and in New Caledonia. Regarding Lapita pottery, another large scale social taboo would seem also to have existed : the ancient societies of New Guinea, the Solomon Islands, central and southern Vanuatu and the East Coast of New Caledonia do not appear to have accepted it. I propose two hypotheses : The first, based on the existence of social taboos, suggests a settlement of Vanuatu and New Caledonia that would predate Lapita; the second is based on the finding of Melanesian pottery, dated 5500 BP, in northern New Guinea. This pottery could be the origin of traditions such as the Mangaasi of Vanuatu and the Podtanéan of New Caledonia. These ceramic traditions would also indicate that these regions may have been settled by a people older than Lapita. These hypotheses can and must be verified in the field, through systematic and multiple excavations of rock shelters in the larger islands of the Solomons, Vanuatu and New Caledonia.

Over the last few years too much emphasis in island Melanesia may have been put on the Lapita culture. It appears from the recent literature that the Lapita culture, while in existence, was the origin, cause, driving force and master-mind of everything cultural, economic, social and ritual that happened from the Bismarck archipelago to Fiji (Spriggs 1984, Kirch 1990).

I wish to address this issue by focussing on some important cultural facts which were probably in place throughout western Melanesia before the Lapita culture first appeared and during its existence. I also wish to propose some speculative ideas on things which are not Lapita, but which may have implications for a better understanding of Lapita's place in Melanesian prehistory. The validity of these ideas can and must be tested in the field.

Pigs and Pots: New Guinea and Australia

One of the most important cultural markers of Melanesian society is the pig. It is almost as if the foundation or fabric of Melanesian society hinges on the presence of pigs. In New Guinea, the social, economic and ritual life revolves around pigs. This is the case for coastal, lowland and highland communities including those located just opposite northern Australia. New data from archaeological sites on the Sepik river and along the northern coast near the Irian Jaya - PNG border clearly demonstrates the presence of pigs by at least 5,500 to 6,000 BP (Gorecki et al. 1991). It is perhaps not a coincidence that this is also the period when horticultural systems in highland New Guinea are the subject of profound transformations (Feil 1987; Golson and Gardner 1990).

Yet we do know that pigs did not enter the Australian continent until their introduction by Europeans. Two implications arise from this fact. One is that pigs did not walk across the Arafura plain which means they were not present (as domesticated, feral or wild) in southern Papua during the existence of the last land bridge. Second, pigs were not included in the complex traditional Torres Strait exchange system linking Australia with New Guinea that developed following the last sea level rise. This is important since it is known that many items (and ideas) were exchanged between northern Australia and southern Papua during the last 2,000 years (Moore 1978). The implication is that northern Australians were culturally "strong" or established enough to decide to erect a mental pig fence between them and their Melanesian neighbours (Figure 1). In other words, a strong social boundary was already in place in the region by at least 6,000 BP, one that was set by the potential receivers of new goods (see Plate 1 for a more recent example of a social fence from Guadalcanal). Such behaviour simply stops the spread of selected material culture and can become very strong archaeological boundary markers.

Curiously, the origin and spread of pottery fits into similar but more complex patterns of cultural behaviour. Whatever the antiquity of pottery in Melanesia, two very strong fences were erected against its adoption. One of these is again northern Australia. Here, people were not only culturally established enough to reject a possible introduction attempt from southern Papua, they also simply refused to adopt it when forcibly introduced by Macassan traders (Mulvaney 1966 ; Macknight 1986).

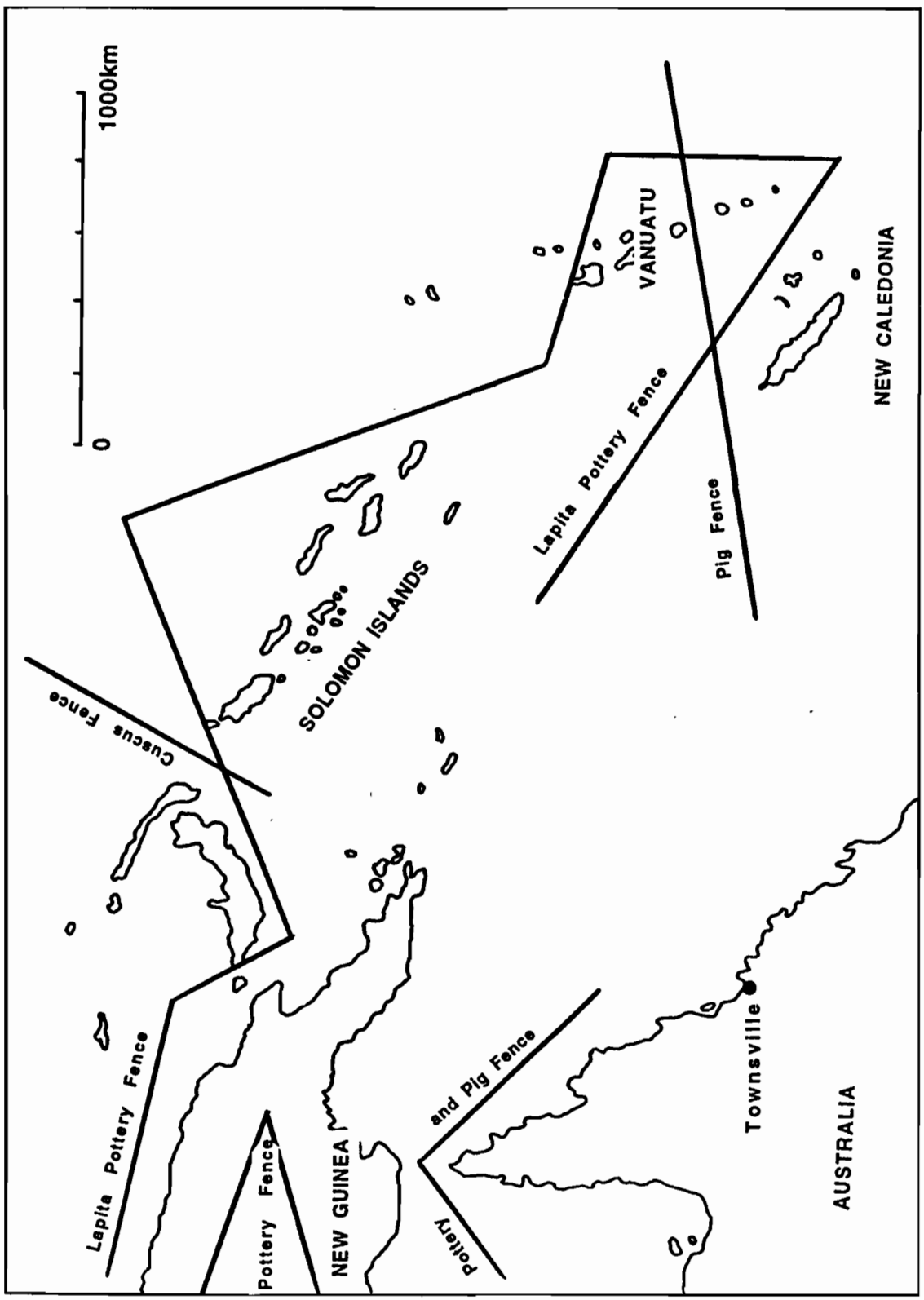


Figure 1 : Some prehistoric social fences in Melanesia

More importantly, highlanders from New Guinea also did not want to have anything to do with pottery. Yet here we are dealing with an entirely different culture, a Melanesian one, with its high population densities, large pig herds, extensive ceremonial exchanges and highly complex horticultural systems. They were entirely surrounded by societies manufacturing, using and trading pottery. In some areas like the Yuat and the Bismarck ranges, the industry came within a "pot-throw" of the highlanders (Bulmer 1977; Gorecki and Gillieson 1989). Yet they still refused it despite being hungry for and accepting many other goods that were exchanged in dense and well established trading networks between them and lowland/coastal societies (Hughes 1977). What these highlanders did was to erect a pottery fence all around them because they were established enough to make such a decision (Figure 1). Here too we are dealing with a strong social boundary (plate 1) whose antiquity must go back beyond the appearance of pottery in New Guinea.

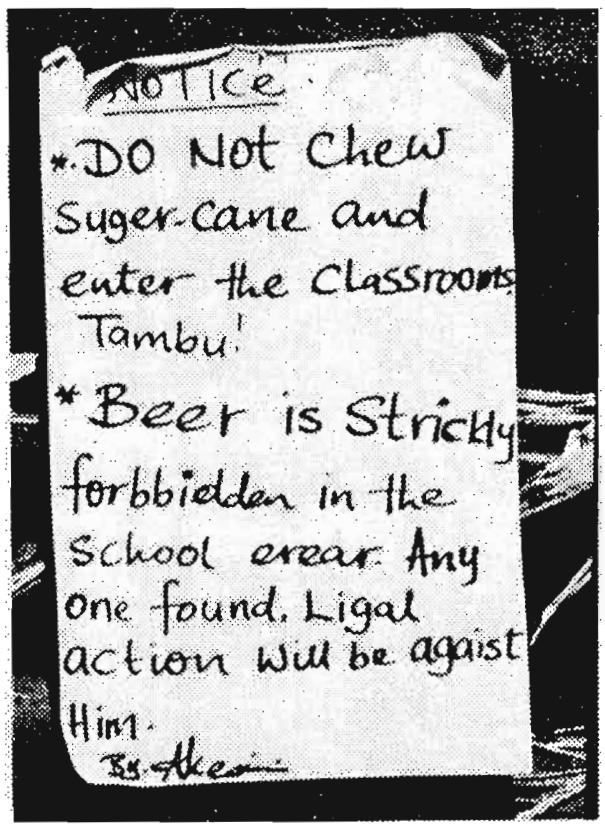


Plate 1 : Social fence, Guadalcanal style

Two main points are emerging from these observations. One is that these Melanesian and north Australian cultures were established enough to be in a position to deliberately reject selected items and ideas available to them from neighbouring groups. Second, this implies that these cultures were solidly in place before these innovations first appear from the outside.

Colonisation of Island Melanesia

A chronological review of the literature on island colonization follows an interesting trend. What we see in the early contributions is a strong belief that island Melanesia can only be colonized by Austronesians or, more precisely, by members of the Lapita network (Bellwood 1978; Jennings 1979).

The first challenge to this was the evidence coming out of Balof 1 (Downie and White 1978), followed by further evidence from Misisil (Specht 1980). The Bismarck archipelago became Melanesian again rather than Austronesian, reunited with mainland New Guinea by a long forgotten umbilical cord (White and O'Connell 1982). The concept of some inter-island/long distance trade network existing there thousands of years before the Lapita period became acceptable (Allen 1984).

The Pleistocene finds made on New Ireland during the 1985 Lapita Homeland Project confirmed the above, pushing back to over 30,000 BP the foundation of island societies in the Bismarck archipelago (Allen et al. 1989; Allen and Gosden 1991). The new "Pre-Austronesian" Melanesian frontier was placed there, and the earliest site to the east, Nissan, became (briefly) an island first colonised by Lapita people.

Kilu on Buka island has yet again changed this overall perspective on island colonization by pre-Austronesian people (Wickler and Spriggs 1988; Wickler 1990). The new pre-Austronesian frontier could now be placed at the other end of the Solomon Islands chain, on Makira (San Cristobal). Interestingly, the famous Lapita sites of the Reef-Santa Cruz (Green 1979; Sheppard and Green 1991) could probably be perceived now as being the genuine "new" horizon colonised first by members of the Lapita culture; that is, by people having an Austronesian background.

The current faunal evidence (J.P.White, pers.comm.1992) coming out of the New Ireland-Nissan-Buka region indicates the presence of another of these strong social fences: this one stops the cuscus from entering the Solomons (Figure 1; Allen et al. 1989; Flannery and White 1991). What lies beyond Makira are the Vanuatu chain of islands with New Caledonia and Fiji beyond it. Could pre-Lapita people have made it to these shores (Irwin 1981,1989,1991)? I would strongly argue that they did so for Vanuatu and New Caledonia.

One of the reasons for this is again based on a pig argument. As for northern Australia, pigs failed to be accepted not only in the entire New Caledonian region (in prehistory and during Captain Cook's attempt of introduction) but also in the southern half of Vanuatu (Galipaud, pers.comm.1992). One hypothesis proposed to explain this would be that people could have been well established as far as New Caledonia before the pig expansion. People could have rejected pigs when these first appeared in the company of Austronesian/Lapita visitors as they could have been "strong" enough to repeat this behaviour in 1774. I would suggest that the initial colonization of Vanuatu and New Caledonia by non-Austronesian people may predate the Lapita phenomenon and could eventually be dated to a period between the development of horticulture in Melanesia (currently at 9,000 BP in New Guinea) and the arrival of pigs in Melanesia (currently firmly dated at between 6000 and 6500 BP, also in New Guinea). This is based not only on the pig argument but also on some pottery arguments presented below.

Pre-Lapita Pottery: Vanuatu and New Caledonia

It is now accepted that the first Lapita pottery appears around 3500 BP and that at its onset is in its most flamboyant form (Anson 1986; Spriggs 1990). The debate surrounding this apparent anomaly relates on the one hand to a possible pottery introduction from the west (southeast Asia) and on the other hand to the absence of an earlier pottery form anywhere in Melanesia (Bellwood and Koon 1989).

Two known forms of prehistoric pottery from Melanesia have for a long time been a

thorn in the Lapita pottery debate: the Mangaasi tradition from Vanuatu (Garanger 1972) and the Paddle Impressed tradition from New Caledonia (Garanger 1974; Frimigacci 1981; Galipaud 1990). For the first one it is important to remember the following statement made when its nature and antiquity was first established :

Elle apparaît, dès les plus anciens niveaux, dans toute sa perfection et sa diversité ... son origine comme celle de la poterie incisée de Bougainville et de Watom pourrait peut-être se situer dans la région nord orientale de la Nouvelle-Guinée (Garanger 1972 : 124)

What Garanger is suggesting is that Mangaasi pottery not only appears in the earliest cultural levels of Central Vanuatu but also that it is a fully fledged industry. It may be older elsewhere, and that its origin could be in north-east New Guinea. The Markham Valley is perceived as a potential candidate for this origin, partially because the pottery there includes many zoomorph figurines somewhat reminiscent of those found in Mangaasi levels. Another but less known area rich in zoomorph figurines made of clay is the middle Yuat river, a tributary of the Sepik (Plate 2). Garanger adds :

...nous pouvons dire que la préhistoire du centre de l'archipel néo-hébridais commence, vers la fin du VII siècle avant notre ère avec l'apparition de la poterie dite 'de Mangaasi'... Quelques années plus tard, des potiers... introduisent la poterie de tradition `Lapita-Watom' (1972 : 127)

It is clear from this that in central Vanuatu the Mangaasi tradition was there earlier than the Lapita one, leading Garanger to again question the origin of Mangaasi pottery (1972 : 133). He argues that to understand developments such as Mangaasi pottery one has to open up new archaeological frontiers, one of these being the eastern most part of south east Asia, the other being the Northern coast of New Guinea. It is in the later that Swadling and I have been operating since the mid-1980's (see below).The Paddle Impressed pottery tradition found in New Caledonia has also been of some concern when discussing the place of the Lapita and its pottery in the colonisation of eastern Melanesia. For a start, there could be a difference in the distribution of these two pottery traditions within New Caledonia. The Lapita seems to be more restricted, found essentially along the west coast and on the Loyalty islands. The Paddle Impressed seems to be more widespread including the east coast of New Caledonia. Further, almost invariably the Lapita is found in association with the Paddle Impressed; in contrast there are many sites with Paddle Impressed pottery that are not at all associated with the Lapita (Frimigacci 1974; Galipaud 1988; Frimigacci and Siorat 1988).

The chronology of these two pottery traditions is also of interest. For a long time it was believed that they were contemporary, with the Paddle Impressed lasting longer and evolving into another one (Frimigacci 1981). More recent archaeological investigations in New Caledonia have changed this view. It is now believed by some that this Paddle Impressed pottery is actually older, i.e. earlier, than the Lapita. This is certainly a statement of consequence, leading Galipaud to comment that:

Frimigacci suggested that Paddle Impressed pottery could have been imported to New Caledonia by Lapita potters... I now raise the possibility of an introduction of Lapita dentate stamped pottery by the makers of Paddle Impressed pottery (1990 : 140)

What this New Caledonian and Vanuatu evidence suggests is that over this vast region, there are a variety of pottery traditions that could be older than Lapita. Its is rather

tempting to link the makers of these early pots with the pre-Austronesian people who, as I am suggesting above, may have come into the region before the pig was introduced into Melanesia.

Pre-Lapita Pottery : Northern New Guinea

One of Garanger's wishes discussed above is being fulfilled since the 1980's : archaeological investigation of the northern coast of New Guinea (the Sepik-Ramu region) is in progress (Swadling et al. 1988). Despite the paucity of sites yet excavated, some remarkable results have been obtained on issues raised here, in particular on the antiquity of pottery in Melanesia.

Plate 2 : Clay figurines from Yaul, Middle Yuat (PNG)

Plate 3 : Contemporary Vanimo pottery (Leitre village)

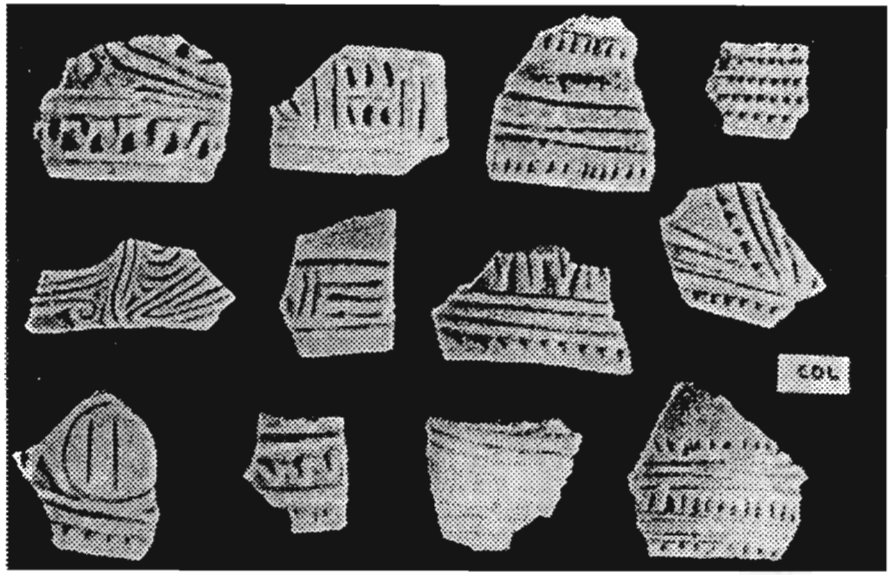


Plate 4 : Surface sherds, Boyen Hamlet (Middle Sepik), (1 cm = 4 mm)

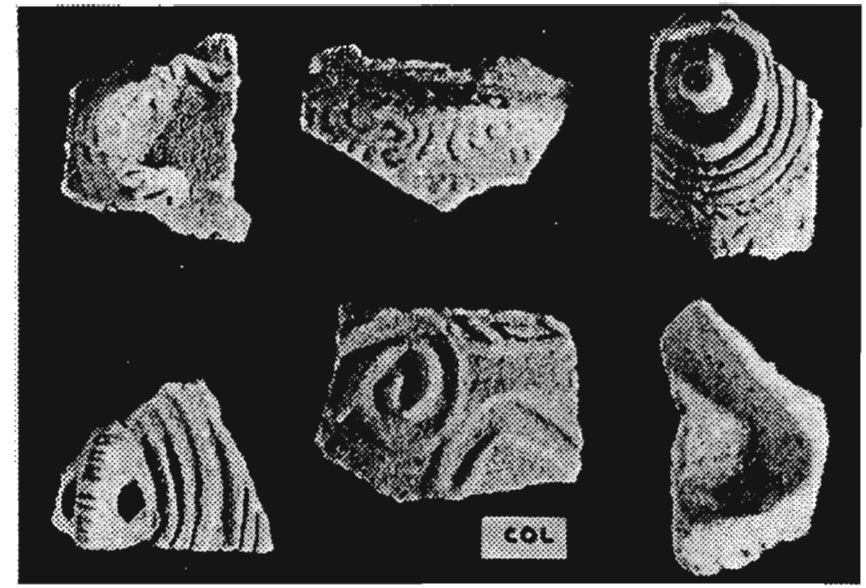


Plate 5 : Surface sherds, Boyen Hamlet (Middle Sepik), (1 cm = 4 mm)

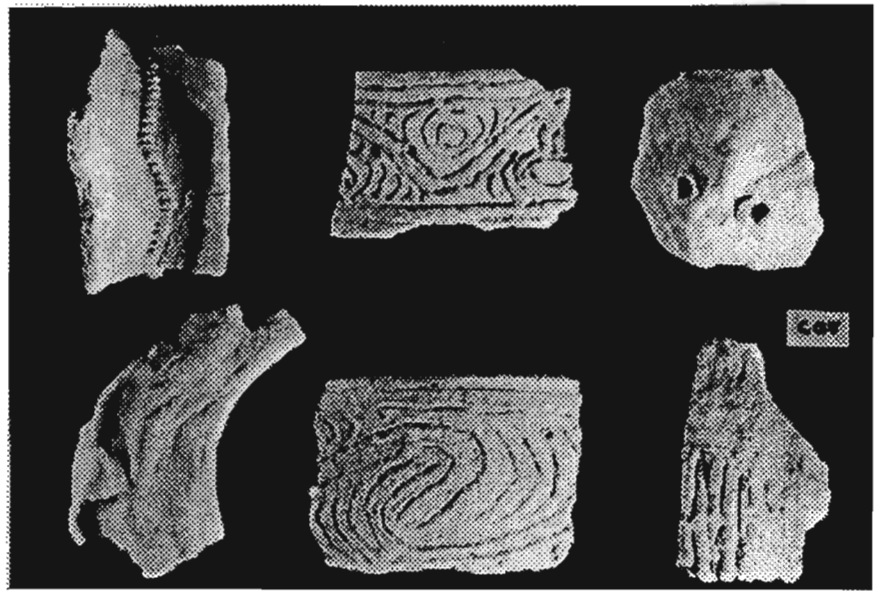


Plate 6 : Surface sherds, Old Bonam Village (Lower Sepik), (1 cm =3,5 mm)

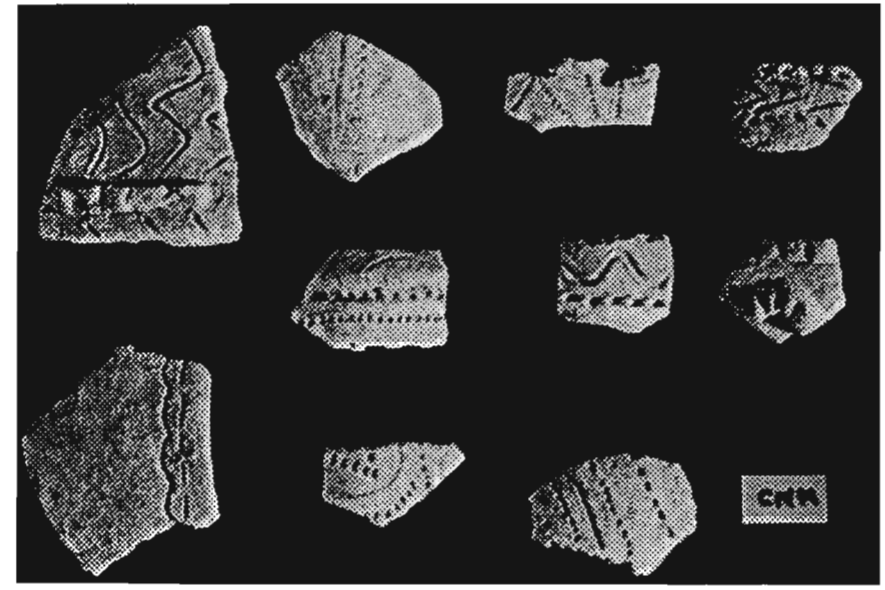


Plate 7 : Surface sherds, Marienberg Mission (Lower Sepik), (1 cm = 5 mm)

From a geomorphological viewpoint, it is clear that the northern coast of New Guinea has been and still is under severe natural stress of great importance for the preservation of archaeological sites (Chappell 1989; Chappell and Polach 1991; see also Enright and Gosden 1992). As a result, multidisciplinary projects are attempting to place cultural events in their proper natural context (Swadling 1990; Swadling and Hope 1992). In the Lower Ramu region, a number of sites have been recently excavated by Swadling. Two of these have yielded pottery industries of great antiquity. Pottery from the Beri site has been dated to 5,700 BP and the one from the Akari site has been dated to 5,400 BP (Figure 2). From this, Swadling et al. (1989:109) conclude that:

These dates suggest that pottery-making began in the area about 5600 BP. The material includes incised and lip-notched ware.

The lower Ramu finds force us to reconsider the pottery recovered from Wanlek (Figure 2; Bulmer 1977, 1985) in the Bismarck ranges (nothing to do with the Bismarck archipelago). One of the interpretations offered on the stratigraphy of the site is that pottery levels may be dated to 5,500 BP (Bulmer 1985 : 128). If this is correct, then the pottery from Wanlek would be as early as, and contemporary to, that of Beri and Akari.

Two new sites found in Fichin west of Vanimo town (Figure 2) are of interest to the discussion here : Lachitu (RIQ) and Taora (RIO). At both sites, we have noticed major introductions occurring at about 5,500 years ago. These include the pig, some stone tools suggesting the manufacture of bows and arrows, small fully ground adzes, strange slate artefacts and pottery (Gorecki et al 1991). These introductions may indicate major changes in the region, possibly caused by the Austronesian expansion into the western Pacific.

Gillian Cox is currently undertaking the analysis of the pottery found at these sites and a preliminary summary of her findings follows (a detailed report on the pottery is in preparation). Some 665 pot sherds were recovered from Taora and Lachitu caves. Of these, only 36 were diagnostic sherds, the remainder being plain body parts.

The earliest ceramic levels in the two caves ("Fichin" tradition) are dated to about 5400 BP (marine shell dates with a -400 years correction included). The thin well-compacted walls of the 81 sherds recovered in these levels suggest hand-building using a paddle and anvil. Microscopic examination of broken edges confirms this assumption. The small indentations in the interior surfaces of the sherds imply that the fingertips of the potters were commonly used as anvils.

X-ray photography of a selection of sherds confirmed that the clay used was very well levigated and worked prior to the construction of the pottery. Fine coral beach sand appears to have been normally used as temper. There is evidence of surface manipulation through scraping, slipping and burnishing. Only one example of simple wet-incision decoration was recovered from these levels (Figure 3; all illustrations of pottery sherds are by G.Cox). Considering the narrow body walls of this period, averaging 4mm (with one sherd a mere 2mm), and the hard and well-fired nature of the pottery, the sample recovered suggests the cave users had great mastery of this craft manufacture. It is unlikely that the sherds recovered in these earliest ceramic levels represent the real beginning of pottery manufacture. An earlier and cruder form of pottery must be found elsewhere, probably to the west of New Guinea.

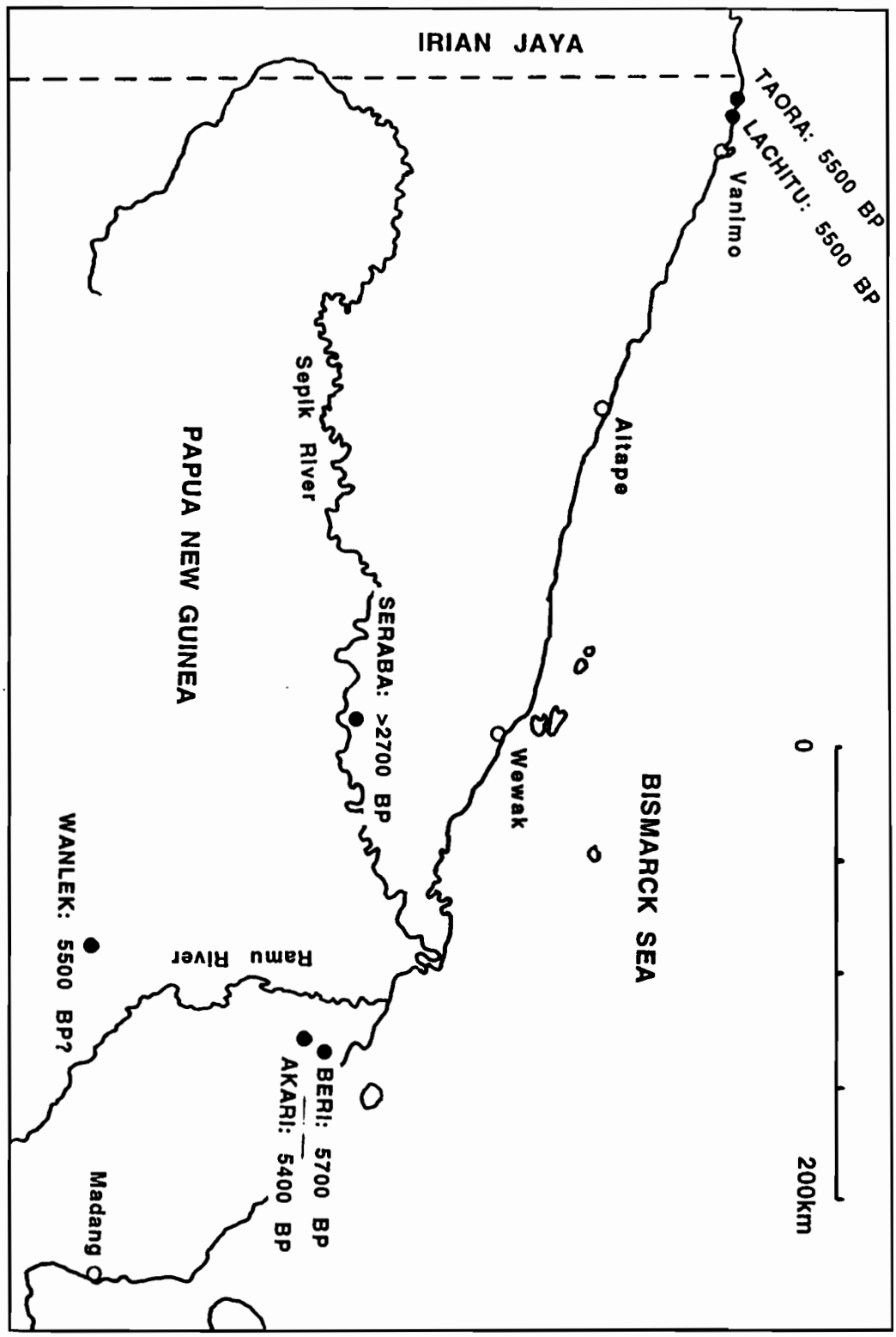


Figure 2 : Early pottery sites in northern New Guinea

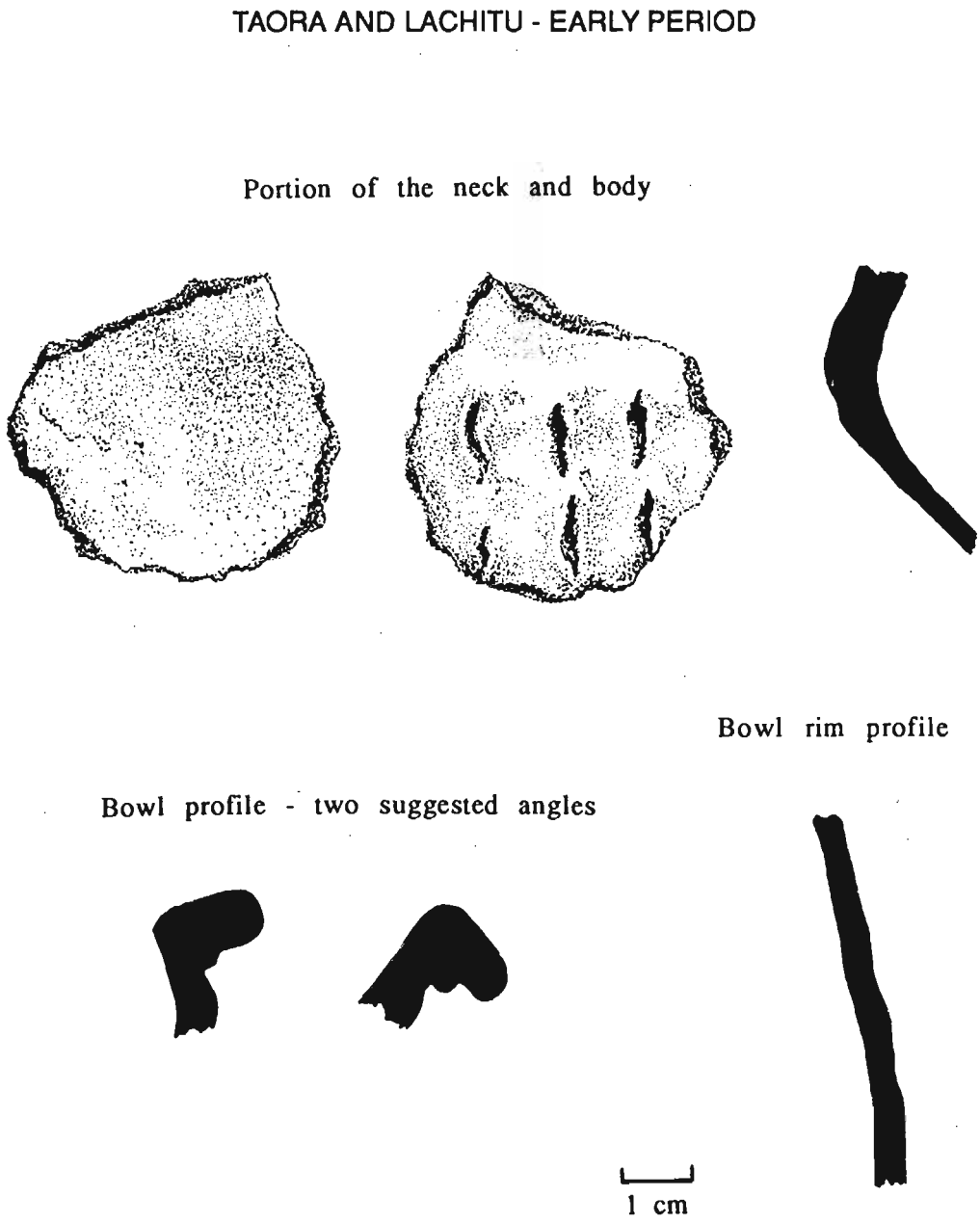


Figure 3 : Diagnostic sherds, "Fichin" tradition, 5,500 BP

The remarkable characteristic of the 5,400 years spread of the Vanimo samples is the homogeneity of the collection as regards vessel shapes, construction techniques, surface modification and body thicknesses. Whilst there is some experimentation in rim forms and decoration the overwhelming evidence is of production by the same cultural group (Figures 4 to 7; RIS is a disturbed but rich open site adjacent to the current reef near Taora shelter). It is only in the more recent levels, certainly by 1,200 BP, that another tradition ("Vanimo") is added: it is thick, coarser, less well made (Figure 8) and very similar to the contemporary Vanimo type (May and Tuckson 1982; Plate 3).

TAORA - MIDDLE PERIOD

Body sherds - exterior surfaces

Portion of a rim and neck

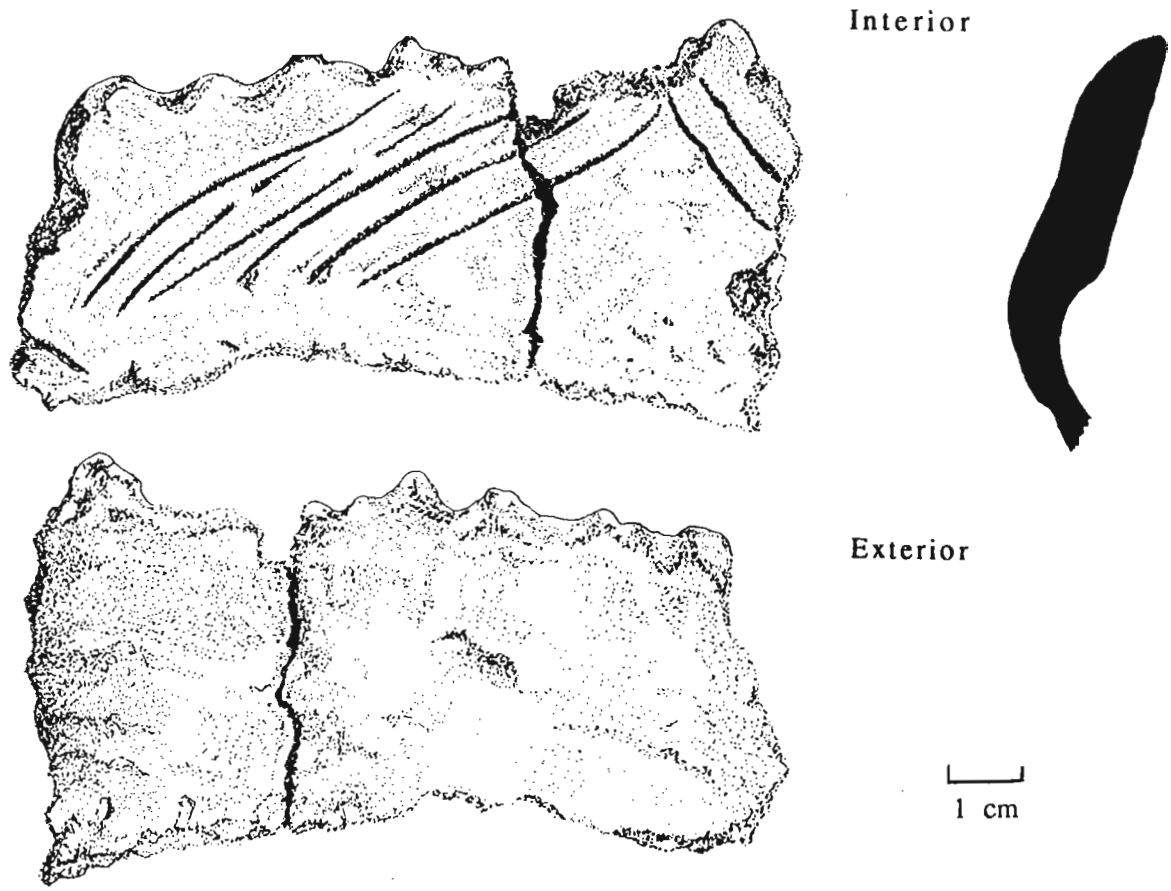


Figure 4 : Pottery from Taora shelter, "Fichin" tradition, 2,600 BP

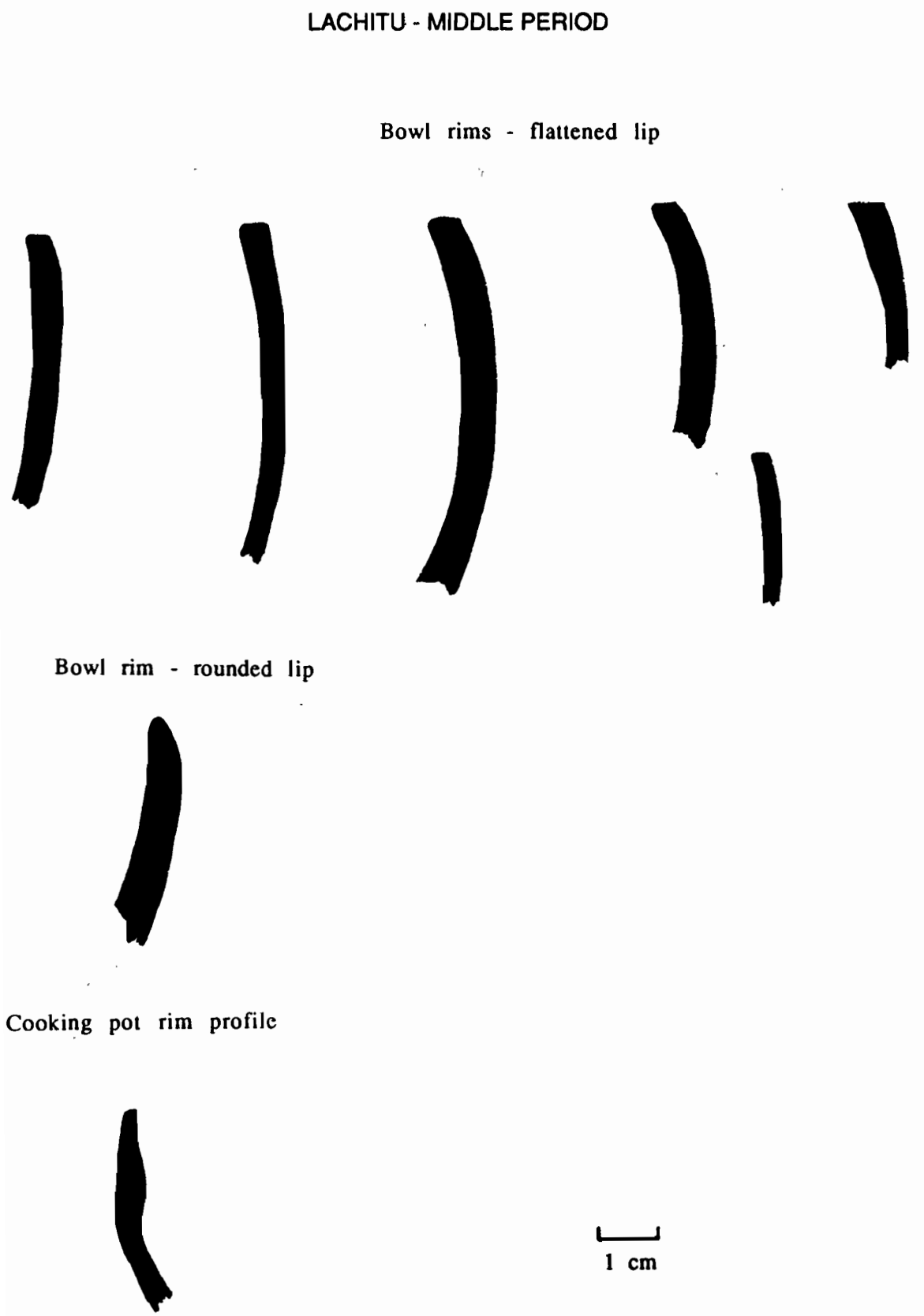
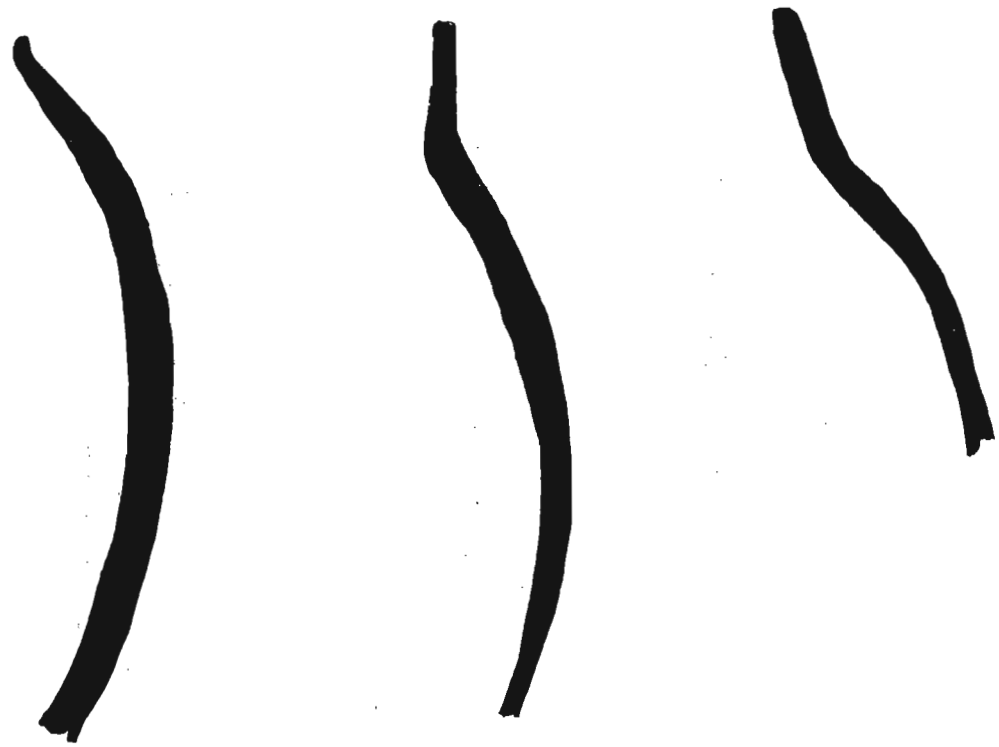


Figure 5 : Pottery from Lachitu shelter, "Fichin" tradition, 1,200 BP

LACHITU - SURFACE COLLECTION

Rim profiles of cooking vessels



Portion of a bowl with têtons

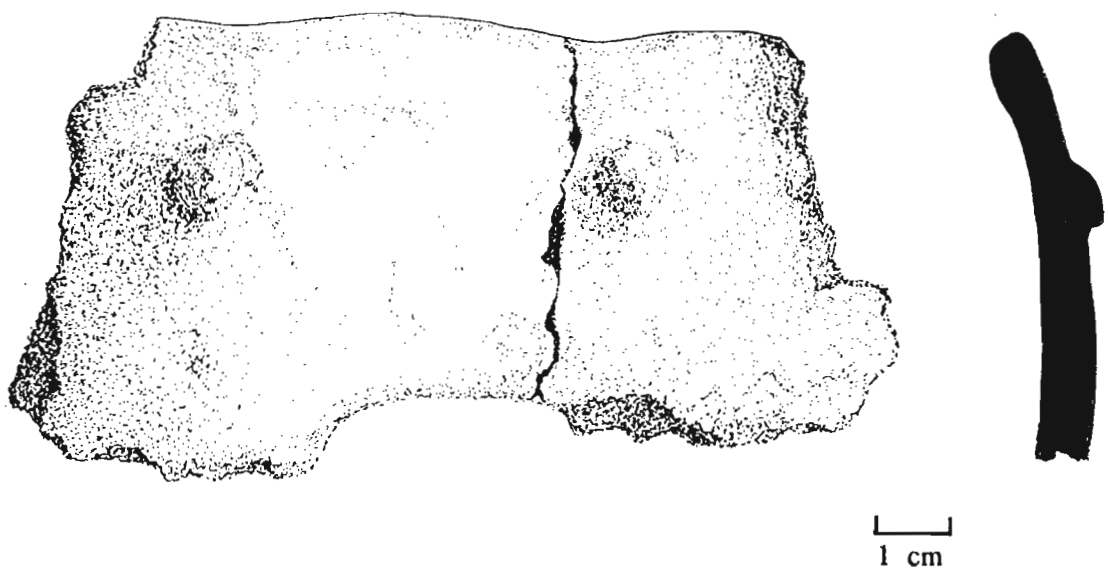


Figure 6 : Pottery from Lachitu shelter, "Fichin" tradition, surface

RIS - SURFACE COLLECTION

Incised parallel lines on thin walled vessels (rim sherds)

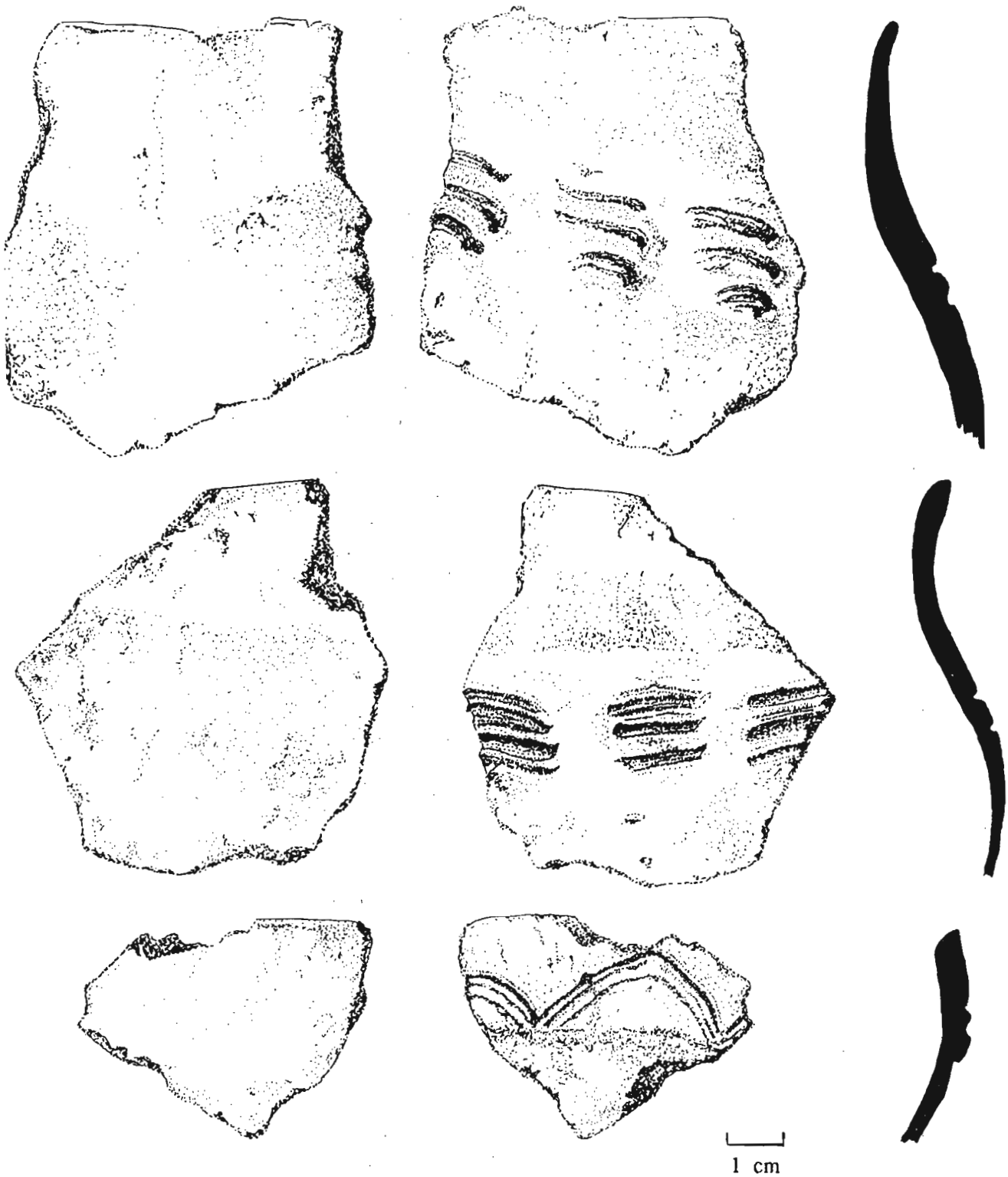


Figure 7 : Pottery from site RIS, "Fichin" tradition, surface

My understanding of the Vanimo pottery, supported by the finds made by Pamela Swadling in the lower Ramu, the Middle Sepik site of Seraba near Timbunke excavated in 1987 (unreported yet but with pottery well established by 2,700 BP) and the Wanlek site, is that we indeed have an early and widespread pottery tradition in Melanesia that predates the Lapita one by something like 2,000 years: this is rather substantial. A probable outcome of this 5,500 years continuity in pottery manufacture in the Sepik region is its enormous diversity today in northern New Guinea (May and Tuckson 1982; Plates 4 to 7).

The origin of this pottery, as suggested by the Vanimo evidence, is likely to be found further west into Asia. What interests me more is that this "Sepik" tradition seems to spread far to the east to reach precisely all the islands which may have been occupied before Lapita times. This would include Vanuatu and New Caledonia. Sometimes this pottery is called *Lossu,* sometimes *Lasigi, Buka, Mangaasi* or *Podtanean.* Based on these arguments, and despite my unfamiliarity with Fiji pottery, it appears that this archipelago may eventually be included in the model as well. What I suggest here is that there could be an inter-island trade network that stretched from mainland New Guinea to New Caledonia which was in place before the Lapita pottery emerges, one of its manifestation being this diverse non-Lapita pottery.

These non-Lapita traditions may not belong to the Austronesian culture but could be an outcome of that earlier Melanesian expansion into the Pacific. If this is accepted, then for once we have a logical West-East temporal gradient for which everyone has been looking for decades: pottery entered New Guinea 5,500 years ago from the west, and reached New Caledonia some 3,400 years ago. It follows a trading network that was built up and expanded on by descendants of people who lived in Misisil, Balof, Kilu and even Kohin in Manus. The Lapita expansion could be rapid simply because it is grafting itself on networks built by other people who were already in place in that vast chain of islands.

The Last Hurdle

Another exercise that is urgently required as far as Lapita sites are concerned is to have a hard critical look at what we have labelled Lapita sites. Maps showing these have more and more dots on them, yet a growing number of these dots should probably not be there in the first place. If this surgery is carried out, then for the New Guinea region alone "Lapita" sites such as Aitape, Siassi, Lamau and Mouk should fall into oblivion. Such an exercise would lead to even greater gaps between regions under genuine Lapita pottery influence.

The above leads me to the last social fence I wish to discuss : the Lapita pottery fence. It seems easy to understand why no Lapita sites have been found in mainland New Guinea : people there simply did not want it because they had a pottery of their own. Similarly, those who lived in the main Solomon Islands also did not want it. Central and southern Vanuatu also was rather reluctant to take up that new fashion called Lapita. Finally, those living along the east coast of New Caledonia were quite happy with their paddle impressed pottery.

What we are probably observing is again the presence of one of these social fences (Figure 1). In this case it is possibly a permeable one, where Lapita ideas (e.g. when to start making pots, when to start incised decorations, when to stop decorating pots and when to stop making pots) are allowed to pass through while the majority of these communities are not interested in the goods themselves (Lapita pots).

RIS - SURFACE COLLECTION

Incised oblique lines on thick walled vessels (rim sherds)

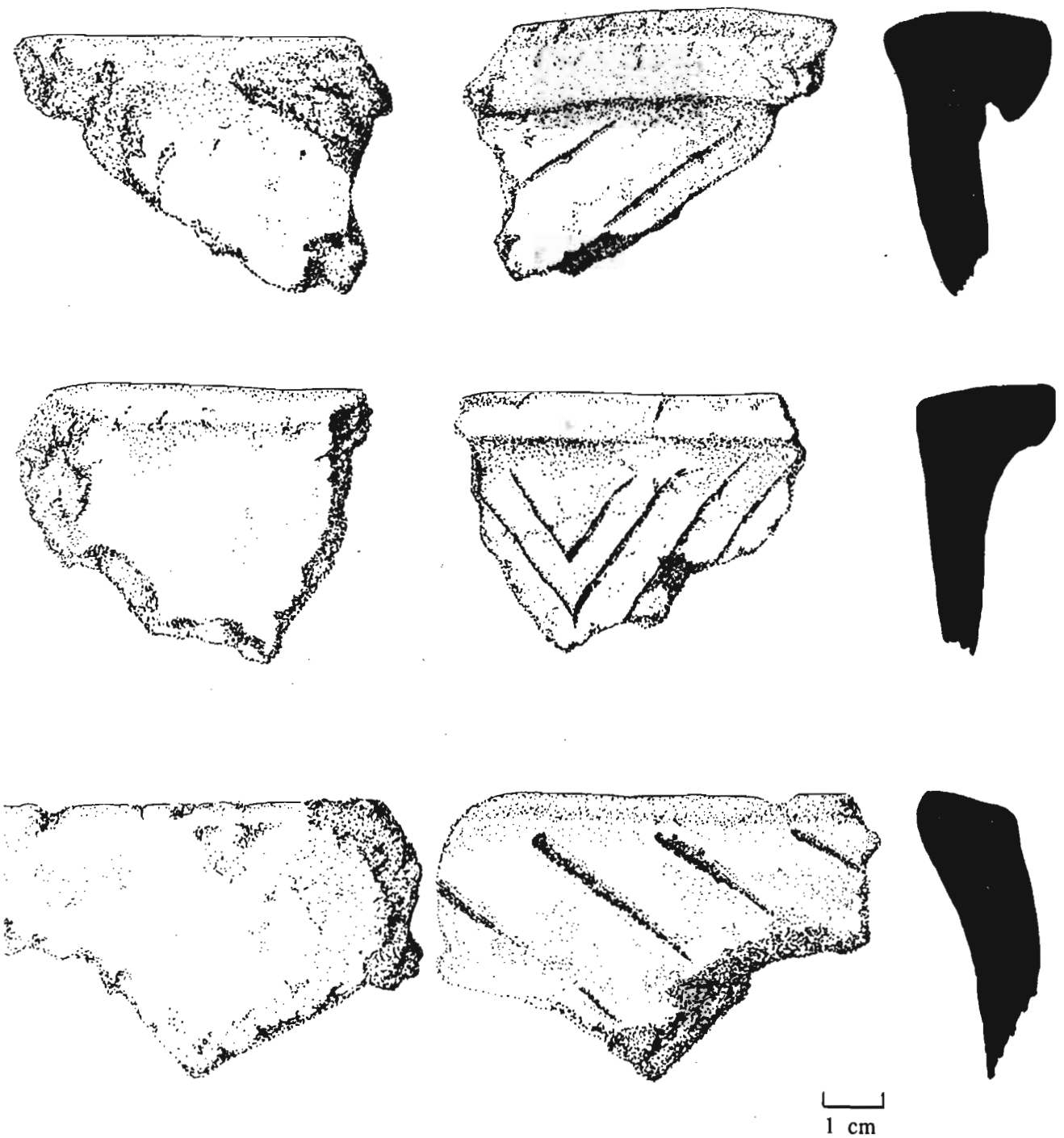


Figure 8 : Pottery from site RIS, "Vanimo" tradition, surface

Where accepted, Lapita pottery may simply be added to a system already structured; it is a welcome novelty. In this case, we may be witnessing a restricted opening of the Lapita fence. Two other issues may be related to the presence or absence of Lapita pottery in a given society. One is a "copyright attitude" in which the Lapita potters themselves are not prepared to depart from, or share the exclusivity of producing this magnificent ware. Secondly, for the receiving community this novelty is not representing anything at all. It is adding nothing to their perception of what their social, ceremonial or exchange world is.

I believe that Galipaud (see quote above) is right, and that the implications are rather serious. What I think happened in the region shown on Figure 1 is that a totally non-Lapita society was well established throughout, and that the Lapita culture became in some areas only a highly visible manifestation of what was already in place. What does that mean ? Put simply, for the region concerned we are not talking of 'Lapita without pot' people expanding, or 'Lapita with pot' people expanding. Rather we are essentially talking of new goods being accepted or refused in already occupied islands and not about the colonisation of new territories by people carrying these goods. Can the validity of these propositions be tested? Definitely yes.

CONCLUSION : THE TEST

The hunt for Lapita sites has led us to concentrate our attention towards specific locations in the landscape at the expense of a more diverse approach towards a variety of potential archaeological sites. The majority of sites excavated in island Melanesia are beaches, foreshore dunes and offshore islets. Such a strategy has resulted in a good understanding of the antiquity, nature and evolution of island societies over the last 3,500 years, and by the nature of these sites, of societies having strong maritime oriented economies. Very few coastal rockshelters have been excavated to complement data obtained from adjacent open sites. Even fewer sites of any kind have been excavated further inland so as to understand past life styles away from the beach. I believe this anomaly may have blurred the real process of human adaptation to the Melanesian islands. It is the antiquity of this prehistory that may be particularly affected since current coastlines are and have been the subject of profound natural changes directly affecting archaeological sites (Enright and Gosden 1992).

For instance, if one excludes from our knowledge the early rockshelter sites known from Manus, New Ireland, New Britain and Buka, we would have essentially a recent Melanesian prehistory based on data gained from beach sites. On the other hand, if one relies on results from only one or two excavated shelters from few islands we would also have a prehistory different to the one we know at the moment. It would be like deciding in the 1970's that there is no more need to excavate shelters in New Ireland given the outstanding results obtained from the Balof site of that time. Yet we all know what great contribution the New Ireland rockshelters of the 1985 Lapita Homeland Project have made to world prehistory.

What we need now is a pause in our beach hunt so as to assess the potential of further revising the human history of island Melanesia. This could be achieved by repeating a type of 1985 New Ireland exercise. The focus should be on large islands within regions where rockshelter sites have never been seriously investigated : the Solomons, Vanuatu and New Caledonia. Such an approach would certainly put to the test most of the ideas presented in this essay. Whatever the outcome of such a campaign, it has to provide a more complete and more realistic picture of Melanesian prehistory. It may even demonstrate that Lapita is only a smoke screen to greater things that have happened.

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NEW DISCOVERIES IN SOUTHEAST ASIA RELEVANT FOR MELANESIAN (ESPECIALLY LAPITA) PREHISTORY

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RÉSUMÉ

Nouvelles découvertes en Asie du Sud-Est intéressant la préhistoire mélanésienne et plus particulièrement le Lapita

Cette communication s'intéresse en tout premier lieu à la question générale des relations du Lapita avec l'Asie du sud-est insulaire. Elle présente la théorie soutenue par l'auteur qui propose que le phénomène Lapita soit un épisode du peuplement humain à la fois très réussi et très rapide. Cet article présente également les résultats de nouvelles découvertes archéologiques dans les sites de Halmahera, Kayoa et Morotai dans les îles Moluques du nord, en Indonésie. Ces résultats indiquent la présence au début de la période holocène de populations dont la subsistance dépendait (on ignore encore dans quelle proportion) de l'exploitation des noix de *Canarium* sur l'île de Morotai, et de la chasse aux marsupiaux (dont certaines espèces maintenant disparues) dans le sud de Halmahera.

Peu de temps avant 3500 BP, les régions sud de Halmahera furent peuplées par des groupes qui utilisaient des poteries à engobe rouge similaires à celles découvertes plus tôt dans des contextes néolithiques à Talaud, Sabah et aux Philippines. Ce type de poterie n'est pour l'instant connu que dans les régions de langue austronésienne d'Halmahera et, compte tenu de son association avec des objets de coquillage et de pierre, elle fournit un antécédent possible au Lapita. L'auteur considère cette poterie comme un indicateur archéologique de la colonisation austronésienne, et à Halmahera, elle pourrait aussi indiquer le début de l'extinction locale des marsupiaux. A Morotai, en dehors de la zone austronésienne, la première date fiable pour l'usage de poterie remonte seulement à environ 700 BP. Ces résultats sont encore préliminaires, et des travaux complémentaires sur le terrain sont programmés pour 1993.

ABSTRACT

This paper discusses first the general question of Lapita links with Island South-East Aisa and stresses the author's view that Lapita represented a very rapid and successful episode of human population colonization. The data section of the paper presents the results of new archaeological findings from Halmahera, Kayaoa and Morotai in the northern Moluccas, Indonesia. These results indicate the early Holocene presence of populations whose subsistence involved (to an unknown intensity) the exploitation of Canarium nuts on Morotai and the hunting of marsupials, some of which are now extinct, in southern Halmahera.

Shortly before 3500 BP the southern regions of Halmahera were then settled by people who used red-slipped pottery, similar to that excavated previously from Neolithic contexts in Talaud, Sabah and the Philippines. Such pottery is so far in evidence only in the Austronesian-speaking regions of Halmahera, and with its shell and stone artefact associations it provides a possible antecedent for Lapita. It is regarded by this author as an archaeological marker of Austronesian colonization, and in

Halmahera it might also have marked the onset of a local period of marsupial extinction. In Morotai, outside the Austronesian region, the first good date for pottery usage is only about 700 BP. These results are still preliminary, however, and further fieldwork is planned for 1993.

In 1989 I presented a paper at the Circum-Pacific Prehistory Congress in Seattle entitled "Are there antecedents for Lapita in Island Southeast Asia?" (Bellwood 1989a). Since this paper is to be published soon I will not attempt to repeat any part of it here. Instead, I will summarise some of the views stated there and add information on some recent archaeological findings in Island Southeast Asia, especially in the northern Moluccas which could be of relevance for Melanesian prehistory.

As an introduction to this material I should state that my view has generally been that Pacific prehistory and especially Lapita, cannot be understood unless one takes a long view from the combined data of archaeology, linguistics and human biology. Pacific prehistory also cannot be understood in the long term unless one has a sound working knowledge of the prehistory of Southeast Asia. There are many subliminal hints in the Pacific literature that a boundary lies around the western end of New Guinea and that this boundary, since at least 3500 BP (perhaps even since 35,000 BP?), has separated a pristine Oceania from a quite different world of Southeast Asia. This is a view perhaps best expressed in the writings of John Terrell (e.g. Terrell 1986 ; reviewed in Bellwood 1987). It is a view which has also been implicit in many of the publications which have resulted from the Lapita Homeland Project in the Bismarck Archipelago (e.g. Allen and White 1989 ; Gosden 1991). Having worked extensively in both Oceania and in Southeast Asia I find that this model of western Pacific primacy is insufficient by itself to explain the may cultural and biological similarities which relate the peoples of Island Southeast Asia and Austronesian Oceania.

Indeed, I still hold, as I have always done, that linguistic and biological data make a high degree of Southeast Asian origin for groups such as Polynesians and Micronesians far more likely than an indigenous origin out of 30,000 year old western Melanesians. The archaeological evidence is not so clear on this because a number of rapid cultural changes seemingly occurred during the second millennium BC in the "Lapita Homeland" of the Bismarck archipelago (or somewhere close-by), thus making it difficult to trace Lapita ancestry in any obvious way into the archaeological record of Island Southeast Asia. A convincing model to explain such rapid changes has recently been offered by Green (1991). Despite this I still regard the initial Lapita phenomenon as not only encompassing the concept of "ancestral Polynesian" in the cultural and biological domains, but also as something which was rapidly taken over culturally and linguistically by indigenous Melanesian populations. This take-over was perhaps lubricated by joining a unique, never-again-to-occur, lingua franca-based cultural network at a time when dialects of a single Austronesian language might have been spoken around coastal regions of western Melanesia.

Lapita-related Material in Southeast Asia

In my Seattle paper I discussed a body of evidence relevant for the Lapita origin debate. The most important came from the site of Bukit Tengkorak in Sabah where an assemblage of red-slipped pottery (including at least one very finely incised vessel), Talasea obsidian and an industry of shell beads and bracelets was excavated from layers dating between 3000 and 2300 BP. (I am now unsure about the existence of shell fish-hooks in the

site, although these have been mentioned in previous reports). Bukit Tengkorak was thus contemporary with the main phase of Lapita expansion and its inhabitants had some kind of trade contact, albeit perhaps not direct, with New Britain some 4000 kms away. The Bukit Tengkorak results have been published in full and I do not need to discuss them further here (Bellwood and Koon 1989 ; Bellwood 1989b).

A number of other important assemblages in southern China and Island Southeast Asia were also discussed in the Seattle paper, indicating the existence across many regions from Zhejiang to the Philippines and central Indonesia of red-slipped pottery decorated with Lapita-like repertoires of stamped circles, geometric dentate stamping, incised spirals and cut-out decorations in pedestal. Much of this material can obviously be removed from consideration with respect to Lapita origins owing to late or uncertain dates (Spriggs 1989). However, on a recent visit to Taiwan I was informed by Huang Shih-chang that a total of six radiocarbon dates on estuarin bivalve shells is now available for the site of Yuanshan in Taipei (Huang 1991 : 7 ; see Bellwood 1985 : 214-6 for the possible significance of this site). The oldest and youngest of these samples are respectively 4220 ± 60 and 3490 ± 80 uncal BP (laboratory not mentioned). Professor Huang also informed me that charcoal samples (apparently as yet unpublished) were also run and tended to be about 400 years younger than the shell dates. All of this makes a date close to 4000 BP or even earlier for the early Yuanshan still very likely. The oldest Neolithic sites in Taiwan, however are still not well dated (Spriggs 1989), and I know of no convincing evidence for a commencement before 6000 BP, or even perhaps before 5000 BP. I now believe that agricultural colonization in Island Southeast Asia, in this region coterminous with Austronesian expansion, was extremely fast once it got underway. Assumptions that the rapid spread of Lapita was something unusual may turn out to be unwarranted as we learn more about Island Southeast Asian prehistory.

Basically I see no reason to change my 1989 views on the significance of an earliest Neolithic horizon of sometimes red-slipped but otherwise mostly plain pottery occurring prior to 3500 BP from the Philippines, through Sulawesi into Timor, and now in Halmahera (see below). An ultimate origin in Taiwan, perhaps from the Yuanshan culture, still seems quite possible to me, although I intend to look into this more carefully on future visits to Taiwan. Equally relevant material with strong maritime orientations also occurs in the far south of the island (e.g. Li 1983). In Island Southeast Asia this red-slipped pottery horizon provides a likely source complex for the derivation of Lapita potting technology. However, I would stress that the pottery of this horizon is mostly plain, except for a few eleborately-incised vessels such as the c.3000 BP specimen from Bukit Tengkorak (Bellwood and Koon 1989 : Figure 4). Most of the "Sa-Huynh-Kalanay" type of incised pottery found across Island Southeast Asia is now known to be of Early Metal Phase date, after 2500 BP. Recent AMS dating of human bone associated with Three-Colour Ware from Lubang Angin in Sarawak confirms this (Ipi and Bellwood 1991), although I am still unwilling to reject all pre-metal dates for this kind of pottery.

Such observations stress the now-commonly held view that the remarkable decoration on Lapita pottery was a Melanesian-area innovation, perhaps derived from an older tradition of tattooing or barkcloth decoration, as suggested by Roger Green (1979). Under situations of colonising stress material cultures can change so quickly that immediate archaeological origins can become obscured, as we know from relations between Britain and the European Continent at many time periods from the Neolithic to the Anglo-Saxon. I suspect we would find the same if there were no historical records concerning the recent European colonisations of North America and Australasia ; would the British source of the

first white settlers of Australia really be so obvious if they had no written language?

A reference to "colonising stress" leads me to another point. Recently browsing through some early nineteenth century statistics on Australia I was intrigued to note that the average number of live births between 1841 and 1846 to women of European descent born in Australia was 6.8. Since this time the average has dropped fairly continuously, reaching 4.0 for 1871-76 and 2.8 for 1898-1903, since which time it has generally dropped down towards 2.0 (McDonald et al. 1987 : 55). I do not know the exact historical reason for the very high Australian 1840-1866 figures, which are uniformly over 5.0 live births per woman, but they do not simply reflect varying rates of childlessness or non-marriage. I understand they are parallelled on the American frontier in the same period and suspect here that many of the normal socio-economic brakes on population growth were minimised in a situation of colonization into a frontier zone of low-density population and adequate food supplies. Perhaps human populations are capable of going into reproductive overdrive under certain situations. If we try to imagine the previously-uninhabited Pacific Islands of 3500 BP, with their undamaged ecosystems, rich faunal resources and presumably no population-threatening diseases or devastating predators, then it is not hard to understand why Lapita mothers might have gone into overdrive too, and it matters little in this regard whether we call them Melanesians or Polynesians. Perhaps that is one reason why there are so many Lapita sites compared to previous periods and why the complex appears to have spread so fast.

Having presented the above observations on matters related to Lapita and its origins I now wish to outline the results of recent archaeological research on Halmahera and adjacent islands in the northern Moluccas of eastern Indonesia. The results of this research are likely to be of significance for our understanding of western Melanesian prehistory in all time periods. This report, however, is provisional.

Archaeological Research In The Northern Moluccas ; Interim Results

The research reported here was carried out in December 1990 and January 1991 (see Acknowledgements). Prior to the fieldwork the island of Halmahera and its satellites offered four major questions to researchers in prehistory ;

1.The date and source of initial Pleistocene settlement
2.The role played by the region in the Austronesian settlement of the Pacific
3.The nature of the interaction between the two major ethnolinguistic population groups of the region - Papuan an Austronesian - during the past 4000 years
4.The history of the spice trade with China, India and the West.

I do not wish to discuss these questions at length here, although the results presented are relevant for the first three (the issue of the spice trade has not yet been approached in the field). Five sites were test-excavated, as follows (Figure 1) :

Uattamdi rockshelter, Kayaoa Island
Tanjong Pinang rockshelter, southern Morotai
Sabatai Tua hilltop site, southern Morotai
Sambiki Mosque open site, southern Morotai
Siti Nafisah cave, Nusliko, southern Halmahera

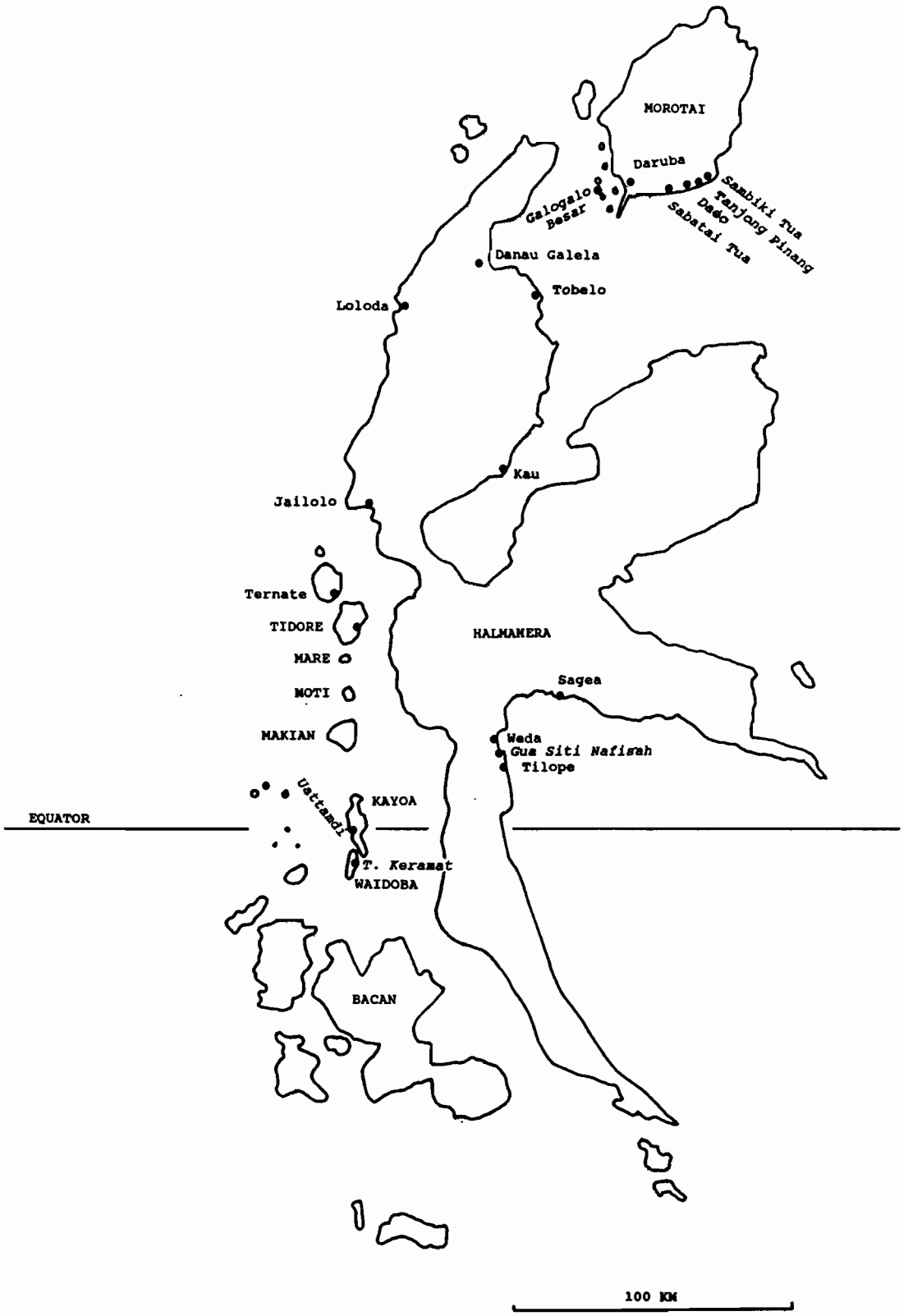

Figure 1. Map of the northern Moluccas showing sites investigated in 1991

A) Uattamdi rockshelter

This 11 by 8 m shelter is cut into the lowest of the three coral limestone raised terraces which fringe western Kayoa. It lies about 1 km northwest of Guruapin village. The excavations eventually encompassed a trench 6 m long by 1 m wide through the centre of the shelter, with about 1.20 m of archaeological stratigraphy. Basically, two archaeological periods are represented, with an intervening stratigraphic zone between them represented by a layer of pumice and beach sand. The radiocarbon dates (below) indicate that this intervening zone represents about 1500 years of virtual non-occupation of the site.

The later deposit, above the beach sand layer, produced corroded and undatable Chinese copper cash and the broken remains of Early Metal Phase jar burials, perhaps two or more, with cranial remains (including shovel-shaped incisors), lots of monochrome glass beads, an excellent incised and carinated accessory vessel (Figure 2) and fragments of iron. This assemblage is similar to those of the Early Metal Phase from Leang Buidane in Talaud (Bellwood 1981) and Agop Atas in Sabah (Bellwood 1988). Three radiocarbon dates on charcoal are relevant to it (Table 1) : ANU 7772 at 900 ± 70 BP ; and ANU 7774 at 380 ± 190 BP (the latter probably results from disturbance of the upper layer of the site). Bones of dog and rat occur in this upper level.

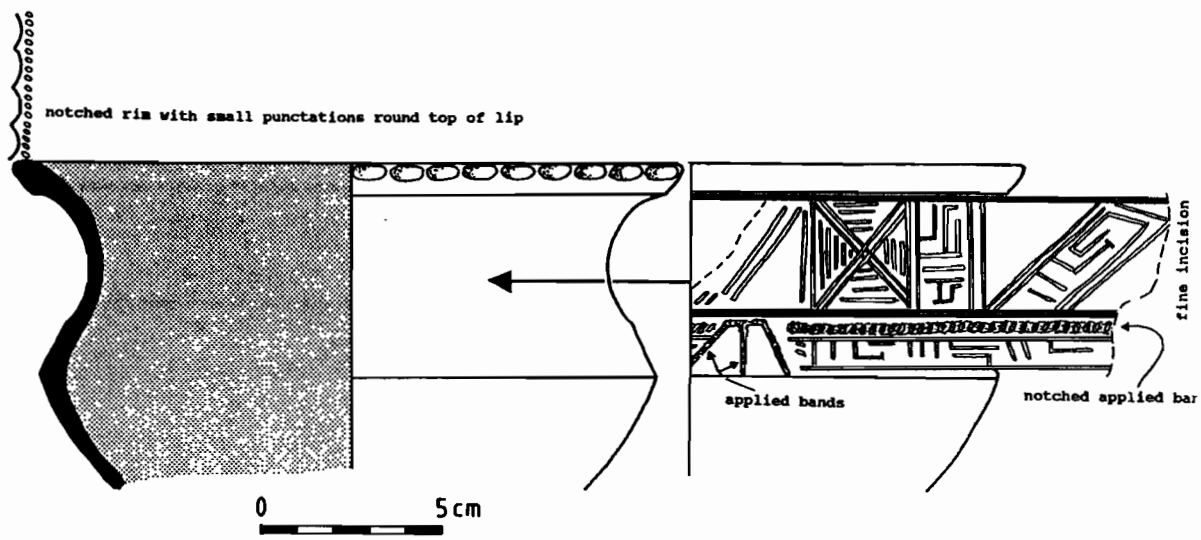

Figure 2. Carinated vessel from the upper deposit at Uattamdi, decorated by fine incision, applied bands and internal red slip. c.1000 BP

The lowest deposit of Uattamdi, however, beneath the beach sand interruption, is more interesting from an Oceanic viewpoint. This is about 70 cms thick, has no metal or glass, and produced the following artefact classes :

- Plain or red slipped pottery, like that deposited after 4500 BP in the shelter of Leang Tuwo Mane'e in Talaud (Bellwood 1976 ; 1981). This pottery is quite thin (average body sherd thickness 3-4 mm) and virtually all vessels were red-slipped around their upper portions and rims (Figure 3). Some vessels appear to have had red-painted stripes, as also at Leang Tuwo Mane'e. Globular vessels with restricted necks and open bowls are the main forms. Fragments of flask necks also occurred. Some rims at the top of this lowest deposit have lip notching (the earlier ones do not). Apart from red-slip there is virtually no other surface decoration.

Table 1 : Radiocarbon dates from the northern Moluccas

ANU No.	Context*	Date**	Material	Comments
7772	Uattamdi 25 cm	900±100	charcoal pieces	Chinese coins, jar burials
7773	Uattamdi 30 cm	1190±70	charcoal pieces	Chinese coins, jar burials
7774	Uattamdi 45 cm	390±190	charcoal pieces	disturbance?
7775	Uattamdi 65 cm	2610±170	hearth charcoal	red-slipped pottery
7776	Uattamdi 120 cm	3440±110	marine shell	red-slipped pottery
7778	T. Pinang 10 cm	3390±70	marine shell	probably preceramic
7779	T. Pinang 30 cm	4090±70	marine shell	preceramic
7780	T. Pinang 35 cm	4720±70	marine shell	preceramic
7781	T. Pinang 55 cm	5390±70	marine shell	preceramic
7782	T. Pinang 70 cm	8860±110	marine shell	preceramic
7783	T. Pinang 100 cm	37510 (+650/-600)	marine shell	human presence uncertain
7784	Sambiki Tua 20 cm	720±180	charcoal	pottery workshop
7785	Siti Nafisah 10 cm	2540±70	marine shell	pottery
7786	Siti Nafisah 15 cm	3410±70	marine shell	upper preceramic
7787	Siti Nafisah 30 cm	4690±120	marine shell	preceramic midden
7788	Siti Nafisah 55 cm	4890±70	marine shell	preceramic midden
7789	Siti Nafisah 65 cm	5170±100	marine shell	preceramic midden
7790	Siti Nafisah midden	1870±80	marine shell	red-slipped, incised pottery

* Depths below surface; these are considered the most useful measurements for this interim report. Full stratigraphic details of the excavations will be presented elsewhere.

** All dates are uncalibrated years BP and use the Libby half-life (as sent to me by the ANU laboratory).

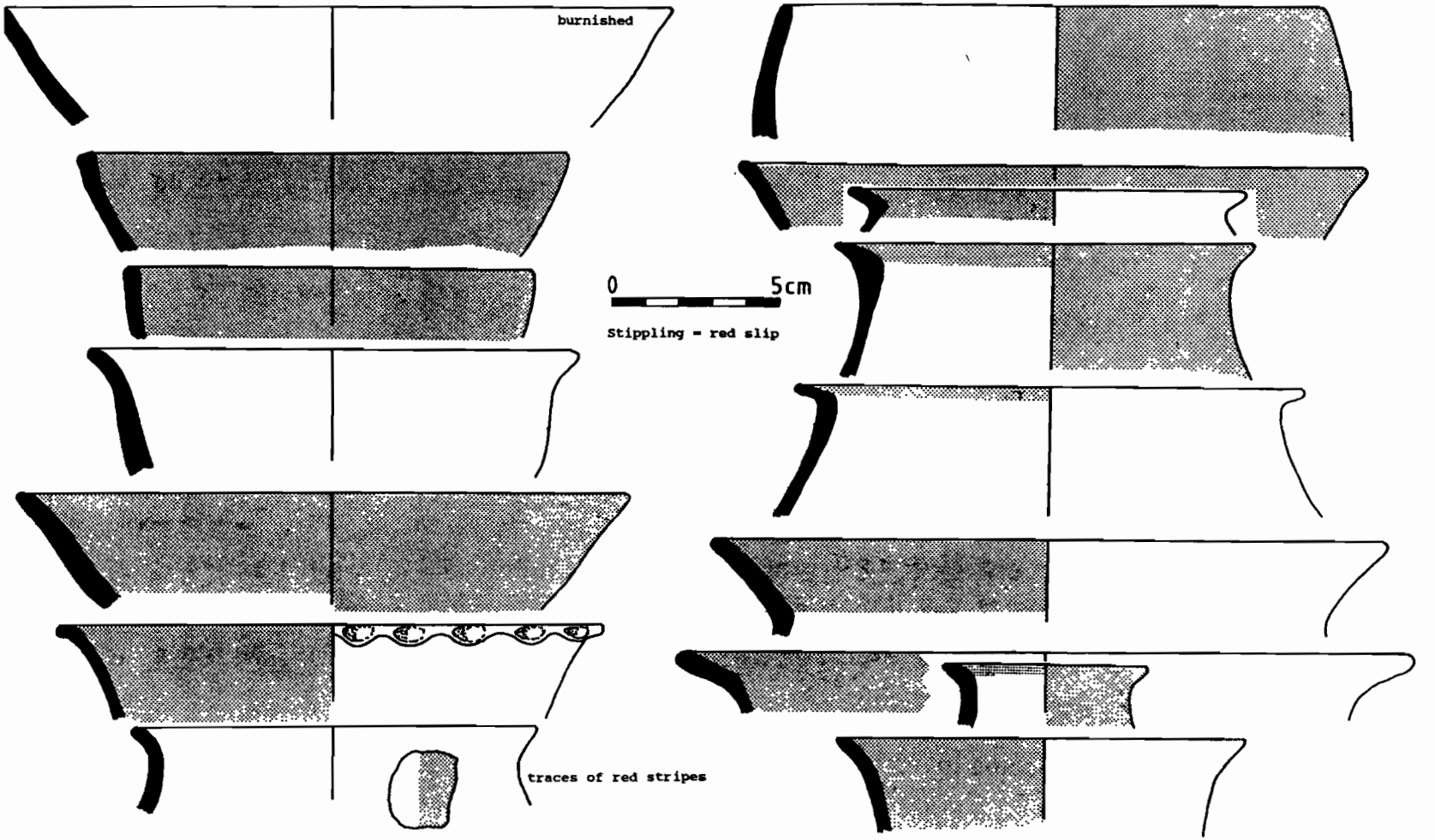

Figure 3. Red slipped pottery from the lower deposit at Uattamdi (This illustration shows all the reconstructible complete rims from this layer)

- Large quantities of marine shell and animal bone, together with many hearths with volcanic cooking stones. The bones include those of Phalanger ornatus, a Halmahera endemic species and the only species indentified so far from this level.

- A flaked and ground stone adze with a lenticular cross-section (Figure 4a), plus lots of adze chips and one edge-ground limestone adze (Figure 4b).

- Shell disc beads, bracelets, spoons/scrapers, knives and lots of worked pearl shell (but not certain fish-hooks).

- A few bone points and stone flakes of different materials, but not obsidian.

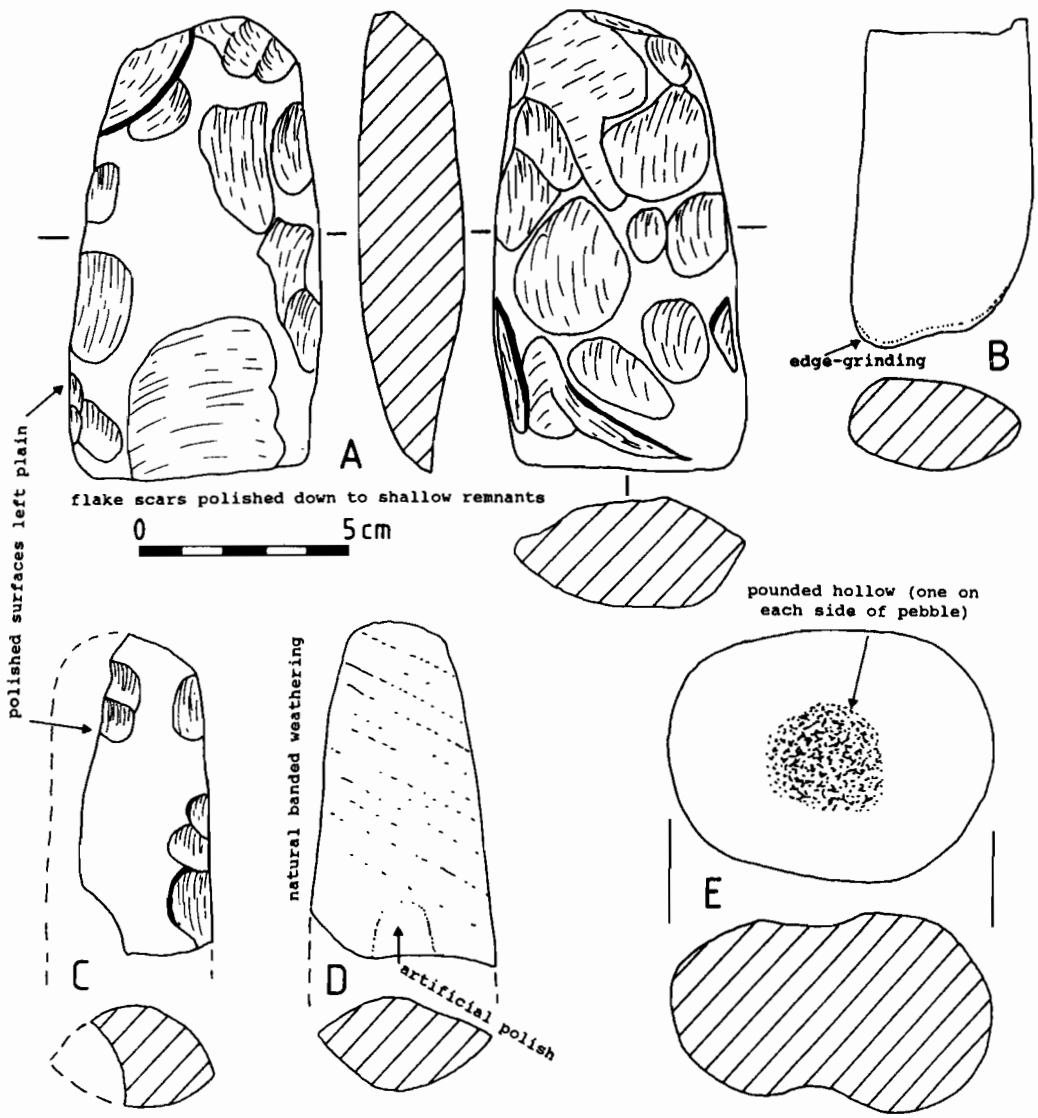

Figure 4. Excavated stone artefacts from the northern Moluccas. A) Lenticular-sectioned stone adze from the base of the Uattamdi deposit, c.3400 uncal BP ; B) edge-ground limestone adze from the base of Uattamdi ; C) lenticular-sectioned stone adze fragment from Siti Nafisah, ceramic deposit ; D) lenticular-sectioned axe/adze from Siti Nafisah, perhaps preceramic (see text) ; E) *Canarium* crushing stone from Tanjong Pinang

The base of this lowest layer dates to 3440 ± 110 BP (ANU 7776) on small marine bivalves found firmly stratified within a hearth. ANU 7775, 2610 ± 70 BP, dates a hearth 55 cms higher in the stratigraphy and 15 cms below the top of the lower cultural layer, which can therefore be dated overall to between c.3500 and 2500 BP. Uattamdi contains no preceramic deposits and it is possible that the small island of Kayoa was not inhabited permanently until agricultural populations entered the area.

B) Tanjon Pinang Shelter, Southern Morotai

This site differs from the last, and also from Gua Siti Nafisah (below), in that it is within the region of northern Halmahera occupied by speakers of Papuan languages. The shelter covers about 8 by 4 m and its base is situated about 8 m above sea level. A trench of 3 by 1 m was excavated within it. Archaeological layers were only 1 m deep, but encompassed both ceramic and preceramic contexts. Pottery with simple impressed or incised designs is confined to the top of the deposit (down to 25 cm). This pottery resembles that excavated from the Sambiki Mosque site nearby and there dated to c.700 BP (see below), and is different from the Uattamdi lower deposit pottery, not only in surface decoration but also in being much thicker (Figure 5). Also in the upper levels of the Tanjong Pinang shelter were some quite well-preserved remains of apparently secondary human burials, including teeth and skull parts, together with a breast pendant of shell. These had obviously been buried in holes and had caused much disturbance.

The affinities of the Tanjong Pinang pottery lie mostly with assemblages of the Early Metal Phase elsewhere in eastern Indonesia, despite the lack of metal in the Morotai sites. The notched and scalloped rims, for instance, are well paralleled in a number of 2000-1000 BP excavated assemblages from Madai in Sabah (Bellwood 1988 : 180, 182, 195, 198). A sample of marine shell submitted from the upper level with pottery gave a date of 3390 ± 70 BP (ANU 7778), but because of the disturbance caused by the burials it seems safest to regard this date as applying to preceramic activity. The Sambiki date of 700 BP seems to be the most acceptable and direct determination available at present.

Also found in the pottery layers were a flake of obsidian (from an unknown source according to Glenn Summerhayes) and a number of rounded pebbles with pounding hollows on both sides (Figure 4e). According to our workmen these would have been used for crushing ***kenari (Canarium)*** nuts - a perfectly feasible explanation -. Interestingly, these *kenari* anvils were found down to 50 cm, or 25 cm below the first appearance of pottery, so they would appear to be a class of artefact which was used continuously from preceramic until recent times.

The underlying preceramic deposit in the Tanjong Pinang shelter was rather enigmatic. Like the upper ceramic layers it contained fair amounts of marine shell distributed continuously to the base, but no human and very little animal bone. *Kenari* anvils, four crudely flaked pebble cores of volcanic rock, three flakes and several unmodified pebble "manuports" were found in this layer, with the lowest flake appearing at 80 cm, just below a marine shell date of 8860 ± 110 BP (ANU 7782). The preceramic level presumably continued upwards to at least the date of 3390 ± 70 BP represented by sample ANU 7778.

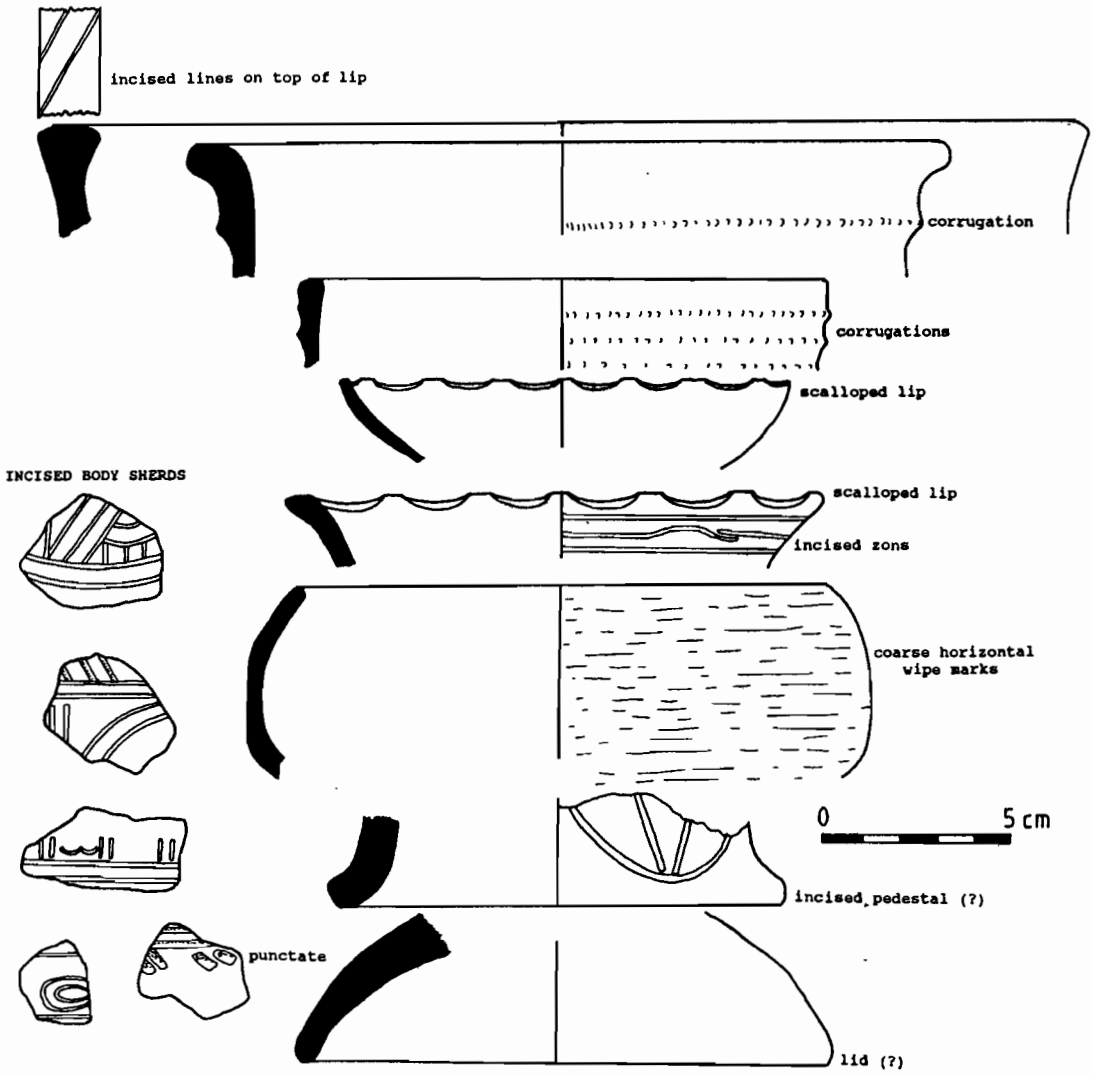

Figure 5. Pottery form Tanjong Pinang. This illustrations shows the main rim and vessel types

However, there is still one problematical date from Tanjong Pinang so far undiscussed. The basal layer of the site, only 30 cm below ANU 7782 and 20 cm below the lowest definite artefact, also produced marine shells of the same species as those distributed continuously above to the site surface, but here without stone tools or artefacts of any kind. A sample of *Nerita* shells from this level gave a date of 37,500 (+650/-600) BP (ANU 7783). Is this date a result of human occupation? I think the only way to be sure is to go back and excavate some more of the site to obtain a larger artefact sample. The date could, of course, be for non-cultural shells trapped in the shelter during the period of its uplift, although the basal layer of the shelter is not a beach deposit but a soil like the archaeological layers above. Furthermore, the sea level at 37,500 years ago was somewhere between minus 50 and 70 metres (Chappell and Shackleton 1986), so this would imply an uplift of the site by as much as 80 metres since that time. Although rapid, this

is not impossible (cf. an uplift rate of 1.9 m per thousand years given by Chappell and Polach 1991 for the Huon Peninsula of New Guinea).

C) Sambiki Tua Mosque Site, Southern Morotai

On a visit to Sambiki Tua village, about 3.5 kms east of Tanjong Pinang, we noticed large numbers of potsherds eroding out from beneath the foundations of the village mosque. The villagers also showed us several polished and untangled stone adzes with quadrangular or trapezoidal cross-sections, some of which were said to come from within the village and even in one case from the mosque site itself. A 1 by 1 m square was therefore laid out behind the mosque. The square revealed a deposit about 35 cms thick with very dense sherdage, including lots of fired lumps of clay. The area was clearly close to a pottery workshop area for a long period, and the presence of postholes suggests that some of the potting activities might have been carried out under raised house floors. The upper sherdage is a combination of plain, red slipped and incised pottery which overlaps with much that came from the Tanjong Pinang shelter. The lower sherdage is mainly a thick red slipped ware with no other decoration - pottery of this type has not so far been noted elsewhere. It is not known how long a period of potting is represented by the trench section, but it could be several centuries. A radiocarbon sample from near the top of the densest concentration of sherdage gave a date of 720 ± 180 BP (ANU 7784). No imported ceramics or metal were found, and a stone *kenari* crusher identical to the ones from Tanjong Pinang was found on a surface nearby.

D) Sabatai Tua hilltop site

The site, on a hilltop immediately across the river from the present village of Sabatai Tua, was found by accident when the villagers where trying to show us caves (the caves, incidentally, turned out to be of no interest). Large quantities of sherdage appear to have eroded from the top of the hill and many have come to rest on a terrace about half way down the seaward side. Two test pits revealed no *in situ* stratigraphy owing to soil movement and continuous cultivation of the site, but collections of the pottery were made. The Sabatai Tua pottery (Figure 6) overlaps with that from Sambiki and Taniong Pinang, particularly in the importance of incision and impression, although red slip is very rare. A few sherds of blue and white Chinese pottery and *forna* for cooking sago suggest that the assemblage may overlap with the period of the Ternate Sultanate. There are also some remarkable classes of unique ceramic material, including pottery mortars and massive decorated pestles, perhaps for betel preparation (Figure 7). Some of the pottery recorded by Schmitt (1947) during Second World War activities on Morotai may also belong to this tradition.

E) Gua Siti Nafisah, Nusiiko, Southern Halmahera

This site lies about 70 metres above the alluvial flats of the Sungei Roti, near the northeastern end of the southern arm of Halmahera. It is a very large true limestone cave (not a rockshelter) with a habitable floor area at the front about 3 metres wide by about 10 metres long running back into the cave. The excavations encompassed one large trench of 4.25 by 1 m excavated into preceramic shell midden deposits in the mouth of the cave, and two smaller trenches of 1.8 by 1 m excavated into two areas of pottery-bearing shell midden deposits further inside. The sequence of activity represented in the site is quite complex, but can be summarised under three headings :

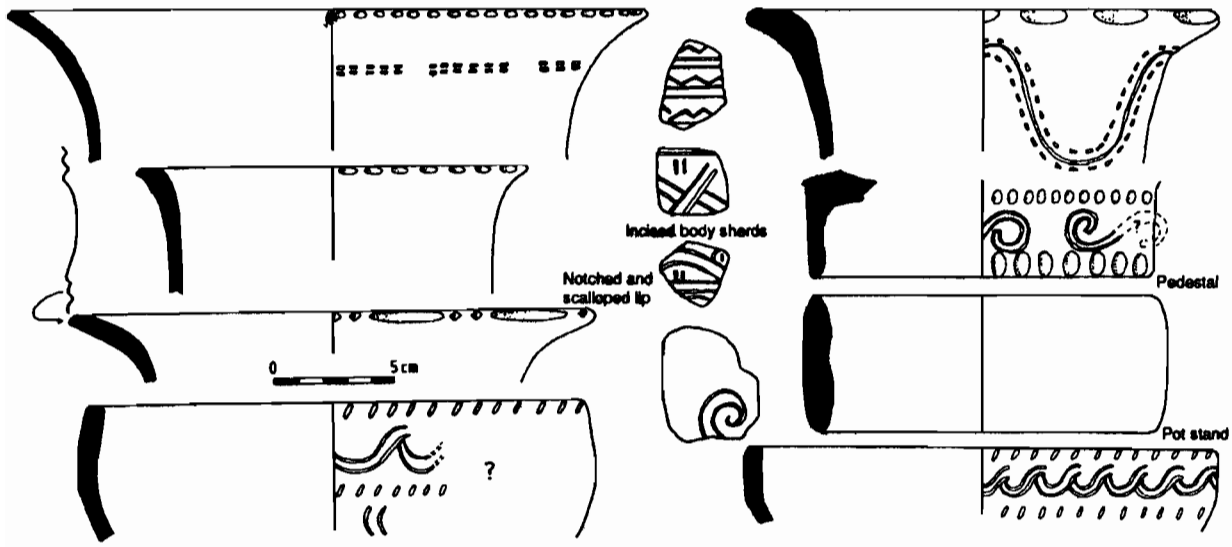

Figure 6. Pottery from Sabatai Tua. This illustration shows the main rim and vessel types

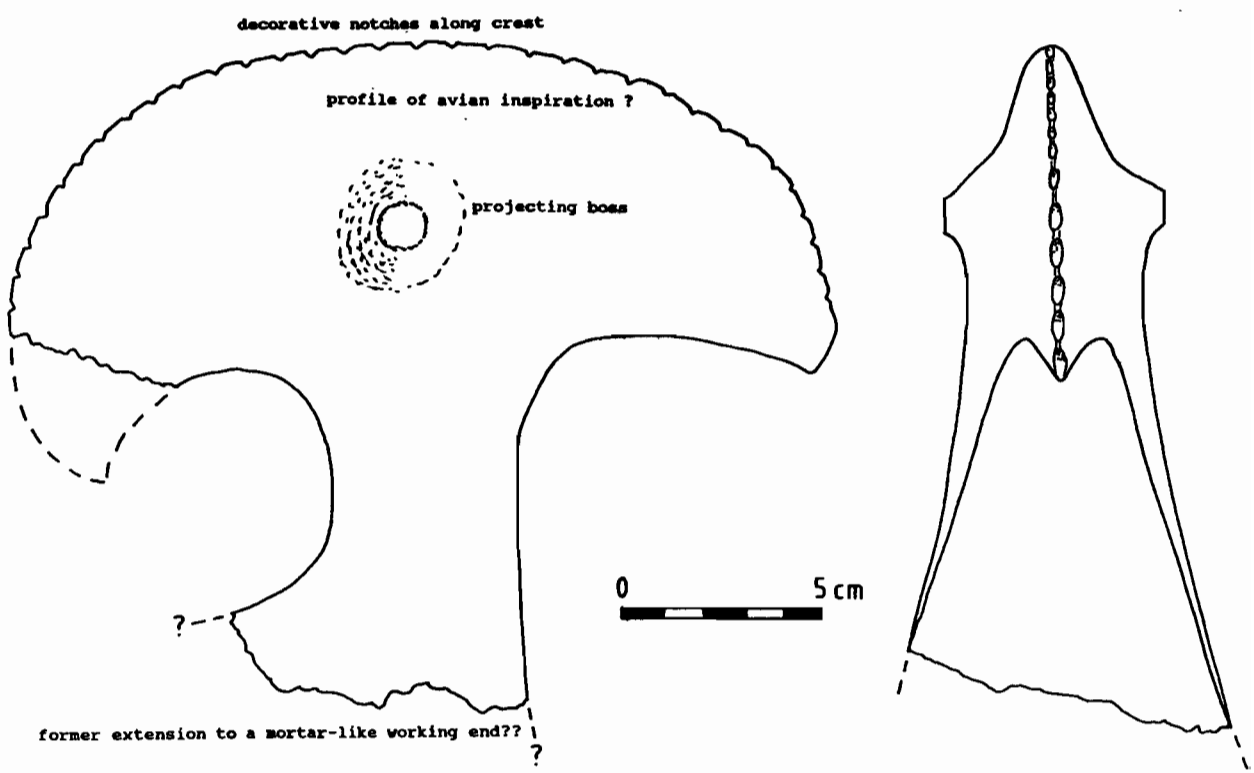

Figure 7. The crest/handle of a large pottery object, perhaps a mortar, form Sabatai Tua

a) Preceramic. A midden close to the mouth of the cave yielded at least 24 species of freshwater and marine shells with varying concentrations (almost solid shell in places) through a depth of 70 cm, together with quantities of animal bones, some ochre (one piece with very clear signs of use), cooking stones and a large number of unworked pebble manuports. This deposit produced no worked stone tools of any kind. Animals identified by Tim Flannery (excluding bats which live in the cave) include *Phalanger ornatus,* a species of *Dorcopsis* wallaby which no longer occurs on Halmahera, and a species of bandicoot (cf. *Echymipera rufescens)* which is likewise locally extinct. The bones of *Dorcopsis* and the bandicoot occur throughout the preceramic midden, which is dated by several radiocarbon samples to between 5170 ± 100 BP (ANU 7789) and 3410 ± 70 BP (ANU 7786), and postdated by a determination of 2540 ± 70 BP (ANU 7785). The most likely explanation for the wallaby and bandicoot is that they are extinct local endemics, rather than human introductions. The question arises whether incoming populations, presumably Austronesian-speaking groups with agricultural practices and perhaps dogs, bore some responsibility for this, but this question is clearly one which requires further research. The preceramic midden itself certainly contains no pig or dog bones.

b) Pottery-bearing occupation, mainly further inside the cave and separated both spatially and probably by a brief hiatus in time from the preceramic occupation. The pottery occurs with a very dense (virtually solid) shell midden which in one place was sealed under a massive stalagmite. The pottery is heavily red slipped and incised and shows some possible affinities with late Lapita pottery in terms of decoration (Figure 8). It is different from the red slipped but otherwise plain ware from the lower deposit at Uattamdi, but I think may be related to pottery excavated in 1990 by W.G. Solheim from a site on Pulau Kumo near Tobelo, northeast Halmahera. Other finds with the Siti Nafisah pottery include definite pig bones, a flaked and partially ground fragment of a lenticular-sectioned stone adze (Figure 4C) like the one from Uattamdi, fragments of stone and pearl-shell rings and bracelets and a shell pendant. This deposit is dated by ANU 7790 on Anadara shell to 1870 ± 80 BP (ANU 7785). This date probably represents the beginning of pottery-using occupation in this site.

c) Enigmatic occupation. Of particular interest was the finding of an ash hearth on a well-trodden floor of decomposed guano stratified under a layer of sterile guano about 5 mm thick, directly beneath the pottery-bearing shell midden just described. This hearth contained the poll of a lenticular-sectioned and untangled stone axe/adze (Fig. 4D). No pottery was found in association and I believe this is a significant absence, not simply a matter of sample bias. The present guano surface seal over the c.1870 BP shell midden is only about 5 mm thick or less, so this tool may be very much older than the pottery-bearing midden since its guano seal is compacted. It may even belong with the preceramic occupation at the front of the cave, described at (a) above. Given claims for flaked and ground axe-adzes in the New Guinea Highlands throughout the Holocene (e.g. White 1972) I would suggest that this find may record the preceramic use of an axe/adze tool kit on Halmanhera. Unfortunately, the ash hearth contained insufficient charcoal to give a date and no shellfish were found in association.

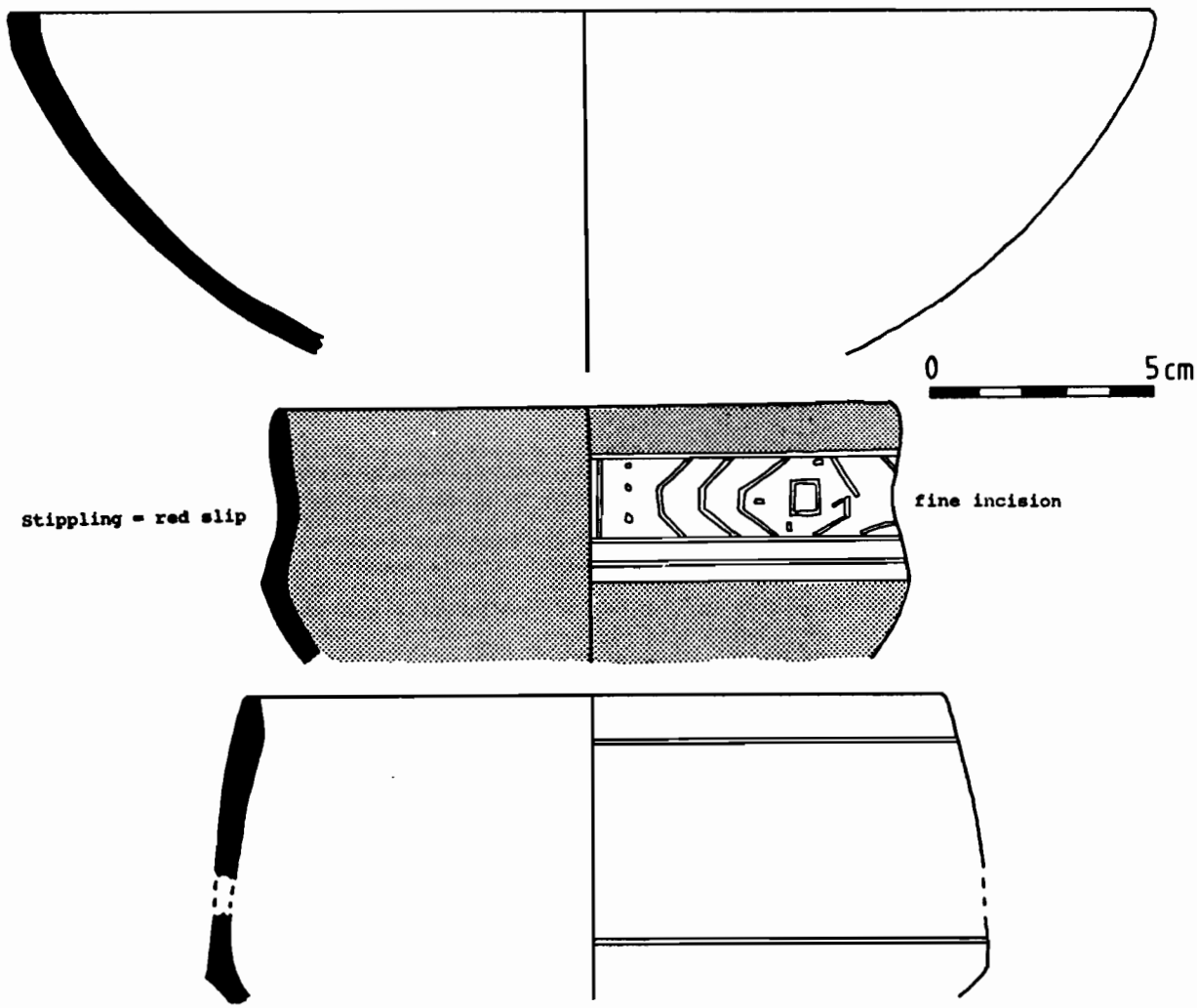

Figure 8. Reconstructible vessel forms from the Siti Nafisah shell midden, c.1870 uncal BP

CONCLUSION

Before the fieldwork began four questions, as listed at the beginning of this report, were deemed to be of central interest. Of these questions, the fourth was not really researched since it would require coastal excavations in Ternate and Tidore. However, the Chinese coins and Early Metal Phase burial material from Uattam must surely have some significance in terms of contacts with more westerly parts of Indonesia and mainland Asia about 1000 years ago.

Given the 37,500 BP date from Tanjong Pinang the first question, of initial human settlement, may be discussed, but not yet easily answered. Until further information is obtained from the Tanjong Pinang site I am prepared to surmise that Halmahera was first

settled from western New Guinea and not from regions of Indonesia to the west or south. A glance at a map will quickly show that the easiest sea crossings go towards New Guinea, via the islands of Gebe and Waigeo. The most puzzling observation on the preceramic of the region is that it seems to be almost devoid of flaked stone tools, apart from the few flaked pebbles from Tanjong Pinang and the possible axe/adze from Siti Nafisah. Good stone seems to be very rare around Halmahera - do we have a predominantly lignic prehistory, especially at Siti Natisah?

On the second question, of Austronesian settlement, we clearly now have lots of materials from the Uattamdi and Siti Nafisah sites which overlap in time with Lapita and which show affinities with it in terms of pottery, shell ornaments and stone adzes. The absence of Talasea obsidian at Uattamdi is puzzling, however, given its frequency much further west at Bukit Tengkorak in Sabah, and there is currently no apparent explanation for this. I can only conclude here that we do not yet have an obvious archaeological ancestor rather than a contemporary for Lapita in Halmahera. The evidence from Uattamdi, where pottery-using occupation seems to start abruptly at about 3500 BP, and Siti Nafisah, where marsupial extinction occurred at about the same time, suggests that the makers of the red-slipped pottery did not arrive in Halmahera very long before this date. This raises many interesting questions about the dating of the appearance of red-slipped pottery all over the Philippines and eastern Indonesia, and my own growing impression is that this phenomenon might have been part of the same expansion, and perhaps just as rapid, as that represented by Lapita. On the other hand, it is worth remembering that the research reported here is only a "first strike", so it is possible that dates for pottery older than that from Uattamdi may eventually be forthcoming from other Halmahera cities. After all, the first Lapita "strikes" in Melanesia produced dates of around 800 and 400 BC (Lapita and Watom), many centuries later than those now reported by Kirch and Hunt (1988) from Mussau.

Other important matters probably connected with Neolithic expansion will be the dates of introduction to Halmahera of non-native mammals such as pig, dog and sambhur deer. The lower layer of Uattamdi may give the answer for pig, although none has been found there yet. Pig is present in Siti Nafisah at c.1870 BP.

The third question, of Papuan/Austronesian interaction, may well turn out to be one of the most important for the present-day peoples of the region. It still seems to be a reasonable hypothesis that Papuan speaking peoples settled Halmahera before Austronesians, and it is noteworthy that the Austronesians today only occupy some of the offshore islands and the southern portion of Halmahera. The more densely-settled northern region has always presumably remained the domain of Papuan languages, even if the influence of Austronesian languages, especially in the period of Ternate and Tidor Sultanates, has been very strong. The Morotai sites have not, so far, produced any early red-slipped pottery like that of Uattamdi or Siti Nafisah, and the radiocarbon date from Sambiki gives us only a 700+ year timespan for pottery manufacture on the island. Of course, some caution is required here until further dates are forthcoming, although the current impression from the pottery data is one of considerable diversity along a north-south axis. Whether the underlying preceramic remains of Tanjong Pinang and Siti Nafisah can be said to be sufficiently similar to indicate that a more homogeneous population once occupied the region, prior to 3500 BP, is going to be more difficult to answer in the virtual absence of style-bearing stone tools.

However, like the human story of New Guinea itself, the prehistory of Halmahera can be expected to be unusually complex. Further fieldwork to address what are obviously many continuing questions is planned for mid-1993 and funding is already available.

Acknowledgements And Notes

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POTTERY TRADITIONS IN MICRONESIA

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RÉSUMÉ

Les traditions céramique en Micronésie

L'art de la poterie a été pratiqué par le passé dans toutes les îles hautes de Micronésie. Seules deux îles (Yap et Palau) ont préservé cette tradition jusqu'au présent éthnologique. Toutes les autres îles, telles que Truk, Ponape et Kosrae avaient abandonné la pratique de la poterie au cours de leur histoire. Dans le cas de Truk et Kosrae, cela pourrait s'expliquer par la mauvaise qualité des argiles disponibles.

La poterie la plus ancienne, et la plus richement décorée, était fabriquée dans les Iles Marianes dès 3600 BP. Une autre tradition céramique apparaît dans le reste de la Micronésie vers 2000 BP. Les caractéristiques technologiques de ces deux traditions possèdent certains traits communs. L'usage de sable corallien comme dégraissant était universel sauf à Palau. On retrouve la même technique parmi les traditions céramiques Lapita de Mélanésie. La tradition de poterie utilisant des sables coralliens comme dégraissant pourrait avoir des origines multiples, venant de l'Ouest et du Sud, mais ceci n'est pas encore prouvé. L'usage de sable corallien disparut progressivement à travers l'histoire, et des poteries non-calcaires furent fabriquées plus tard dans les Marianes, à Yap et à Ponape. Cette évolution pourrait bien être due à l'influence de l'environnement sur la technologie.

La poterie produite à Palau présente des caractéristiques uniques, et pourrait avoir une origine distincte des autres traditions de poterie dégraissée au sable corallien, venant peut-être de l'Ouest.

ABSTRACT

Pottery making was once practiced in all the high islands in Micronesia. Only two islands (Yap and Belau) kept the tradition until ethnographic present. The other islands, such as Chuuk, Pohnpei and Kosrae had abandoned pottery making later in the history. The reason for abandoning pottery making in Chuuk and in Kosrae could be explained by the poor quality of clay resources.

The oldest and the only decoration-rich pottery was made in the Mariana islands as early as 3600 BP. The other tradition appeared in Micronesia about 2000 BP. Technological characteristics of these pottery traditions share some similarities. The use of calcareous sand temper was commonly practiced except in Belau. This practice was also found among the Lapita pottery traditions in Melanesia. The calcareous sand tempered pottery tradition may have had more than one origin, west and south, which is still uncertain. The use of calcareous sand declined through history and non-calcareous pottery was made later in Marianas, Yap and Pohnpei. The change was likely due to the environmental effect on the technology.

Pottery made in Belau is very unique and may have had a different origin from the other calcareous sand tempered pottery tradition, perhaps from the west.

Introduction

Only recently have we acquired a reasonable amount of information on the pottery traditions in Micronesia. It was believed that pottery had been made and used only in western Micronesia until some potsherds were found among dredged coastal deposits in the Truk islands in 1974. Further archaeological research in other islands in eastern Micronesia then demonstrated that a substantial amount of pottery was once made not only in the Truk islands but in all the high islands in Micronesia (Figure 1). This paper describes the changes in distribution and technology of pottery traditions in Micronesia and will indicate some possible routes by which pottery making was brought into Micronesia.

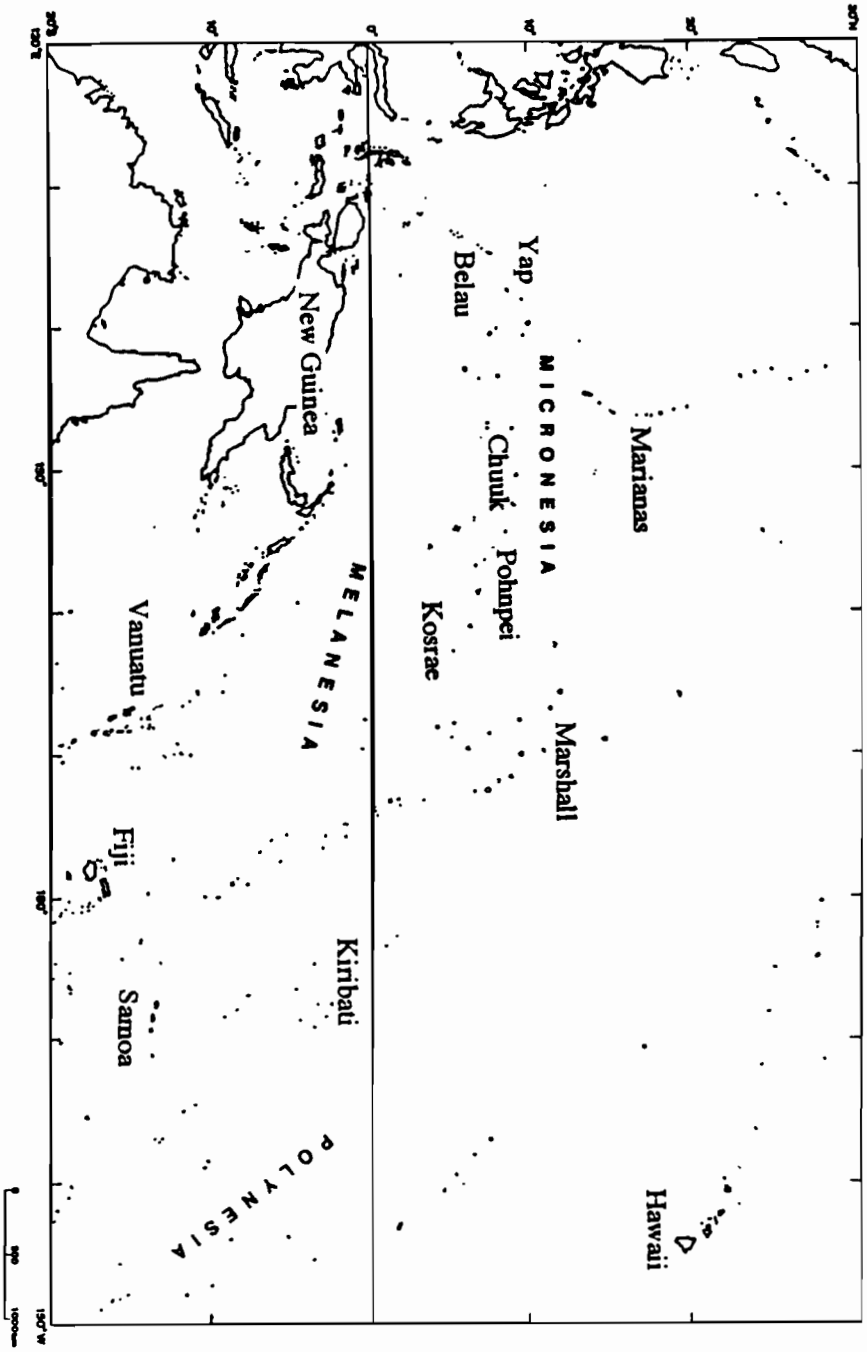

Figure 1. Map of the northern Pacific

Traditional Pottery Making In Micronesia

Only two pottery making traditions were known historically in Micronesia. Technological details of pottery making were recorded in Yap and Belau in the Western Caroline islands. There are both similarities and differences in the technologies of these two pottery traditions. Despite the large numbers of surface potsherds in the Mariana islands, it is not clear whether or not people were making pottery there too at the time of first European contact. There are no descriptions found in historic documents concerning traditional pottery making in the Marianas.

Yap

In the Yap islands during the historic period, pottery making was carried out by women belonging to the low class villages **(mlingal).** These villages were located inland where rich clay resources were available. Newly made pottery was not allowed to be exchanged or given to anyone but had to be delivered to the overseer high class village. Pottery was then distributed to other villages through the traditional communication network system called **tha'.** Pottery was also given to the people in the Central Caroline islands who had **sawel** trading relationships with certain villages in Yap (Lingenfelter 1975).

The majority of pots made in the historic period were shallow plain bowls for cooking (Figure 2). The pot shapes made in the various villages were similar to each other throughout Yap. Only the size of pots varied. The technology of pottery making was also generally similar, with only a little variation (Intoh and Leach 1985 : 127-145).

The ceramic environment in Yap is unique. The clay obtainable in Yap is montmorillonite-rich (40-80%) and is extremely plastic. Having metamorphic rocks as the base geological formation, volcanic sand in Yap is scarce. Traditional pottery was thus made from the very plastic clay without sand temper. This influenced the technological details of pottery making (Intoh 1990).

The clay is purified by picking stones and roots out, and shaped into a cylinder. A short coil is formed with a little clay taken from the outer surface of the cylinder. A pot is shaped with many such coils and an incurved rim is formed with a shell tool. After the pot is dried in a shed for a month, the bottom of the pot is shaped by scraping off the excess clay with a bamboo tool. Three more months are spent for drying the pot before firing.

A large fire is made for half an hour before the dried pot is put on it upside-down. The firing temperature reaches around 900oC. When the pot becomes red, it is taken out from the fire with a long stick in order to be cooled in the air. Only one pot is put in a fire at a time.

Belau (Palau Islands)

Pottery making in Belau was also carried out by women, while the firing was done by men. There were some variations in clay resources available in Belau. Clay of whitish colour was used in historic pottery making. The technological process of pottery making is similar in general to that of Yap.

Figure 2. Ethnographic pottery of Yap (after Müller 1917)

Figure 3. Ethnographic pottery of Belau (after Krämer 1926)

Clay lumps are examined and small stones and sand-particles are removed. The clay is then shaped into a flat round block with a thick central portion. A small amount of clay is removed from the central portion and formed into a short sausage-like coil. Coils are smeared onto the outer edge of the bottom rim. The whole pot is shaped by adding many coils one after another and smoothing the surface using wetted fingers. This method is similar to the technique recorded in northern Yap (Intoh and Leach 1985 : 127-132).

After the pot is dried for several hours, the surface is finished with a paddle and anvil. After a few days drying, the base portion is also finished with paddle and anvil on the potter's knee. Pots are ready for firing after drying for a day. This short drying time is very different from Yap where several months are required for drying as was mentioned above.

Two large dried pots are placed upside down on a pyre of firewood. It is another difference from Yap that pots are put on firewood before the fire is lit. The firing takes about twenty minutes. When the fire has burned out, the pots are taken out and put on the ground.

There were several vessel forms made in historic times. Two major types of cooking vessels can be distinguished : round pots with high walls and oval flat pots. There were other kinds of pots as well : tall molasses containers, large pots (more than a meter high), and clay lamps (Krämer 1926 : 130-138).

Distribution Pattern of Prehistoric Pottery in Micronesia

It is now apparent that pottery making was once practised in all the high islands in Micronesia. Pottery making in eastern Micronesia was abandoned sometime before European contact. There was a variation in distribution patterns of prehistoric pottery in both time and space (Figure 4).

The oldest pottery making in Micronesia was practised in the Mariana islands, going back to around 3600 BP. The practice probably continued until 1521 when the first European contact was made. Two major kinds of pottery can be distinguished in the long history of pottery making there. Two sets of names were given by different researchers ; Marianas Red and Marianas Plain by Spoehr (1957) and CST (Calcareous Sand Tempered) and VST (Volcanic Sand Tempered) by Reinman (1977). CST is roughly equivalent to the Marianas Red and VST to the Marianas Plain.

There is as yet no secure evidence of pottery making in other Micronesian islands between 3600 and 2000 BP.

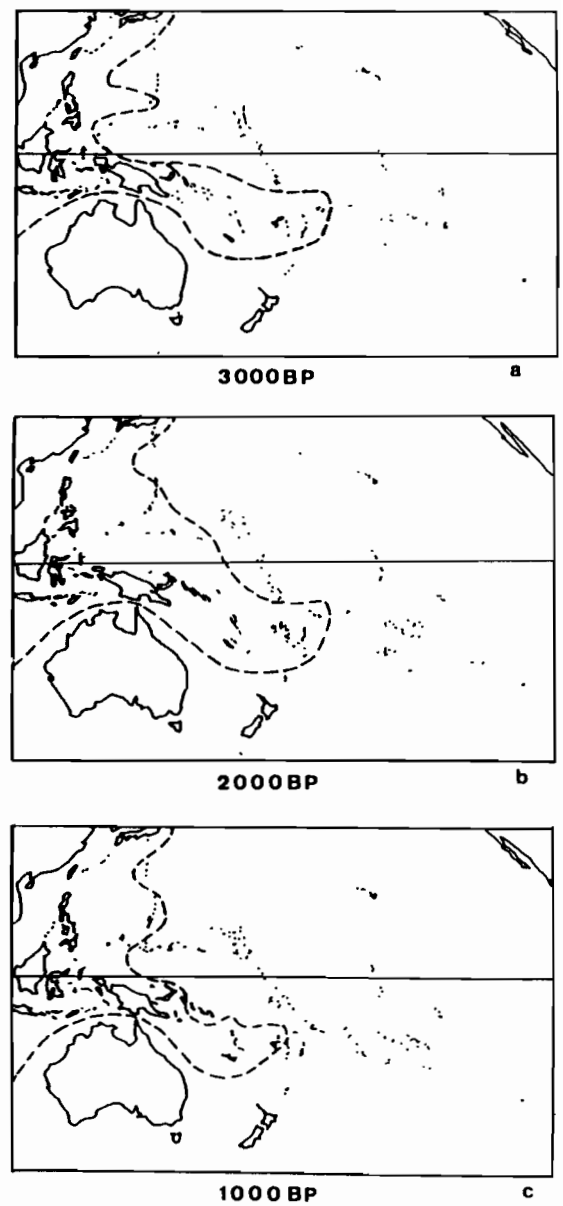

Figure 4. Changing pattern of pottery distribution in Oceania at different periods

Around 2000 BP., we find the sudden appearance and the widest distribution of pottery making. Pottery was made in Yap, Belau, Chuuk (Truk islands), Pohnpei (Ponape) and Kosrae as well as in the Marianas. This is the time when pottery was made in all the high islands in Micronesia. All of this pottery, except for that from Belau, had calcareous sand mixed as a temper. This technological characteristic is shared with early pottery traditions in the Marianas and with many Lapita assemblages in Melanesia and western Polynesia.

After a short while, pottery making ceased in Chuuk and in Kosrae. This has been explained as resulting from the poor quality of clay resources available in both islands (Athens 1990a). Pottery making continued in Pohnpei until about 800 BP. (Ayres 1990 : 190) and until historic times in Yap and Belau (Figure 4a).

There are many coral islands in Micronesia where no clay resource is available for pottery making. Pottery was, however, imported and utilised in some of them. Prehistoric Yapese pot sherds were excavated from Ngulu (Intoh 1984), Ulithi (Craib 1980), Faraulep, Lamotrek (Fujimura and Alkire 1984) and Fais (Intoh 1991). The dates associated with these excavated potsherds vary ; from A.D.500 until historic times on Ngulu, around A.D.1000 in Lamotrek and from A.D. 100 up to historic times on Fais. The trading network system, *sawei,* probably had a role in transporting pots to these coral islands from Yap. A small amount of Belauan potsherds was included in some of these excavated assemblages, such as those from Ngulu and Lamotrek.

The use of pottery in prehistoric Micronesia can be divided into the following three patterns.

1) Pottery made and used throughout the occupation history (Marianas, Yap and Belau).

2) Pottery made and used by the first migrants but abandoned later (Chuuk, Pohnpei and Kosrae).

3) Pottery not made, but imported pots used (some coral islands in the Central and Western Caroline islands).

We should, of course, consider a further pattern where no pottery was used at all. However, we cannot be definite at present because many islands remain unexcavated.

Prehistoric Pottery Assemblages in Micronesia

Variations in pottery attributes (formal details, decoration and function) reflect cultural as well as natural environmental conditions of the society in which pottery was used. In this section, the characteristics of the prehistoric pottery assemblages in Micronesia will be looked at in sequence.

The Marianas

Around B.C.1600, about the same time that Lapita pottery appeared in the Bismarck islands in Melanesia, a decorated pottery tradition appeared in the Marianas. The tradition was characterised by thin-walls, red colour and the use of calcareous sand temper. This early pottery tradition has been called as Mariana Red Ware or as Marianas Calcareous

Sand Tempered. Because of the contrast to the late pottery associated with Latte structures, the early pottery is called Pre-Latte pottery. The majority of the pots are shallow bowls and pans. Pot shapes vary at the shoulder (incurved, out-curved and carinated), and at the base (round or flat) in particular (Figure 5).

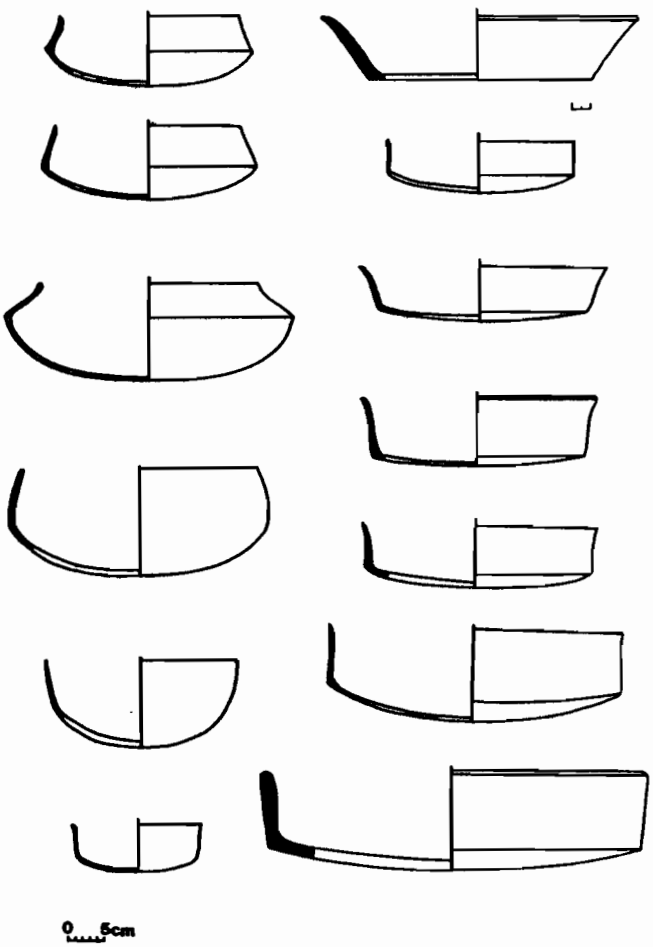

Figure 5. Reconstructed pot forms of early Mariana pottery (re-drawn from Ray 1981 by M. Isogai)

The percentage of decorated potsherds is not very high. Decoration is concentrated around shoulders, rims, and lips. Decorative techniques include fine-line incising, punctuation and stamping. Impressed decorations are often filled with white material (Figure 6, 7). This was once called "lime-filled, impressed trade ware" by Spoehr (1957 : 120-122), because the finding of such potsherds was limited in time and in space ; no earlier than ca 2500 BP. (Moore 1983). Recent excavations in Achugao area of Saipan, however, demonstrate that this decorative tradition was present for the entire early sequence of the site, between about 3600 and 2000 BP. (Butler and Fant 1989 ; Butler pers. comm.) The distinction of Spoehr's "lime-filled, impressed trade ware" from other decorated pottery is questionable.

Within pottery assemblages from the Pre-Latte period, characteristics of temper, surface treatment, surface finish, and rim form show substantial homogeneity, and there is a relatively high inter-site similarity between assemblages on different islands (Graves et al. 1990 : 220).

The early pottery tradition was gradually transformed into the plain pottery tradition. Major changes associated with the transformation were differences in tempering material and in wall thickness. Calcareous sand temper decreased while volcanic sand temper increased from the early pottery to Latte period plain pottery with some regional variation (Graves et al. 1990). The time span for plain pottery was between about 1000 and 500 BP.

Although the majority is plain pottery, a variety of exterior surface treatments have also been recognised in late prehistoric pottery. Six attributes are classified : burnished/polished, wiped/brushed, combed/trailed, impressed/incised, and lime plastering (Graves et al. 1990 : 216).

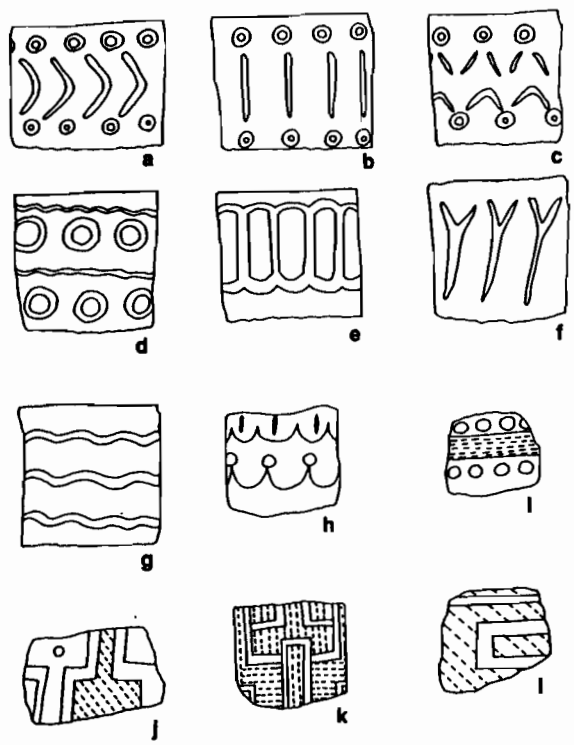

Figure 6. Decorative patterns on the excavated potsherds from the Marianas ; a-g : Guam, h-l : Saipan (re-drawn from Spoehr 1957, Ray 1981 and Butler and Fant 1989)

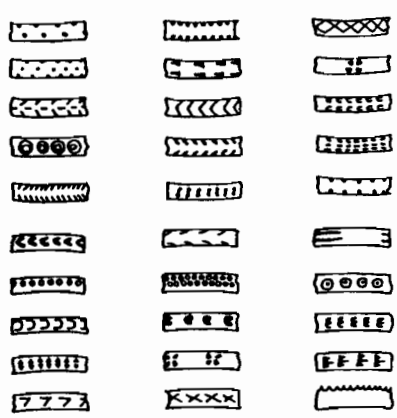

Figure 7. Incised lip decorations of the early Marianas pottery (re-drawn from Moore 1983, Leidemann 1980 and Ray by M. Isogai)

Yap

In the course of Yapese prehistory, three different types of pottery were manufactured (Intoh 1984), varying in tempering material, texture and shaping method. No decorated pottery has been found.

The earliest type is called Calcareous Sand Tempered ware (Yap CST ware) and is characterised by the used of clay mixed with calcareous sand temper. This pottery begins as early as the evidence for the first people in the island group. Yap CST pottery has been excavated mainly from low lying coastal sites in the South and in the East. The time span of this type of pottery is currently indicated to be between 2000 and 600 years BP. (Intoh 1990a : 131-132). The majority of CST pottery is small bowl form with a range of rim styles : in-curved, out-curved and straight. A carinated bowl form was also reconstructed which is similar to a Lapita pot form (Figure 8, top).

Plain pottery appeared as early as CST pottery at some sites, but was dominant between 800 and 600 years BP. A typical Plain pot had a thick wall and was built with the coiling method. The rim form varies from straight to slightly incurved. Plain pottery was called as Unlaminated pottery by the Giffords and it was claimed to be the same as the Marianas Plain Ware by Spoehr (Gifford and Gifford 1959). This claim, however, cannot be supported given the differences in technological details and in the clay resources used.

The third type, which appeared latest in the sequence, and which persisted into the ethnographic period, is called Laminated Ware. This pottery has very hard walls, and shows laminations in the wall section. The pot shape is a simple incurved bowl and is more less uniform throughout Yap (Figure 8, bottom). The appearance of this type of pottery occurs about 600 BP.

Belau

Pottery was made in Belau throughout its occupation history, since 2000 BP. (Masse 1991 ; Snyder 1989). Belauan pottery is not easily analysed into discrete types. Rather, there is a wide range of continuous variability in thickness, paste, and colour. This is the only island group in Micronesia from where no calcareous sand tempered pottery has been found. Grog (crushed potsherds) and sand were used as tempering materials.

The majority of the pot forms is incurved- or straight-walled cooking bowl with some oval ones (Figure 9). Decorated pottery is found in small quantities (Figure 10). Decorations are made with nail impressing, incising, stamping and painting (Osborne 1966, 1979 ; Hidikata 1973). Rim indenting is also found on some of the pots that have a flat rim. The dating of these decorated potteries is not at all clear.

Chuuk

Pottery in Chuuk has been excavated only from Fefan Island. It is a locally made pottery. The assemblage consists of dark crumbly potsherds which are tempered with calcareous sand. The majority of the reported pot forms are globular. Few decorated potsherds have been found except for a few body sherds which have incised lines. One rim sherd was found which had notches on the lip (Figure 11b). The period characterised by pottery in Chuuk (named as the Winas Pattern by King and Parker) is currently suggested to range between 2500 and 1500 BP. (Shutler et al. 1984 ; King and Parker 1984 : 418-9).

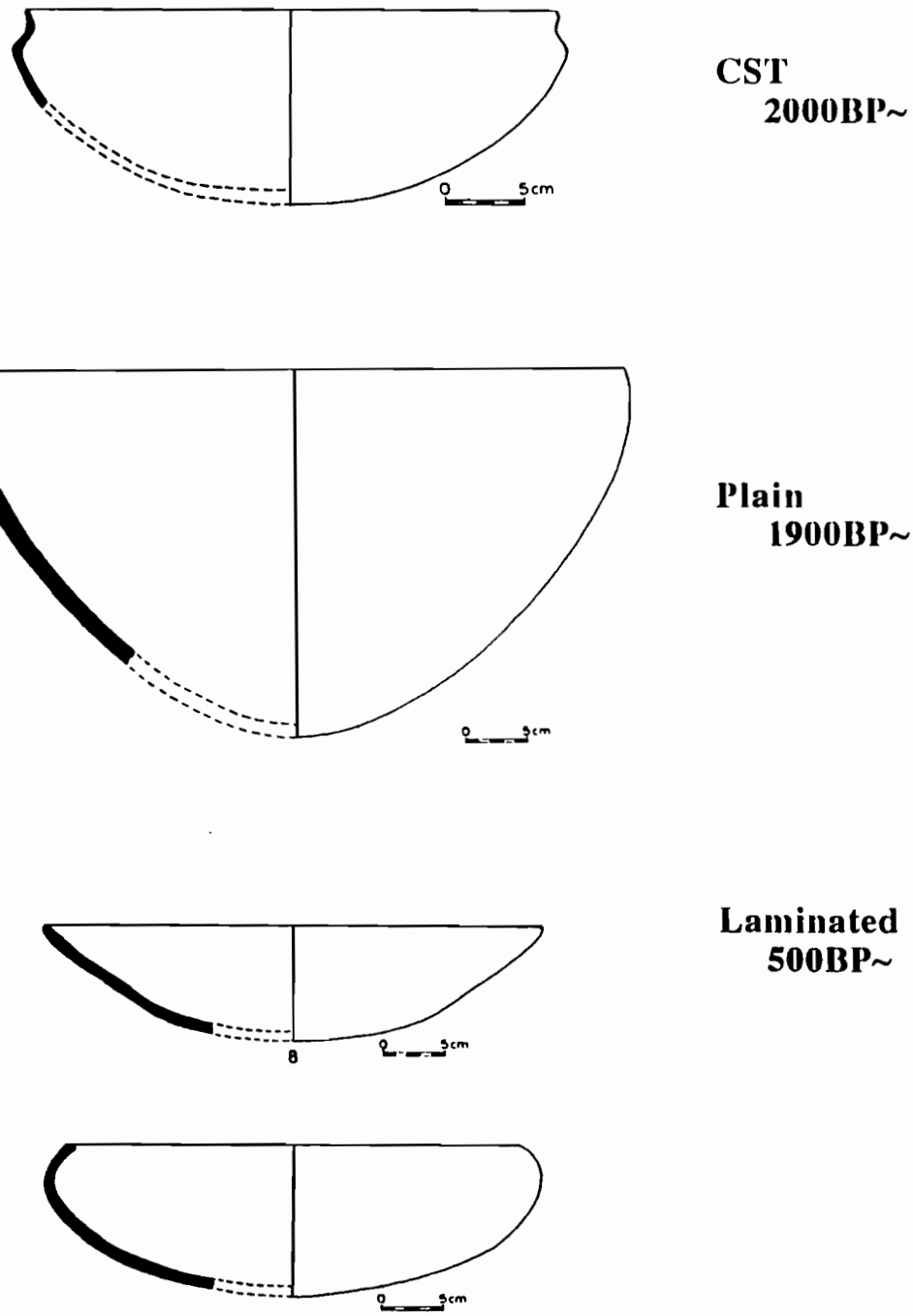

Figure 8. Reconstructed Yapese pottery (after Intoh 1991a)

Pohnpei

This is the only island in the eastern Caroline Islands where pottery was produced and used for more than a millenium. Pottery was used between about 2000 BP. and 800 BP. (Ayres and Bryson 1989), although Ayres assumes that pottery making goes back to 2500-3000 BP. (Ayres 1991 : 190). Pottery is reported from the Awak valley in north-east, Kiti in south-west of the main island and from Nan Madol.

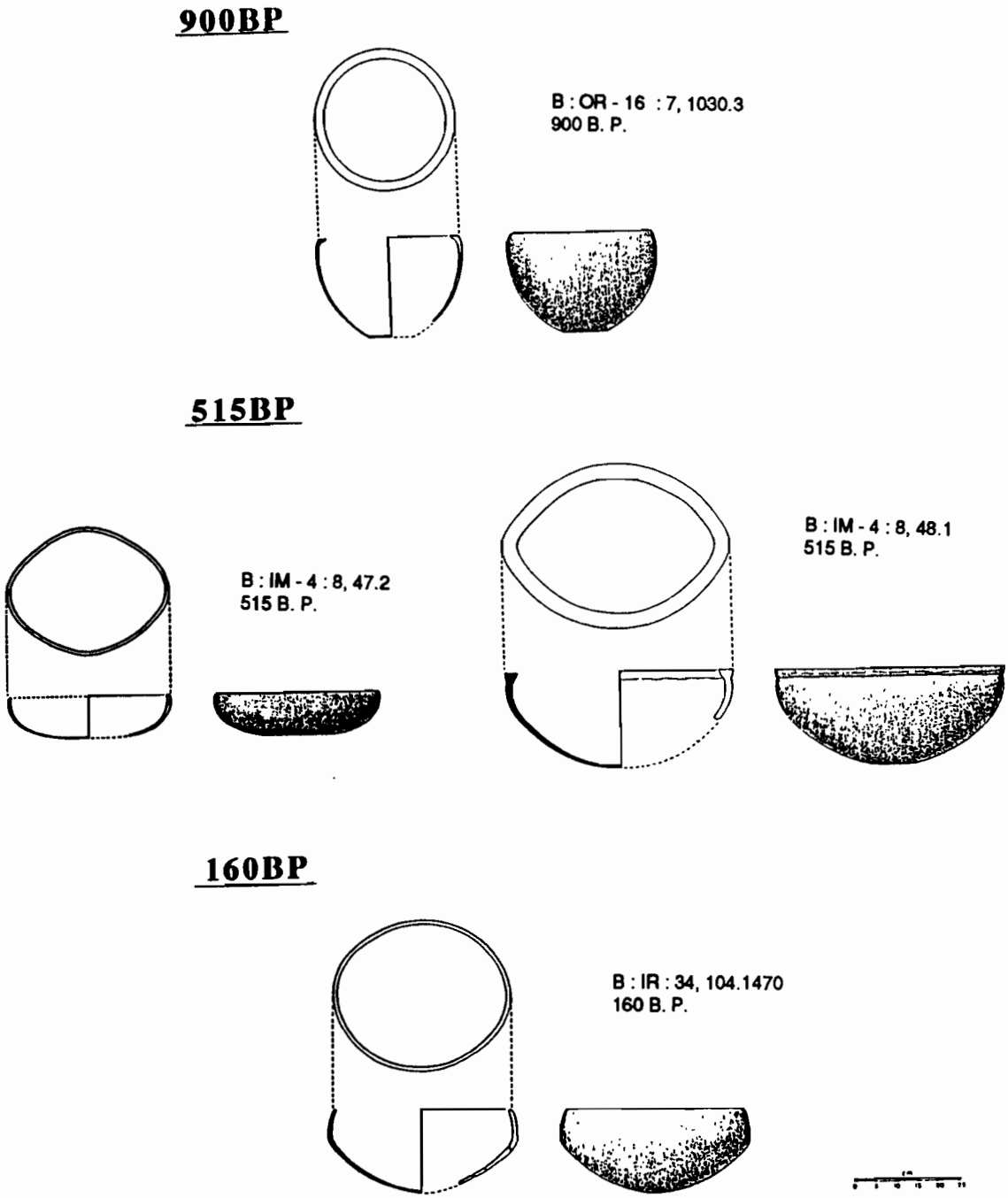

Figure 9. Reconstructed Belauan pottery (after Snyder 1989)

Vessel shapes are principally large open-mouthed, globular pots, bowls, including some very small ones, and rare constricted neck jars/pots. (Figure 11c-i). None of sherds indicate sharply angled side walls, flat bottoms or sharply constricted openings. More than 80% of the early pottery was tempered with fine calcareous sand (CST pottery), while the rest have volcanic rock fragments/sand and crushed potsherds. These share vessel form, rim form, lip form and decorative elements with CST pottery. CST pottery nearly disappears after about 1600-1500 BP.

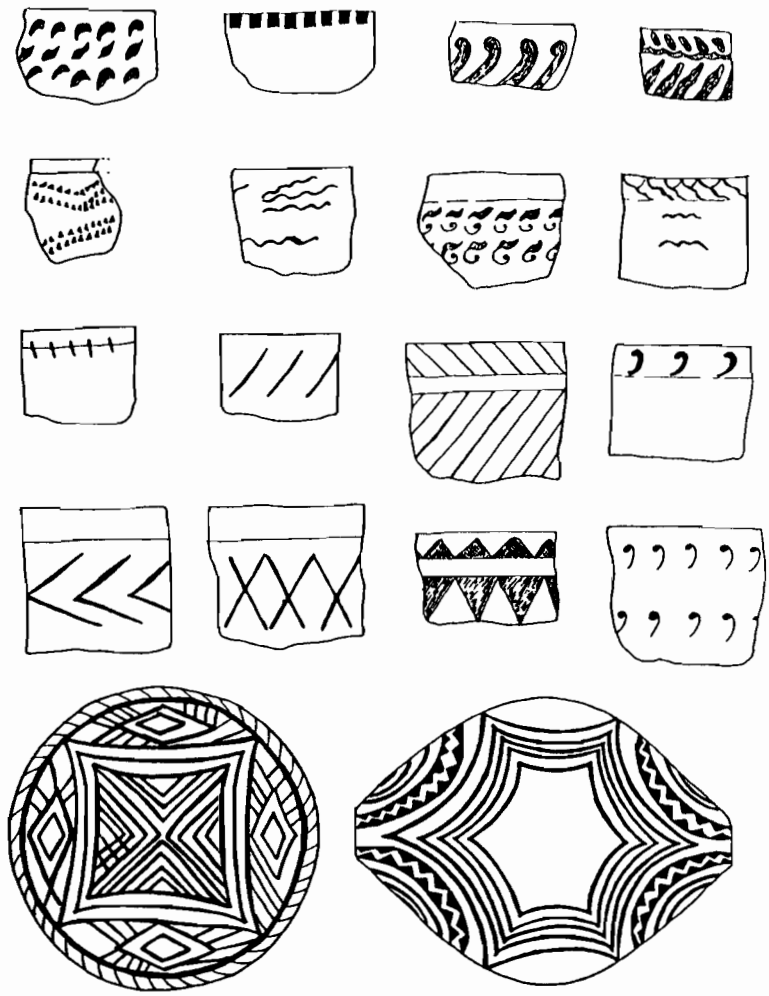

Figure 10. Decoration motives on Belauan pottery (after Hidikata 1973 ; Osborne 1979). The lowest two are reconstructed painted desing on ethnolographic pottery

About 35% of the rim sherds have parallel notches along the inner and outer lip edges as well as three rows of punctuation along the inner rim surface (Athens 1991b : 28). No slipped sherds are found.

Kosrae

Some 200 potsherds were excavated from Lelu island in Kosrae (Athens 1990a). These were found in deeply submerged coralline sediments beneath a compound of Lelu. No potsherds have been found on mainland Kosrae thus far. This indicates that pottery was once used locally in Kosrae and was eventually abandoned. It is tentatively indicated that pottery was used on Lelu between about 100 B.C. and A.D.250. One-third of the excavated potsherds (about 280 pieces) were tempered with calcareous sand while the others have no temper or are naturally rock-tempered.

Kosrae pottery is distinguishable from Pohnpei pottery but shares a significant attribute with the Truk pottery ; angled side walls or bases. No decorated sherds have been found.

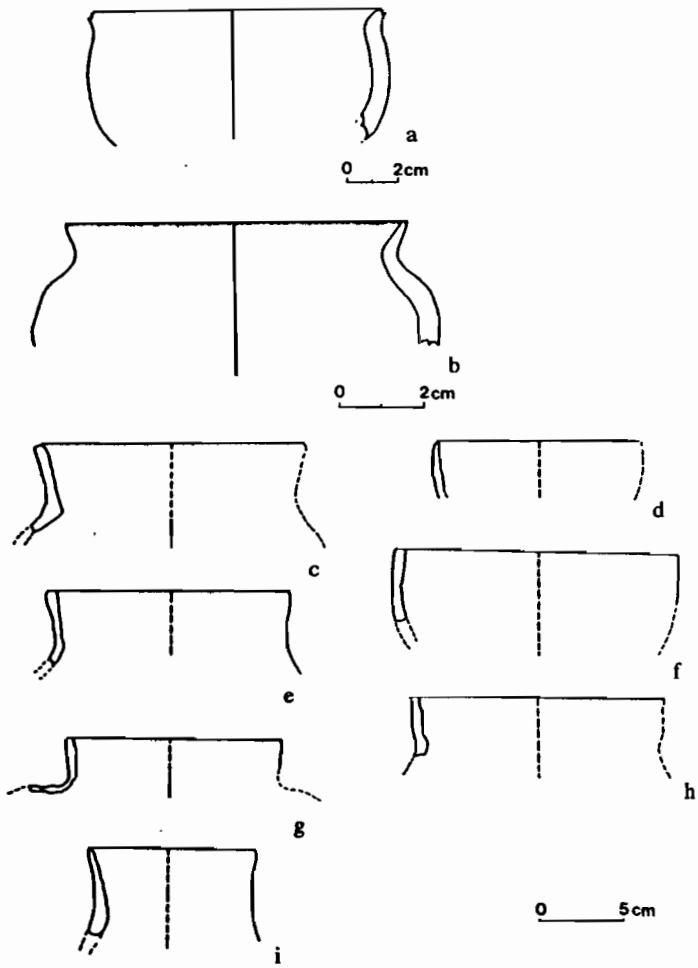

Figure 11. Reconstructed shapes of excavated pottery from Chuuk (a, b) and from Pohnpei (c-i) (after Shutler *et al.* 1984 ; Ayres 1990)

Origins of Micronesian Pottery Traditions

It is apparent that there were more than two pottery traditions distributed in Micronesia. The earliest, well decorated pottery tradition in the Marianas is unique compared to the plain pottery traditions in other islands. The time gap between the Marianas and the others is about 1500 years which should be taken into account. The decorative attributes (incinsing, stamping, etc.) associated with the early Marianas pottery show a general similarity with the Lapita tradition in Melanesia. The earliest dates associated with both pottery traditions fall in a similar range (3600 BP). The decorative pattern of the Marianas pottery, however, is also similar to the early pottery traditions in the Southeast Asian archipelago, especially to that of the Philippines. The origin of the Mariana decorated pottery tradition could well be looked for in the west. A direct relationship with Lapita is uncertain.

Later pottery traditions in Micronesia include large technological and formal variability. The variation developed from a certain pottery tradition on each island or island group after initial colonization had taken place. Such developments were reported from the Marianas (Graves et al. 1990), Yap (Intoh 1990a) and Pohnpei (Ayres and Bryson 1989).

These changes could have been developed with various reasons, such as technological adaptations, functional variations and other cultural requirements. We should thus look to the earlier pottery assemblages of each islands in order to examine the cultural relationships between the different pottery traditions.

It can be pointed out that all the pottery traditions which appeared around 2000 BP. in Micronesia share the same technological attribute of calcareous sand temper, except Belau. Takayama (1981) suggested that the calcareous sand tempered pottery in Micronesia is all related and has the same origin in the west. This view is not, however, supported by recent excavations in the eastern Caroline islands. Ayres, Bryson (Ayres and Bryson 1989) and Athens (1990a,b) rather look to the south, to Vanuatu or the southeast Solomons, as a homeland for the early pottery traditions of Pohnpei, Chuuk and Kosrae. These suggestions are based on the similarities in pot form and rim notching. Although Melanesia has been indicated as a source area, independent settlement routes for different islands are indicated (Athens 1990a). This is because some of the pottery attributes associated with these different pottery assemblages vary significantly.

Although there is a strong possibility that the lip-notched pottery traditions in the eastern Caroline islands were derived from the Melanesian region, we should not neglect a possible movement from the west as well. For example, the recent excavation on Fais island in the central Caroline Islands has shown that Yapese pottery has been constantly brought in since about 1900 BP. This is further supported by the finding of several greenschist stones from the earliest cultural deposits or falls which only occur in Micronesia in Yap (Intoh 1991). The physical properties of the early calcareous pottery found in Pohnpei are not yet clear. The Lapita related attributes mentioned above are largely seen in the plainware (Ayres and Bryson 1989 : 9). More data on the early assemblages from Pohnpei are eagerly awaited.

In sum, pottery traditions in Micronesia have several origins and came into the region at different times. The only decoration-rich pottery was made in the Mariana islands as early as 3600 BP. and could have been derived from the west. The calcareous sand tempered pottery tradition may have had more than one origin, west and south. This is still uncertain. This tradition appeared in Micronesia about 2000 BP. Pottery made in Belau is unique and may have had a different origin from the other calcareous sand tempered pottery traditions, perhaps in the west. It is clear that the plain pottery traditions in the eastern Caroline islands had some influence from the south. This complexity in origin is further compounded by the transformations in each environmental unit after the colonisation had taken place.

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NEW IRELAND AND LAPITA

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RÉSUMÉ

La Nouvelle-Irlande et le Lapita

Cette communication décrit des fouilles effectuées à Lemau, en Nouvelle-Irlande. La totalité du matériel d'intérêt archéologique a été trouvée dans 30 cm de sable humide, la plus grande partie à proximité immédiate de la plage. On y a trouvé de la poterie, de l'obsidienne, des éclats de pierre volcanique et du verre. La majorité des fragments de poterie se situait dans les 10 cm inférieurs, et celle du verre dans les 10 cm supérieurs. Trente et un tessons présentant des décorations de motifs géométriques disposés en bandes on été retrouvés, vingt et un d'entre eux sont incisés et dix décorés de pointillés ou à la roulette. Nous n'avons trouvé aucune structure, mais avons dégagé quelques trous de poteaux et un four enterré .

Trois autres sites, sur la côte est, où ont été découverts un total de quatre tessons décorés de manière similaire, constituent l'ensemble des poteries 'Lapita' trouvées en Nouvelle Irlande. S'agit-il vraiment de sites 'Lapita' ? Ma réponse est négative, en raison de l'absence d'autres objets typiques de cette appellation. Ma théorie est que ceci est le cas dans la plupart des sites soi-disant 'Lapita' de l'archipel de Bismarck, et que par conséquent nous ne pouvons affirmer l'existence d'une 'culture' ou d'un 'complexe culturel' Lapita dans cette région.

ABSTRACT

Excavations at Lemau, New Ireland are described. All archaeological material occurred in 30 cm of humified sand ; most material occcurred just behind the beach. Pottery, obsidian, volcanic stone flakes and glass were found, with most pottery in the lowest 10 cm, most glass in the upper 10 cm. Thirty-one sherds with geometric decoration in bands were recovered, 21 being incised and 10 dentate stamped or rouletted. No structures, but some post holes and an oven pit were noted.

Three other sites on the east coast, with a total of 4 sherds with similar decoration, constitute the corpus of 'Lapita' pottery in New Ireland. Are they 'Lapita sites' ? My answer is no, since there are no other artefactual markers of this attribution. I argue that such markers do not occur on most so-called Lapita sites within the Bismarck Archipelago area and that we therefore cannot say that a Lapita 'culture' or 'cultural complex' exists in the area.

In 1984, as part of the initial LHP survey, Jim Allen and others collected small pieces of pottery, 2 with 'possible' dentate stamp decoration, at Lemau (Lamau) on the west coast of New Ireland. In 1985 Gorecki and Anderson dug 3 sq. m in two mounds there, recovering about half a pot with an incised geometric design on a classic 'Lapita' shape, one dentate stamped sherd, a piece of obsidian and some plain sherds. Both the pot and the decorated sherd came from 'sterile' beach sand up to 45 cm below an upper humified sand layer some 30 cm thick in which European artefacts were present throughout (Gorecki et al.).

This discovery has been sufficient to empower the Lemau site to enter the Lapita exchange network, that cat's cradle of often hypothetical links between sites where similar pottery has been or ought to be found.

In 1990 four of us (Anne McConnell, Phil Colman, Tom Williams and I), wearying of the delights of the Balof caves, returned to Lemau. We excavated 6 x 1m squares (T1, 1A, 2, 3, 4, 10) between the steep beach lip (3 m above HWM) and 130 m inland, and a further 9 sq. m (T5-9) immediately beside Gorecki's original find spot on the landward side of a low mound some 6 m back from the beach lip.

The excavations nearer the beach revealed the same basic stratigraphy as found by Gorecki -- some 30 cm of humified sand overlying white sand, gravelly to the east and west of the main area. Further back, the white sand was replaced by clays, silts or water rounded pebbles, presumably from one of the two streams which flow either side of the village. In our large excavation (T5-9) there was some evidence of internal stratigraphy in the upper humified layer. This was in the form of a 1-2 cm white sand layer some 10 cm below the surface. It was however intermittent and did not bear any apparent relation to the location of artefacts. This excavation also revealed in the basal sand a number of postholes (humified sand circles 10 - 20 cm diam) and a large **mumu** pit with numerous fire-cracked cobbles dug 60 cm down into it. The **mumu** appeared to be partly overlain by the white sand layer, and some of the postholes may have been also. No charcoal or other organic material was present in any pit or posthole.

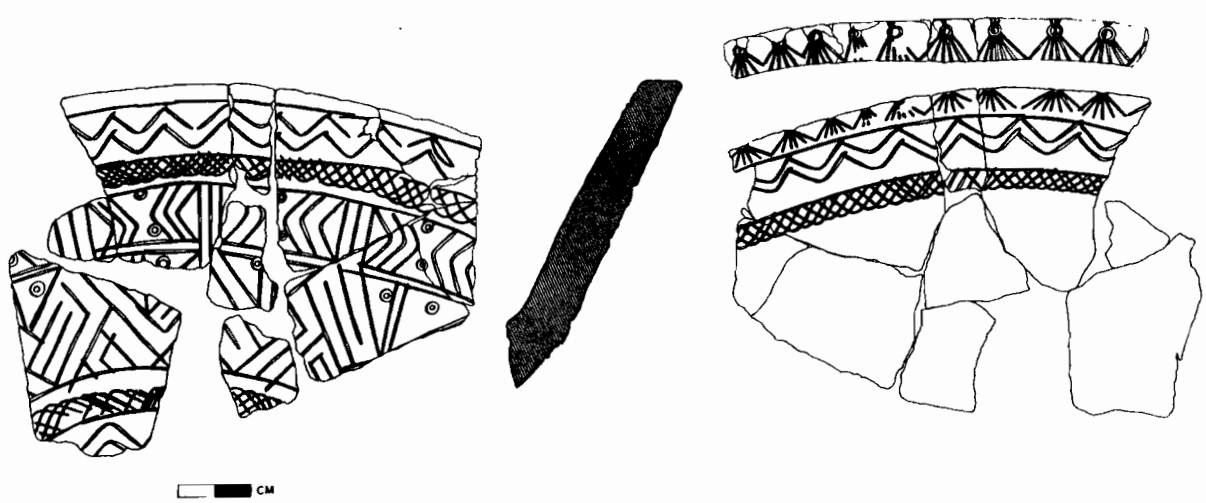

Figure 1. Platter from EFY, Lemau, West coast. Left to Right : outside, section and inside.

The artefacts included pottery, obsidian, volcanic stone flakes and European period materials, notably glass. In the tables I have amalgamated the finds from all excavations into 3 levels since I can see no reason for doing otherwise (Table 1).

Table 1 : Lemau : total finds. Number (gram)

Lev.	Obsid.	Volc.	Undecor	Pot Decor	Rim	Glass	Other Euro
1	35(11.6)	4	48(94.3)	16(211.2)	-	330(442.3)	13
2	17 (8.8)	2	121(397.6)	7(76.0)	2(7.9)*	17(46.3)	4
3	33(16.7)	-	224(657.6)	11(68.5)	6(13.0)	6 (3.1) -	

*Plain rim weighing 7.9 g, notched rim weighed as piece of incised decoration.

The 3 levels include all the humified sand : we found no artefacts at all in the 'sterile' sand below, despite removing several cubic metres. We could see no reason to expect artefacts within what appeared always to be clean beach sand and the formation processes which emplaced the pottery found by Gorecki remain unexplained.

The location of the finds indicates there is a gross vertical separation between European materials and pottery, with small but equal quantities of obsidian throughout. The division is not, clearly, absolute and, indeed, our largest ceramic, eleven joining sherds lying in close proximity, came from the base of level 1, about the top of where the middle white sand should have been, but wasn't, in this area (Fig. 1).

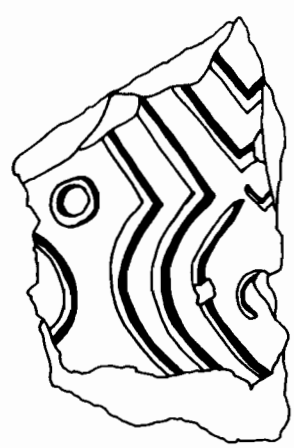

Figure 2. Incised decoration from EFY, Lemau. (X 2).

The decorated pottery comprises 21 incised sherds (Fig. 2) and 10 dentate stamped or rouletted (Fig. 3) ; one sherd has both. All the designs are geometric and in bands. Two small sherds show what might be jabbed decoration. There are 8 rims, most of them notched or twisted, on otherwise undecorated sherds. On stylistic and shape grounds I estimate MNI on the basis of decoration as 11, and as 9 on the basis of rims, with the two groups overlapping to some extent. We might be dealing with the remains of 14-18 pots in total.

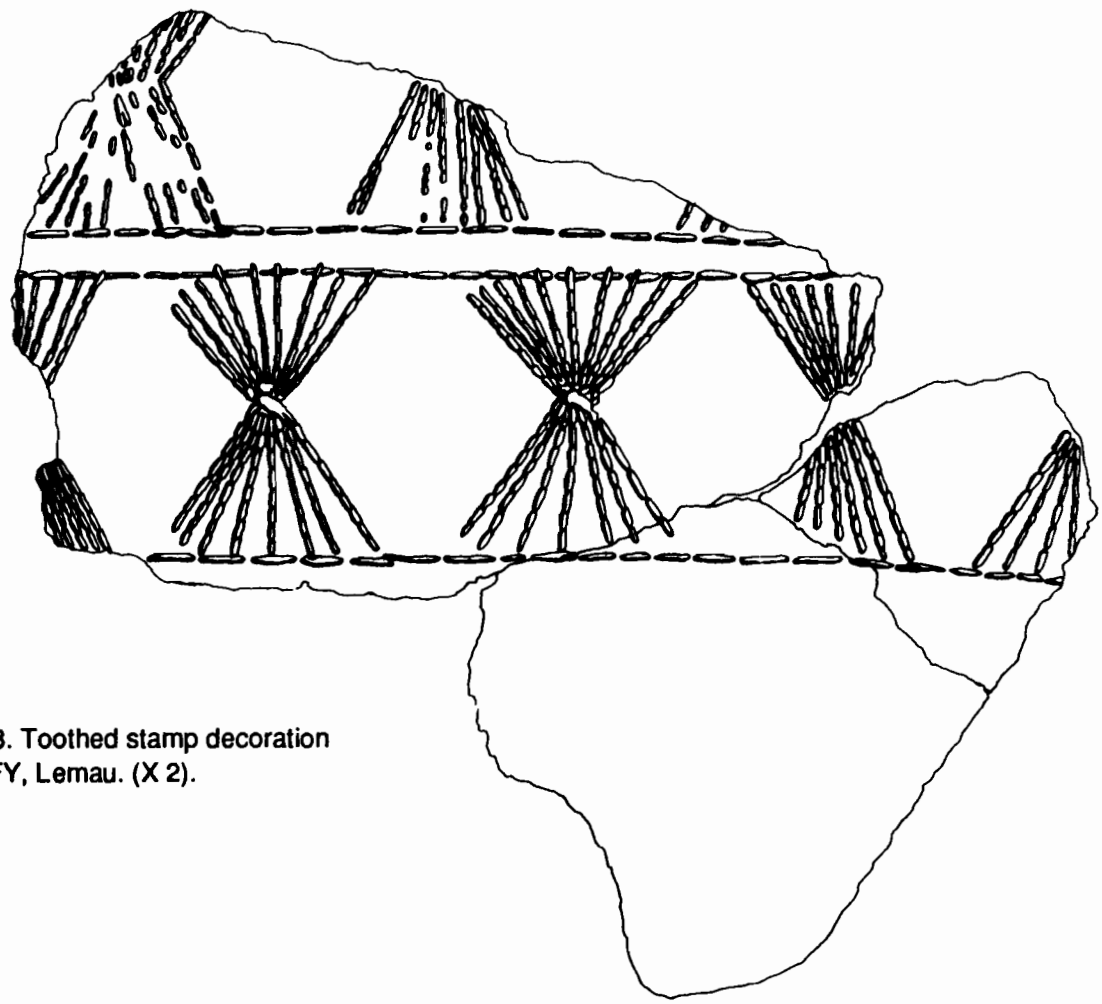

Figure 3. Toothed stamp decoration from EFY, Lemau. (X 2).

Figure 4. Incised decoration from EAB, Balof. (X 2).

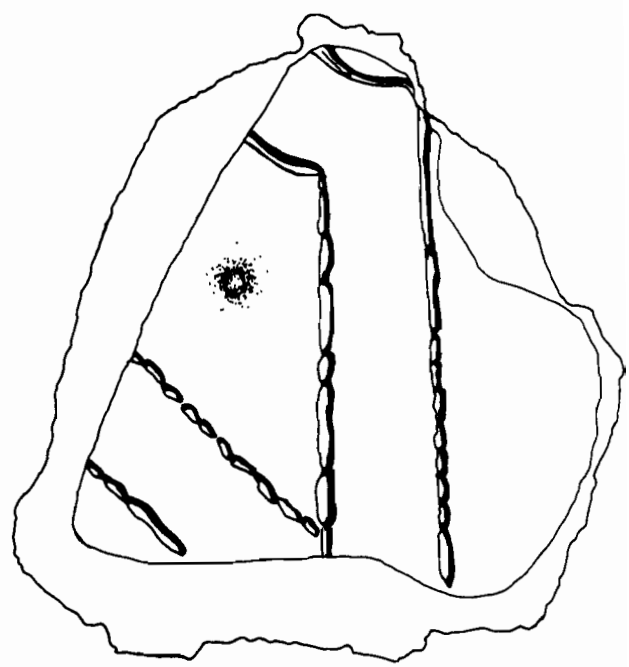

Figure 5. Incised decoration from EOA, Manga. (X 2).

There are three other sites that I know of in New Ireland with comparably decorated ceramics, all on the east coast. These are :

Balof 2 (EAB). One incised sherd, geometric pattern, from an excavation well inside the cave, bracketed by C14 dates of SUA2967 1860 ± 170 (above) and SUA2968 1560 ± 230 (below) (Fig. 4). This sherd is associated -- if we include Balof 1 in the comparison -- with a few sherds decorated with irregular incised lines and some notched rim sherds (Downie and White, 1978 : Fig 3).

Lesu/Lossu. Two dentate stamped sherds. These are associated with large quantities of applied and incised pottery, some of it quite elaborately decorated, but not with the highly ordered geometric design of 'classic' Lapita (White and Downie 1980).

Manga (EOA). This is a Catholic mission about 150 km south of Namatanai. Twenty two sherds, 2 stone axes with lens-shaped cross-sections and 2 flakes from river cobbles were collected in 1990 from just north of the mission on a heavily gardened hillside some 500 m inland and 30 m ASL. One sherd was incised with a geometric design (Fig. 5).

These finds, along with others particularly in New Ireland but also elsewhere in the Bismarck Archipelago, seem to me to raise questions concerning current use of the terms 'Lapita site' and 'Lapita cultural complex'.

In 1988 Matthew Spriggs implicitly asked "what is a Lapita site"? "Is one pot enough ?" (1990 : 6). Or, indeed, one sherd. But what is an acceptable definition? Open sites with some percentage of dentate stamped pottery, even when associated with incision, nail impression and relief (applied) are always called Lapita (e.g. Specht 1991, Lilley 1991). They nearly always have some associated obsidian. On these grounds Lossu and probably Balof and Manga would be called Lapita sites also.

But is this reasonable ? The vast bulk of pottery decoration at Lossu is incised and relief (White and Downie 1980), and the motifs are not particularly similar to those found elsewhere in the Bismarcks, for example at Watom, Anir or Mussau. The pottery at Lossu is, however, similar to that found at Lasigi, Fissoa, Pinikindu, Madina, Huris and other pottery sites along the east coast, but not at present elsewhere in the Bismarcks. I am not convinced that these sites are 'Lapita', despite consistent dating of the first three to around 2500 bp and the presence of obsidian and a few Conus shell armrings at Lossu. I am even more reluctant to label the Balof caves as Lapita sites since that would broaden the definition to include at least the latter half of the period of human settlement in New Ireland. If we do accept them into the fold, are there any sites of the second to first millenium BC which are not Lapita ?

While thinking about this situation, I went back through some of the Lapita literature and what struck me was the constant reference to, or acceptance of, the idea of a Lapita culture or 'culture complex'. Some researchers (Green, Kirch) explicitly use the terms, while the concepts can be seen in the writings of most others (e.g. Gosden, Allen, White and even Terrell).

The idea of a Lapita cultural complex has been around since at least 1961 when it was a gleam in Golson's eye. In 1971 he claimed it was now documented for Tonga and saw its extension to Fiji and New Caledonia as 'expectable' since Lapita potters were the first settlers in these islands (and thus the ancestors of the Polynesians). This is, of course, almost the paradigm situation in which a 'culture' can be defined as a collection of shared

material behaviour and social norms which distinctively mark groups of people off from one another. It would be surprising if the first settlers on small islands did not arrive with a 'culture' i.e. some social, material and biological cohesiveness, however that might be structured.

But Golson did not, in 1971, equate all Lapita pottery with a cultural complex. His discussion of Lapita ware refers to American organising principles of phase and tradition and particularly to the concept of a ceramic series, a set of similar styles (of decoration? manufacture?) contiguous in time and space. The term cultural complex he reserved for the range of artefacts found clearly associated with the first Tongan settlers, using the term in the sense of Rouse (e.g. 1972 : 274 'a pattern of types, modes and other kinds of cultural norms that distinguishes a group of cultural assemblages') and not Kidder, whose use of the term 'culture complex' refers to a chronological set of single-substance artefacts such as pottery (Sharer and Ashmore 1979 : 485).

Roger Green's landmark synthesis (1979) follows the same usage, referring to aspects of settlement location and structure, subsistence economy and exchange, as well as portable artefacts, none of which are universal even among his relatively restricted groups of Eastern sites. In recent conference papers Green has paid more attention to artefacts, notably adzes, in an attempt to define the Lapita cultural complex in the West, but has not so far produced very convincing data.

Within the Bismarcks, there are several sites which have some artefacts other than pottery comparable to those found in Far Oceania. Pre-eminent among these are ECA and ECB on Eloaua (Kirch 1987, Kirch et al. 1991), where there is evidence of the manufacture of a range of shell artefacts, but Watom and the Adwe site in the Arawe Is. should also be included. The temptation has always been, of course, to see these as the earliest evidences of the Lapita 'cultural complex', established by foreign settlers from somewhere unknown further west. There is, however, no good chronological evidence of their distinctive earliness, or archaeological evidence that the origin of these settlements lies in the west rather than being local (Allen and White 1989) or even, as Torrence (pers. comm.) has suggested, further east. It is not clear that these ceramic settlers were the first users of the islands.

More importantly, as I have outlined above for New Ireland, and as research in the Talasea and Arawe areas of New Britain, and in Manus are all indicating, there are numbers of sites which are usually called 'Lapita' but which have no evidence other than dentate-stamped decorated ceramics of belonging to the 'cultural complex'. Note that obsidian in this area is not an appropriate marker of a single linked network : if one looked at the on-the-ground distribution of it in the last two centuries this would look much the same as that of the supposed 'Lapita exchange network'.

In the light of recent discoveries in the Bismarcks, I suggest it is time to ask whether the term Lapita cultural complex is usefully extended from Far to Near Oceania, and if so what it is meant to mean. As Terrell (1989 : 624) points out, there is no single trait that is exclusive to it or even statistically distinguishes it, especially if we can have 'Lapita without pots' (Gosden et al. 1989 : 576). Green suggests (pers. comm.) that the complex's existence is confirmed by the relative absence of equivalent shell, stone or pottery artefacts in older sites, but how many older sites are there? Precious few other than caves -- and almost none of these would demonstrate the presence of Lapita either!

I suggest the term 'Lapita cultural complex' is only useful if we are trying to define a 'culture' in some typological sense. Perhaps in these days of calibrated C14 dates we do not need all the terms that were so usefully employed three decades ago, in an area where first settlement by pottery making agriculturalists, probably even speaking Austronesian languages, is not (at present) in dispute? Using such terms in Near Oceania seems to me to be leading us into assuming we know more about the structure of the prehistoric world of the last two millennia BC than we do.

Dropping some of our conceptual baggage, we can turn to look at, for example, the social and economic behaviour visible in the archaeological record of a particular area in the appropriate time period (e.g. Gosden 1989) or whether the appearance of Lapita ware within a local sequence signals changes in obsidian processing (Specht et al. 1990) or site use. We might go on from there to ask about the manufacture and use of pots (cf. Allen and White 1989, Marshall 1985), their varying distribution in those sites where this can be seen and their relation to other artefacts (e.g. Sheppard and Green 1991), exchange and the meaning of varying degrees of artefactual similarity, and others. Most of us have raised one or more of these questions from time to time, but we often return to the typological questions which are so much easier.

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INVESTIGATIONS INTO THE PREHISTORY OF THE CENTRAL SOLOMONS : SOME OLD AND SOME NEW DATA FROM NORTHWEST GUADALCANAL

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RÉSUMÉ

La préhistoire des îles Salomon du centre : quelques anciennes et nouvelles données du Nord-Ouest de Guadalcanal.

Les fouilles réalisées en 1987-1988 dans plusieurs sites au Nord-Ouest de l'île de Guadalcanal, et la ré-étude des fouilles réalisées en 1966-1968 dans la grotte de Poha, apportent de nouveaux éléments pour la connaissance de la séquence culturelle peu connue du centre des îles Salomon. Ces éléments incluent l'évidence d'une occupation humaine de la région il y a 6000 ans au début d'une séquence chronologique incluant également une occupation contemporaine de celle du complexe Lapita, déjà décrite dans d'autres îles des Salomon. Un résumé de ces données est présenté et certaines des implications intéressant la préhistoire de Mélanésie sont discutées.

ABSTRACT

Excavations conducted in 1987-1988 at a number of sites in northwest Guadalcanal, and a reassessment of the results of the 1966-1968 excavations at the `Poha Cave' site, provide new information on the largely unknown central Solomons cultural sequences. This includes the demonstration of human occupation in the area by 6000 BP at the beginning of a sequence that also has settlement contemporary with the Lapita cultural tradition elsewhere in the Solomon Islands. A brief summary of this data is presented and some of its implications for the prehistory of island Melanesia are discussed.

The central Solomon Islands has remained until recently archaeological *terra incognita*. The lack of data from this area has been a major problem in discussions of the prehistory of Near Oceania, especially as the only excavation from these central islands had indicated aceramic sequences contemporary with the Lapita sites of the Reef/Santa Cruz group in the southeast Solomons. The aim of this paper is to outline some new evidence and to reassess the old data for the prehistoric sequences from the island of Guadalcanal. This data comes from two sources :

(a) a re-interpretation of the results of the 1966-1968 excavation of the Poha, or Fotoruma, Cave in northwest Guadalcanal (Davenport 1968 ; Davenport, Russell and Tedder n.d.), and,

(b) fieldwork conducted in 1987-1988 in the Poha and Vura valleys and the Visale area of northwest Guadalcanal. This included the re-excavation of the Poha Cave (hereafter referred to by its correct name Vatuluma Posovi) and new excavations at a series of caves and rockshelters from both coastal and inland locations. Investigations of the region's rock art (Roe 1992), irrigated agricultural systems (Roe 1989) and a single open settlement site were undertaken also.

Site Sequences and Material Culture

The Vatuluma Posovi cave is located at the base of a limestone cliff on the east bank of the Poha River approximately 1km from the coast. The 1966-1968 excavations, which involved the almost complete removal of the 4m of archaeological deposits, produced a series of radiocarbon dates (Black and Green, 1978 ; Lawn 1974) for an occupation sequence beginning at about 3000 BP and continuing through to the second World War. The discovery and examination in 1987-1988 of a small area of undisturbed sediments at the front of the cave has now extended this sequence back to 6000 BP. This work, together with a re-examination of the original finds and excavation records, including some crucial unpublished information, (Russell n.d.), a detailed survey of the cave and 9 new radiocarbon determinations, has allowed for the reconstruction of the site's stratigraphy. The occupations of this site can be divided into 5 phases :

Phase 1 An occupation layer evidenced only by the remanant deposit at the front of the cave and bracketed by two C14 dates on wood and *Canarium* charcoal : ANU-6733, 5430 ± 220 (calibrated range at 1 sigma 6449-5950 BP) and ANU-6734, 3940 ± 140 (calibrated range at 1 sigma 4799-4158 BP)[1].

Phase 2 An occupation layer present throughout the cave, best dated in the cave rear by a series of C14 dates from the original excavations, including I-2874, 2920 ± 110 (calibrated range at 1 sigma 3259-2892 BP).

Phase 3 Occupation debris separated from Phase 2 by a minor stratigraphical hiatus comprised of sterile limestone and dated by P-1942, 2550 ± 60 (calibrated range at 1 sigma 2752-2548 BP).

Phase 4 Occupation debris, best defined in the cave rear, and dated by I-2875 at 1310 ± 100 (calibrated range at 1 sigma 1310-1160 BP).

Phase 5 A highly mixed and disturbed deposit dating probably from about 600 BP (I-2876, 765 ± 95).

The material culture elements in all of these horizons are extremely limited and restricted to small amounts of chert, a few shell artefacts and two stone adzes ; ceramics, obsidian and shell adzes (despite the claims of the 1966-1968 excavation records) are all absent. There is no indication from the Vatuluma Posovi artefact assemblage of any significant difference in material culture between the earliest occupation and that which follows it. Thus, cherts, armrings of *Trochus,* cut pieces of *Trochus* interpreted as fishhook blanks (on the basis of their similarity to material from Mussau (Kirch 1987 : 173-174 ; Kirch et. al. 1991 : 152) and ethnographically documented hook types from New Ireland (Beasley 1928 : 74, 85-86), are present in phases 1, 2, 3 and 4. Additions to the catalogue beginning in phases 2 and 3 are shell beads, stone adzes of lenticular cross-section and *Canarium* nut anvils.

[1] All C14 dates are from wood and/or Canarium nutshell charcoal. Calibrated dates were calculated using the CALIB (Version 2.0) computer programme (Stuiver and Reimer, 1986) with the `ATM20' 20 year atmospheric values option (Stuiver and Pearson, 1986 ; Pearson and Stuiver, 1986).

The most common artefacts from the site, the engraved designs on the cave walls, are dated from at least 3000 BP by their demonstrated association with the phase 2 layers which provided the I-2874 date (Roe 1992). Although they could conceivably be associated with the phase 1 occupation, there are similar designs from two other dated sites, and at one of these, Vatuluma Ngolu, there is no human presence demonstrated prior to about 2200 BP. The other rock art sites of the Poha Valley and those of the Visale area are undated. All of them, however, demonstrate affiliations with a very widespread engraved rock art tradition in island Melanesia.

Excavations in 1987-1988 at two additional caves and a series of rockshelters in the Poha Valley produced further evidence for the definition of the Guadalcanal cultural sequences. The cave site of Vatuluma Tavuro is presently surrounded by open forest but lies adjacent to the Themeda grasslands that ascend the ridges above the north coast. A 2m x 2m excavation revealed some 0.4m of deposits in four main phases :

Phase 1 An occupation horizon with a basal date of 3810 ± 70 (ANU-6988, calibrated range at 1 sigma of 4402-4091 BP).

Phase 2 Waterlain clays, with the only cultural material being chert ; the deposition of these sediments begins at about 2300 BP (indicated by ANU-6991, 2380 ± 250, with a calibrated range at 1 sigma of 2759-2129 BP).

Phase 3 A second occupation horizon dated by ANU-6990 at 970 ± 110 (calibrated range at 1 sigma of 980-770 BP).

Phase 4 A rather disturbed upper occupation layer, beginning at about 750 BP (ANU-6992 at 850 ± 110, calibrated range at 1 sigma of 920-680 BP).

Like Vatuluma Posovi, the number of artefacts recovered from the excavations was small. A *Trochus* armring fragment in the phase 1 deposit represents the only shell artefact from that occupation. The phase 3 shell artefact inventory is comprised of *Tridacna* rings and small shell beads of a type commonly used as 'currency' ; *Trochus* armrings are absent. One of the beads is a preform, suggesting manufacture of such items in this area. The production of shell valuables of this type is best documented from the island of Malaita (eg. Paravicini 1942-45 ; Woodford 1908) although other manufacturing areas are known to have existed in the Arosi area of north Makira (Quiggin 1949 : 163 ; Mead 1977 : 143) and in the islands of Marau Sound in east Guadalcanal.

Stone tools are restricted to chert chips and flakes throughout the sequence and *Canarium* nut anvils in the phase 3 levels. Although the chert recoveries include few formal artefacts, there is a discernible change in the material between the two earliest phases and phase 3, shown by decreases in the amount of chert present and the size of individual pieces. There is also a change in the character of the cherts. The bulk of the earlier material is a rather coarse, sandy-textured stone, grey or light brown in colour with mottling and banding. This makes it of a type consistent with a source on Guadalcanal, being comparable to the porphyroid cherts from the Mbirao Volcanics formations of eastern Guadalcanal described by Hackman (1980 : 18-20, plate 4) ; similar cherts are also known from Malaita (Hughes 1971). The later chert material is a finer, glassier stone, usually orange/brown in colour, and of a type known from ethnographic data to have been imported from a west Malaita source via the Marau Sound area of east Guadalcanal.

Excavations at a further cave site, Vatuluma Ngolu, also located on the Themeda grassland slopes above Guadalcanal's north coast, failed to recover any evidence of sustained human occupation prior to about 2200 BP. The lowest level at this site comprises almost sterile orange clays with a small amount of wood charcoal and *Placostylus* land snails. This was separated from an upper occupation level (where chert chips and volcanic oven stones were the only artefacts recovered) by a well-defined band of charcoal stained clay, similar to the phase 2 deposits of Vatuluma Tavuro. Charcoal from this clay deposit gave a date of 2220 ± 170 (ANU-6738, calibrated range at 1 sigma of 2359-2039 BP).

Investigations at a number of rockshelters in the Poha Valley catchment and a single shelter in the Vura Valley to the west, revealed no deposits dated earlier than about 1350 BP and generally no older than 400 BP. Artefact recoveries were again restricted in number and add no new elements to the Guadalcanal inventory.

Searches for a suite of open sites to complement the archaeological record of the caves and rockshelters were largely unsuccessful. Intensive plantation agriculture and the enormously destructive activities associated with the World War II period have served to virtually eradicate any archaeological landscape that might once have existed in the northwest Guadalcanal area. Thus only a single site could be located that was worthy of excavation ; this was located within the bounds of the Visale Roman Catholic Mission at the extreme northwest tip of the island. Although the upper horizons of two test pits here had been heavily disturbed (by a combination of modern burials and cyclonic storm surges), approximately 1.3m of apparently intact deposit remained. The initial charcoal and ash-rich occupation layer (sealing a sterile beach sand) dates from about 1400 BP (ANU-6736, 1500 ± 70 bp, giving a calibrated range at 1 sigma of 1504-1318 BP). Artefact recoveries were, like the rockshelter and cave site finds, few in number and variety, with small pieces of the finer cherts and a number of shell currency beads predominating. A single stone adze, comparable in form to the Vatuluma Posovi examples, was recovered from a rather insecure stratigraphic position close to the surface of the excavation and within the disturbed layers.

Test pits at a known inland settlement site, with well-defined surface features, failed to recover any sub-surface evidence for occupation. A number of settlement sites were identified in the Themeda grasslands. These occupied positions either on ridge crests or immediately below them and were usually marked by house platforms, stone alignments and sparse chert scatters. Heavy soil erosion in these areas has stripped away any archaeological deposits that might once have existed and no excavation of these sites was attempted.

Environmental Evidence

Although the cave and rockshelter excavations produced such a limited range of artefacts, exhibiting little evidence of real change through the sequences, the environmental material is quite eloquent in its expression of human activity in the Guadalcanal landscape. I shall return to this evidence, using mainly the information from the Vatuluma Tavuro cave, in a moment. At this juncture, however, it is useful to draw attention to Simon Haberle's palynological work in north Guadalcanal.

Important baseline data on landscape and vegetation history is provided by two pollen cores from the Mela and Laukutu swamps on the massive north Guadalcanal alluvial plain, and from a single core taken in a *Terminalia* and *Pandanus* swamp at Riuaniu on the northwest coast (Haberle 1990). From his analysis of the Mela and Laukutu cores, Haberle

concluded that, while disturbance of the vegetation by natural events such as cyclones, earthquakes and volcanic ash falls had occurred at intervals throughout the sequences, `human activity has also been an important factor in determining the present vegetation patterns on Guadalcanal at least throughout the last 3,300 years', that is from the start of the pollen record in the swamps of the alluvial plains. In particular he notes that `the grasslands of the northern plains of Guadalcanal form a fire-climax vegetation community and are maintained by continued firing by humans. Grasslands and fires were already an integral part of the landscape by 3300 bp.'. Human impact on the environment intensifies with `increased clearance and burning activity...after 2100 bp.'. A late phase of forest regeneration is indicated at around 1200 BP and continues to about 500BP. The Riuaniu pollen core, analysed in less detail than the Mela and Laukutu cores, provided less strong evidence for human impact upon the environment, although the in-filling of a mangrove-fringed estuary at the site may have been accelerated through clearance activities on the hillslopes. The core does demonstrate, however, a dramatic change in the coastal ecosystem, with a shoreline dominated by *Rhizopora* mangroves being replaced by freshwater swamps behind a fairly substantial beach ridge. The consequent reduction of sediment deposition into the marine environment that must have accompanied these changes presumably allowed for the development, or perhaps re-development, of coral reefs and their associated faunas.

I do not intend here to provide details of the environmental recoveries from the 1987-1988 excavations. Rather I will give a broad outline of this evidence for the cultural sequences outlined earlier and then note some inferences and conclusions which the materials support.

The initial occupation layer at Vatuluma Tavuro contains evidence for the exploitation of relatively undisturbed and undeveloped forest and the collection of molluscan foods from fresh and brackish water environments. The bone material is largely restricted to primary forest taxa and especially the endemic *Uromys* rats and the arboreal skink, *Corucia zebrata.* Plant macrofossils are restricted to small fragments of *Canarium* nutshell (not identifiable to species level) ; the absence of anvils for nut processing has already been remarked. Of the molluscan shell, 80% by weight and 57% of the species represented originate from rivers, swamps or mangrove-fringed estuaries. The comparably aged deposit from Vatuluma Posovi seems to indicate a similar economy at that site, especially the emphasis on freshwater molluscs.

In the outline of the occupation sequences from all three cave sites (Posovi, Tavuro and Ngolu) distinct hiatuses in occupation are evident. At Vatuluma Posovi (for which detailed records of sediments, bone, shell and plant macrofossils are not available) this occurs between about 2700 BP and 1300 BP. In the other two cave sites the breaks in the sequence are defined by bands of charcoal-rich and slabby clays ; at Vatuluma Ngolu these clays date from about 2200 BP and at Vatuluma Tavuro from 2300 BP. The latter two dates correlate remarkably well with the evidence from the pollen columns for a period of increased clearance activity from about 2200 BP onwards. Further evidence for the commencement of large-scale clearance is given by a date of 2800 ± 140 (ANU-6732)(range at 1 sigma of 3109-2769 BP) from a buried soil horizon containing abundant wood charcoal adjacent to the Kolevu taro pond-field system near Visale. It seems clear that this large-scale landscape alteration is associated with intensive dryland agricultural practices, presumably undertaken by a population inhabiting open village sites on the ridge crests and slopes.

The post-clearance phases in the cave sites are distinguished from the earlier ones

in a number of ways. In the bone material there is a reduction in the numbers of taxa associated with undisturbed forest environments (especially the virtual elimination of *Uromys* rats), and a number of new elements very late in the sequence, particularly *Rattus exulans*, *Phalanger orientalis*, pig and dog. The inland rockshelters, which see their initial use in this period, have bone faunas comparable to those from the earlier phases of the cave sites. This suggests that a sustained human presence in these environmental zones is either a new phenomenon at this time or that previous activity was at a low level.

The manipulation of the forest flora is demonstrated at a number of sites by an increased diversity in the *Canarium* nut remains. At Vatuluma Tavuro *Canarium* recoveries, and particularly *C. indicum*, are more substantial in the late occupation phases both in quantity and in the size and shape of individual nuts. This is consistent with them being the produce of many trees and suggests there had been a development of an arboricultural element in the economy during the forest clearance phase. Similar accents on tree crops are described by Yen (1974, 1976 :66, 1982 :288-291) for the Santa Cruz group in the southeastern Solomons and by Kirch for the Mussau islands (Kirch 1989). This development of arboriculture is strengthened by the *Canarium* evidence from the inland rockshelter site of Vatuluma Hai Mbau, and by nut anvils in the Vatuluma Posovi and Vatuluma Tavuro cave sites. Open settlements of the Visale area are also associated with remarkable concentrations of boulders with *Canarium* anvils and mortars, as though large-scale processing of nuts was being undertaken. The continued importance of *Canarium* in the agricultural economy is also demonstrated by ethnographic data and the high incidence of the vernacular term for *Canarium indicum, ngali*, in Guadalcanal place names.

Changes in molluscan shell use are again best demonstrated at Vatuluma Tavuro. Thus, in the upper occupational layer mangrove bivalves disappear completely, and although fresh and brackish water species from riverine and swamp environments are still dominant, there is an increase in the quantity of marine shell. This increased availability and use of marine shell species appears to be more marked at the Vatuluma Posovi site but the lack of detailed records again precludes its absolute demonstration. These trends are consistent with the changes in coastal conditions indicated by the pollen evidence from the Riuaniu swamp.

The re-use of the cave sites following the forest clearance episode, the first use of inland rockshelters and the initial occupation at the Visale Roman Catholic Mission site are all broadly contemporary. This is attested by dates of around 1300-1100 BP at Vatuluma Posovi (I-2875) and Vatuluma Tavuro (ANU-6990, overlapping 1-2875 at the 2 sigma range), 1500-1300 BP at the inland rockshelter of Mbusurahinitasi (ANU-6740, 1490 ± 100) and about 1400 BP at Visale (ANU-6736). I have already noted the pollen core evidence for forest regeneration at about this time.

These horizons mark the beginning of the development of the social and economic systems known from ethnographic data and the historical records, especially those of the Spanish explorers (Amherst and Thomson 1901). These systems include intensive, irrigated agricultural practices in the Visale area (Roe 1989) ; the dating of these systems remains problematical but there is some evidence that they post-date the initial occupation at the Visale Roman Catholic Mission site. In other areas agriculture follows a swidden cycle in lowland forest associated with both small hamlets and nucleated villages. The data for coastal settlements within this period remains sparse, but the ethnographically documented distinction between `bush' and `salt-water' peoples suggests that communities in different environmental zones are developing distinctive and probably complementary resource utilisation strategies.

Comments and Questions

In summary the data from Guadalcanal gives the first direct evidence for human occupation of the central Solomons prior to the arrival elsewhere in the Solomons archipelago of the bearers of the Lapita cultural tradition. This occupation, dated between 6000 BP and 4000 BP, is characterised, in the material culture, by the use of a probably local chert source for stone tool production and the presence of *Trochus* armrings and fishhooks. The environmental materials indicate some use of *Canarium* nut, possibly the `wild' *Canarium solomonense,* the hunting of forest taxa and the collection of molluscs from mainly fresh and brackish water environments. There is no evidence of rockshelter occupation in the inland forest areas at this time. A major phase of human impact on the environment is indicated at about 2200 BP, preceded at the Vatuluma Posovi site by an occupation dating from about 3000 BP, and thus contemporary with the Lapita settlements of the Santa Cruz group (for recent reviews of the dates from these sites see Green 1991 and Spriggs 1990). It is distinguished from the earliest phase only by the addition of some new elements of material culture, notably shell beads and stone adzes. In the period between 2200 BP and 1300 BP direct evidence for the location of human settlement and the material culture employed by its inhabitants is lacking. It seems likely however that settlements are sited in close proximity to the large-scale agricultural and arboricultural systems that are developed at this time. Increased rates of sedimentation in the swamps of the north Guadalcanal plain and coast from 2200 BP onwards are caused by erosion of soils from cleared hillslopes. This process of land degradation on hillslopes ultimately results in a partial failure of the sustainability of the agricultural systems there and results in a number of responses. Caves and rockshelter use resumes close to the coast, while inland forest areas see their first substantial human occupation. In the Visale area sediment deposition in valley bottoms allows for the development of intensive irrigated agricultural systems. This enforced diversification of the economic base ultimately develops into the ethnographically described situation.

The Guadalcanal data pose as many problems as they answer. One of the most important of these is how to articulate the cultural sequences now described from the central Solomons with a regional prehistory dominated by studies of the Lapita cultural tradition. Although field surveys may not be wholly reliable in their ability to demonstrate the absence of particular site types, extensive fieldwork in all of the islands of the central Solomons (Miller 1978 ; Miller and Roe 1982) have failed to discover to date any evidence of Lapita occupation ; a claim for finds of Lapita ceramics in Malaita (Childs 1986) has never been confirmed.

Clearly the complete absence of ceramics and obsidian do not suggest that the central Solomons was a full partner in the long-range Lapita exchange network. There are, however, demonstrated links with the Santa Cruz group where Lapita assemblages include cherts from the Ulawa/Malaita area (Sheppard, this volume ; Sheppard and Pavlish 1992), stone artefacts possibly from Guadalcanal (Green 1976 : 259-260) and pottery tempers from Nggela (Dickinson and Shutler 1979 : 1694-1695), the island group to the north of Guadalcanal where Rukia has recently investigated aceramic rockshelter sequences (Rukia 1990). Now that it has been conclusively shown that the Lapita cultural tradition is moving through and/or into an already populated landscape in the central Solomons, other, non-Lapita, exchange networks might reasonably be assumed to exist. Indeed the early chert material from Vatuluma Tavuro already demonstrates local movement of stone within Guadalcanal at 4000 BP. If such a network was later extended to include areas with Lapita occupation, as appears to be the case, but ceramics were not one of its commodities, then

its archaeological signature would not be dissimilar from the evidence we now possess.

Spriggs' 1984 review of the Lapita cultural complex claimed that the Vatuluma Posovi artefact assemblage `would fit easily with what we might expect to find at a Lapita site' (Spriggs 1984 : 208). While this claim remains valid, his implication that the assemblage is typical of those restricted to Lapita period sites and those that follow them is no longer tenable. Trochus armrings and fishhooks date from the earliest occupations in Guadalcanal and thus owe nothing to a Lapita pedigree. This of course also reduces the number of unique artefact types that serve to identify Lapita sites and might even suggest the adoption by Lapita people of some of their material culture from other cultural traditions in Melanesia.

The essential continuity of artefact types throughout the Guadalcanal sequence makes difficult, if not impossible, the identification of cultural horizons solely from their material culture components. Furthermore, low densities of a restricted durable artefact assemblage result in a poor surface visibility of early sites in the landscape except where they are defined within rockshelters or caves. This contrasts sharply with sites endowed with ceramics and 'richer' artefact catalogues. A fundamental problem in investigating non-Lapita sites is found simply in the difficulty of locating them.

Attempts to fit the Vatuluma Posovi data from the 1966-68 excavations into a Lapitoid cultural tradition (Spriggs 1984 : 218), especially given the absence of any ceramics, appears to be based partly on an assumption that Lapita is present in the central Solomons but remains to be discovered (cf. Green 1979 : 51). It now seems equally plausible, from the revised data from the Vatuluma Posovi site and the results of the aforementioned surveys, that there is no Lapita in the central Solomons. Whether or not the present distribution of Lapita sites is indeed a real one, and not solely an artefact of insufficient survey and excavation, two possibilities still have to be considered. The first of these is that a major part of the prehistory of island Melanesia is largely unknown and remains to be properly investigated and characterised. From the Guadalcanal experience this will require due attention being paid to evidence of human interaction with, and impact upon the landscape. The second possibility is that the Lapita cultural complex in Near Oceania may well occupy a geographically and culturally peripheral position rather than the central one it has been given to date, with its apparent pre-eminence possibly itself an artefact of survey. In any further investigations of the prehistory of the central Solomons, it might be prudent if the approaches used did not assume, either implicitly or explicitly, any direct affiliation with the Lapita cultural tradition unless this can be demonstrated by archaeological evidence ; this will obviously require a great deal more data than we currently possess. To take such an approach will not diminish the importance of the extraordinary phenomena that is Lapita, but it will properly acknowledge that other, less visible, cultural traditions are equally worthy of the same kind of detailed enquiries with which Lapita has been investigated.

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LE SITE DE TIWI ET LE PEUPLEMENT DE LA NOUVELLE-CALÉDONIE

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RÉSUMÉ

La situation de la Nouvelle-Calédonie, aux confins de l'arc insulaire mélanésien, a favorisé le développement d'une culture originale enrichie par des apports extérieurs constants. La fouille de l'abri sous roche de Tiwi, à Goro, illustre le schéma de l'évolution culturelle ancienne du Sud de l' île. La date enregistrée pour l'occupation initiale de l'abri dans un niveau contenant de la poterie de Podtanéan m'amène à reconsidérer la signification respective de la poterie de Podtanéan et de la poterie Lapita dans le peuplement de la Nouvelle-Calédonie. Les changements observés dans les niveaux stratigraphiques datés du début de l'ère chrétienne et leurs implications probables au niveau de l'environnement sont également discutées.

ABSTRACT

The geographical location of New Caledonia, at the extremity of the Melanesian arc of island, favoured the development of an original culture made richer by regular input from the outside. The excavation of a rock shelter at Tiwi, near Goro, illustrates the pattern of evolution of the old culture of the South of the island. The dating for the initial occupation of the shelter, at a level containing Podtanean pottery led me to reconsider the respective significance of Podtanean and Lapita pottery in the human settlement of New Caledonia. Some changes observed in the stratigraphic levels dating to the beginning of the Christian era, and their probable implications regard the environment, will also be discussed.

L'avancée Austronésienne en Mélanésie insulaire et en Polynésie occidentale est jalonnée par les témoins céramiques Lapita. Dans l'archipel de Bismarck, les implantations Lapita sont abondantes et témoignent de l'adaptation de ces nouveaux immigrants à un milieu occupé de longue date. La limite de cette cohabitation est celle de l'implantation pré-Lapita : on la situe actuellement dans le Nord des îles Salomon, mais il est probable que les recherches à venir prolongeront son extension vers le Sud (cf. Roe, dans ce volume). Dans le Sud des îles Salomon et au Vanuatu, le Lapita est considéré comme l'élément fondateur. Il est représenté sporadiquement et de façon très localisée par des sites étendus au Sud des îles Salomon : sites des îles Reef/Santa-Cruz, et au Nord de l'archipel de Vanuatu : site de Malo ; il est attesté de manière fugace à Efate (site d'Erueti : Hébert, 1965; Garanger, 1972) et Erromango (site d'Ifo : Spriggs, 1984). Les sites Lapita sont de nouveau abondants plus au Sud, en Nouvelle-Calédonie et à l'Ouest (Fiji). La quasi-absence de Lapita dans certaines grandes îles des Salomon et une grande partie de Vanuatu, que l'on ne peut plus simplement expliquer par l'absence de prospection, pourrait signifier que ce fossile directeur masque une réalité moins visible. La présence en Nouvelle-Calédonie et au Vanuatu d'autres types céramiques anciens permet d'envisager un schéma de peuplement plus étayé.

Le site sous abri de Tiwi à Goro, récemment fouillé et daté, confirme qu'il existait en Nouvelle-Calédonie une population installée il y a plus de trois mille ans dans des zones dont le Lapita est absent jusqu'à présent. Cet abri bien stratifié jette un nouvel éclairage sur l'évolution de l'occupation humaine en Nouvelle-Calédonie.

Description générale du site

L'abri sous roche de Tiwi se trouve sur le littoral sud-est de la Nouvelle-Calédonie, dans une zone peu habitée, proche du village de Goro. L'abri, dont l'entrée ouvre vers l'Est Nord-Est, est protégé des vents dominants. Il surplombe un lagon peu profond, enserré entre les passes de Koué et Toemo.

L'abri, une faille à moitié effondrée dans un massif de péridotites perpendiculaire au rivage, se trouve à la pointe sud d'une baie encaissée. La plaine littorale est bordée par des pentes abruptes donnant accès au plateau ferrallitique. Le sol de la plaine, d'apport marin, présente un horizon humifère de 30 à 40 centimètres d'épaisseur, riche en ponces altérées. La fertilité de ce type de sol est réduite du fait de sa grande acidité. Il a néanmoins été mis en culture autrefois comme l'indiquent les traces de billons alignés perpendiculairement au rivage. Cette plaine littorale basse est mal protégée des fortes marées et des cyclones.

L'abri de Tiwi se trouve à environ 6 mètres au dessus du niveau de la mer, à quelques mètres seulement en retrait de celle-ci. C'est son altitude relative qui l'a protégé au cours des siècles de l'atteinte des éléments. Il s'agit d'une cavité naturelle aux parois lisses dans le massif de péridotites. Ses dimensions sont peu importantes : environ 15 mètres de large et 7 mètres de profondeur pour la partie couverte, soit une surface abritée de 100 m2. Vu les nombreuses traces d'éboulis, en avant de la grotte mais aussi dans certains des niveaux fouillés, la surface couverte devait être plus importante autrefois. Une source saisonnière traverse la zone faillée du massif au dessus de l'abri qu'elle alimente.

L'abri fut découvert en 1987 par J. Monnin lors d'une prospection des zones rocheuses du Sud à la recherche de pétroglyphes. Je fis un premier sondage dans l'abri en 1987 (Galipaud, Kasarherou, 1987 : 1-11), puis une première campagne de fouille du 3 août au 10 novembre 1988 (Galipaud, 1988 : 13-32). La dernière campagne de fouille eût lieu du 2 au 15 mai 1990. A cette date, seuls les niveaux superficiels ont été fouillés extensivement. Les travaux reprendront dans l'abri en 1993.

Dans la description qui suit j'utilise les données du sondage réalisé en 1987 car il a fourni une stratigraphie complète dont certains niveaux ont pu être datés.

Stratigraphie

Le premier sondage a été réalisé dans l'abri en 1987, pour en tester le potentiel archéologique. La stratigraphie est impressionnante (17 niveaux) et présente une grande complexité. Elle se compose dans les niveaux supérieurs de sable fin anthropisé et de dépôts phosphatés intercalaires entrecroisés. Dans les niveaux inférieurs, le sable fait place à un sédiment d'apport ferrallitique en provenance du plateau susjacent. La base de cette stratigraphie, à 3,40 mètres de profondeur, est caractérisée par l'apparition d'un niveau de sable et de corail d'origine marine ne contenant pas de vestige archéologique. La fouille d'une surface plus importante dans les années à venir devra infirmer ou confirmer la stérilité supposée de ce niveau.

Tous les niveaux, à l'exception du dernier, contenaient de la poterie et l'on retrouve de bas en haut la chronologie céramique du Sud de la N.C. Les niveaux les plus anciens, le niveau 16 et le niveau 15, contiennent une grande quantité de poterie de Podtanéan. Le niveau 16, qui n'a pu être fouillé que sur à peu près 30cm^2, à cause des nombreux fragments rocheux encombrant la surface, contenait 15 fragments de poterie de Podtanéan

(fragments décorés et non décorés). Il n'a pas été daté. Le niveau 14 a été daté de 3240 ± 220 BP (Beta 44650), soit une date calibrée de 1519 BC(1).

Le niveau 13 est important car c'est dans ce niveau que la poterie de Podtanéan disparaît et qu'un nouveau type de poterie plus épais, proche de la poterie à anse apparaît. C'est également le dernier niveau formé d'un sédiment d'apport ferrallitique ; les niveaux susjacents sont des sables fortement anthropisés. Dans ce niveau également, l'abondance des fragments de roches indique le possible effondrement d'une partie de la voûte de l'abri.

Le niveau 13 a été daté une première fois de 1390 ± 80 BP (BETA 44237) soit un intervalle calibré de 1420-1170 BP. Ce résultat ayant été jugé beaucoup trop récent, un autre échantillon du même niveau fut soumis au laboratoire. La datation obtenue : 2220 ± 160 BP (BETA 47955) (soit un intervalle calibré de 2739-1860 BP) est plus en accord avec la stratigraphie et le matériel céramique caractérisant ce niveau. Néanmoins, le premier résultat ne peut être rejeté à priori et de nouvelles datations seront nécessaires.

Dans les niveaux supérieurs, on retrouve l'évolution céramique décrite par ailleurs pour le Sud de la Nouvelle-Calédonie (Galipaud 1988, 1990) : poterie épaisse et décors en chevrons, poterie à anses, poterie à pustules. Ces niveaux ne sont pas encore datés à l'exception du niveau 11 dont la datation (1350 ± 80 BP -BETA 44651- soit un âge calibré de 1287 BP) est identique au premier résultat du niveau 13, ainsi que le niveau 6 pouvant marquer la fin de la période pustule, et qui a été daté de 180±70 BP (BETA 44239) soit un intervalle calibré de 277-0 BP.

Les datations obtenues sur les niveaux de ce sondage montrent qu'il y a effectivement en Nouvelle-Calédonie, en plus du site de Naïa, d'autres endroits où le peuplement ancien est caractérisé par la poterie de Podtanéan. Elles confirment dans l'ensemble, les dates déjà obtenues dans d'autres sites de bord de mer et précisent les dates d'apparition de la poterie à anse (niveau 11) et de disparition de la poterie à pustule (niveau 6). L'étude exhaustive de ces niveaux viendra affiner ces résultats.

Les datations des niveaux plus anciens attribués à la période de Koné (niveaux 16 à 13) sont les premières datations de niveaux anciens dans un contexte non littoral. Ces premiers résultats liés aux particularités de la stratigraphie amènent quelques réflexions sur la nature du peuplement originel, la durée et la fin de la période de Koné.

La datation du niveau 14 est la datation la plus ancienne enregistrée en relation avec la poterie de Podtanéan. Ce résultat est d'autant plus étonnant qu'il ne s'agit pas du niveau d'occupation le plus ancien, les fragments de poterie de Podtanéan ayant été trouvés en plus grand nombre dans les niveaux 15 et 16, malheureusement très pauvres en éléments datables. L'ancienneté de ce résultat tient probablement, au moins en partie, aux conditions exceptionnelles de conservation des niveaux anciens dans l'abri et l'absence de date aussi ancienne dans les sites en plein air du littoral ne signifie pas forcément qu'ils n'étaient pas encore occupés. Elle pose cependant le problème de l'arrivée de l'homme en Nouvelle-Calédonie dans son rapport avec l'introduction de la poterie de style Lapita.

(1) Les datations ont été calibrées à l'aide du programme CALIB Ver. 2.0 du Laboratoire des Isotopes Quaternaires de l'Université de Washington (Stuiver M. et Pearson G.W., 1986, *Radiocarbon*, 28 : 805-838)

La fin de la période de Koné

Dans le site de Tiwi, la poterie de Podtanéan disparaît vers 2100 BP soit à peu près en même temps que la poterie Lapita dans les sites du littoral de la côte ouest.

Dans les sites à dominante Lapita, cette date ne marque pas seulement la disparition de la poterie mais aussi l'abandon du site. Ceci est particulièrement évident dans le site Lapita de Patho, à Maré, où les deux occupations attestées par la stratigraphie sont respectivement datées de 2748 cal BP (ANU 6616) pour l'occupation Lapita et 1056 cal BP (BETA 50604) pour la réoccupation de cette même zone, soit un intervalle de près de 1700 ans.

Dans les sites à dominante Podtanéan, la disparition de la poterie ne semble pas entraîner l'abandon du site, en particulier dans le sud de la Grande-Terre où les niveaux se succèdent sans interruption jusqu'à l'actuel (site TON 6, baie de Naïa (Smart 1969), site de Tiwi). Cette constatation m'a amené dans de précédents articles (Galipaud 1988, 1990) à présenter la poterie de Podtanéan comme l'élément moteur de la période de Koné, élément dont la persistance et l'évolution auraient assuré la transition avec les périodes suivantes.

Les datations des niveaux 13 et 11 du site de Tiwi m'obligent à revoir cette hypothèse. L'intervalle de près de 1200 ans qui sépare ces deux niveaux ne permet plus de soutenir l'hypothèse de la continuité.

Il se passe donc quelque chose en Nouvelle-Calédonie au début de l'ère chrétienne; l'évènement majeur de cette transformation est la disparition de la poterie Lapita, mais les causes de cette transformation pourraient être en rapport avec les changements naturels intervenant à cette période.

A Tiwi, les apports terrigènes en provenance du plateau cessent en même temps que disparaît la poterie de Podtanéan. Ils sont remplacés par des apports éoliens d'origine marine et par un pourcentage élevé de fragments de roche, signe d'un éboulement partiel de l'abri. Dans le Sud de la côte ouest, dans les sites des baies de Naïa et d'Engwé, les niveaux datés du début de notre ère sont enfouis profondément dans la zone proche du littoral. Dans ces mêmes sites, des niveaux plus anciens apparaissent à quelques centimètres sous la surface à une centaine de mètres en retrait du littoral. L'absence de niveau ancien en bordure du rivage est une indication des variations eustatiques qui ont affecté la côte au début de l'ère chrétienne.

L'évidence de transformations du milieu il y a quelque 2000 ans est attestée ailleurs en Océanie (Kirch, 1990 ; Spenneman, 1988 ; Spriggs and Roe dans ce volume). De nombreux auteurs ont vu dans ces transformations du milieu naturel la réponse de l'environnement à l'utilisation intensive par l'homme de certains écosystèmes. Le développement de techniques horticoles sophistiquées, telles que proposées par Spriggs (1986) pour Aneytum, peut en effet induire l'abandon de certains habitats, au profit d'autres espaces jugés plus adéquats. Cela n'explique pas, pour autant l'évolution, semble-t-il rapide, des lignes de rivages sur la côte ouest ou le changement dans la sédimentation et les éboulements de Tiwi.

La fin de la période de Koné, en Nouvelle-Calédonie, la disparition de la poterie Lapita ailleurs dans le Pacifique, résultent à l'évidence de transformations naturelles tout autant que sociales dont l'interaction reste à préciser. L'abandon de l'abri sous roche de

Tiwi, du début de l'ère chrétienne à la fin du premier millénaire de notre ère est un témoignage important de ces transformations.

La place du Lapita dans le peuplement de la Nouvelle-Calédonie

La Nouvelle-Calédonie occupe une situation originale au Sud-Ouest de l'arc insulaire mélanésien. Cette position excentrée a du influer sur l'origine du peuplement qui a pu venir de l'Ouest aussi bien que du Nord-Est et favoriser le développement d'une culture originale alimentée par des apports extérieurs diversifiés.

On admet généralement que le peuplement de la Nouvelle-Calédonie résulte de l'expansion Lapita au même titre que le peuplement de l'archipel fidjien, l'un et l'autre ayant eu lieu quasiment simultanément, au milieu du second millénaire avant notre ère.

L'évidence sur la Grande-Terre d'une occupation ancienne non-Lapita suggère que l'homme a pu atteindre la Nouvelle-Calédonie peu de temps avant la diffusion du Lapita, en empruntant, peut être, une voie plus rapide.

On ne peut pas traiter la préhistoire de la Mélanésie comme un tout. La poterie Lapita est le lien qui unit les îles pendant la période du peuplement initial. Néanmoins, ces îles ayant une histoire propre, le Lapita dans chaque île a une originalité qui est fonction de cette histoire.

Dans le Nord de la Mélanésie, l'origine ancienne du peuplement influe sur le développement du Lapita et on observe une certaine continuité entre le pré-Lapita et le Lapita.

A partir des îles Salomon, les sites Lapita sont moins nombreux et très localisés. La seule évidence d'une implantation importante se trouve dans la région Sud-Salomon/Nord-Vanuatu, mais la présence de l'homme est maintenant attestée peu avant l'arrivée du Lapita au centre de l'Archipel (Roe, dans ce volume). Dans le centre et le Sud de l'archipel de Vanuatu, seuls quelques tessons trouvés à Erueti dans l'île d'Efate (Hébert, 1965 : 79) et à Ifo dans l'île d'Erromango (Spriggs, 1984 : 4) rappellent le Lapita et ce malgré des recherches intensives réalisées par J. Garanger dans le centre de l'archipel, M. Spriggs dans le Sud et plus récemment D. Roe et J.C. Galipaud dans l'ensemble des îles. En Nouvelle-Calédonie, les sites Lapita sont nombreux et étendus.

L'absence de Lapita dans le centre et le Sud de l'archipel de Vanuatu rend peu plausible l'hypothèse de l'introduction du Lapita en Nouvelle-Calédonie par le Nord-Est.

Le Vanuatu semble avoir servi, par moments, de frontière au passage d'un certain nombre d'innovations. Il existe au niveau de l'archipel des disparités culturelles marquées entre les îles du Nord et du Sud (la limite pouvant être tracée au niveau d'Efate) dont l'origine pourrait remonter au peuplement de ces îles. L'absence, autrefois, du cochon dans les îles du Sud et le peu de valeur qu'il a encore aujourd'hui est un exemple de cette disparité. Les résultats des études génétiques récentes réalisées sur le Kava (*Piper methysticum*) la précisent. Ces études situent l'origine de la domestication du Kava dans le Nord de Vanuatu (îles Pentecôte, Aoba, Maewo) et sa zone de dispersion vers l'Est plutôt que vers le Sud ; le Kava dans le Sud de l'archipel serait, selon cette même étude, originaire de Fidji (Lebot V. et Levesque J., 1989).

Ces résultats et les faits énoncés précédemment suggèrent que la direction du peuplement, une fois atteinte cette frontière du Nord-Vanuatu s'infléchit vers l'Est, en direction de la Polynésie occidentale. Ceci n'est pas en contradiction avec les données de terrain en Nouvelle-Calédonie et pourrait même expliquer les dates relativement récentes enregistrées dans les sites Lapita. Pourtant, les dates anciennes de la poterie de Podtanéan à Tiwi et Naïa sont, dans l'hypothèse d'un peuplement de la Nouvelle-Calédonie par l'Est, en contradiction avec les dates plus récentes, à Fidji, pour cette même poterie.

L'hypothèse de Gorecki (dans ce volume) d'une barrière "culturelle", c'est-à- dire érigée par l'homme à l'encontre du nouvel arrivant est attrayante. La présence de l'homme au Vanuatu et en Nouvelle-Calédonie, avant l'expansion Lapita, expliquerait à la fois les dates enregistrées pour le Podtanéan en Nouvelle-Calédonie et l'absence de Lapita dans le Sud de Vanuatu.

De cette hypothèse découle alors un modèle de peuplement en deux étapes:

1. Découverte des îles peu de temps avant l'expansion Lapita par de petits groupes voyageant du Nord au Sud et installation. La poterie imprimée au battoir (Podtanéan de Nouvelle-Calédonie) et d'autres styles céramiques anciens de Mélanésie (Mangaasi) ainsi que certains témoins non céramiques associés pourraient y puiser leur origine.

2. Expansion des groupes ou de la poterie Lapita. Le phénomène est rapide car il utilise des voies en partie tracées. La route néanmoins est différente : Salomon puis Fidji, Tonga, Samoa et retour tardif vers la Nouvelle-Calédonie d'où la poterie de Podtanéan aurait pu repartir vers la Polynésie occidentale.

Cette hypothèse, et le modèle qui en découle, prêchent en faveur de l'homogénéité de cette culture ancienne fondatrice en Mélanésie insulaire. La mise en exergue des types de poteries pour la définition et l'interprétation de faits culturels anciens peut masquer l'évidence. Plutôt que de chercher ce qui, avec la poterie, appartient au "complexe culturel Lapita", ne vaudrait-il-pas mieux chercher ce que représente la poterie Lapita dans ce "complexe culturel fondateur" dont les vestiges nombreux et diversifiés démontrent la richesse?

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WHAT IS LAPITA ABOUT OBSIDIAN ? A VIEW FROM THE TALASEA SOURCES

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RÉSUMÉ

Qu'y a-t'il de spéciaiement Lapita dans l'obsidienne ? L'exemple des carrières de Talasea.

Des fouilles récentes effectuées dans la région de Talasea en Nouvelle Bretagne occidentale ont fourni de nouveaux éléments pouvant servir à évaluer la position qu'occupe la période "Lapita" dans un contexte chronologique élargi. Le but de cette communication est de définir la nature de l'évolution de la production des objets d'obsidienne dans cette région au cours des 5000 dernières années.

Je décris en premier la nature des changements dans le mode d'obtention et le traitement de l'obsidienne que l'on peut résumer en termes de (1) choix des sources de matière première, (2) répartition spatiale de la production, et (3) méthodes utilisées pour la fabrication d'outils.

Deuxièmement, la question de savoir si il y a quelque chose de fondamentalement "nouveau" dans les comportements humains durant la période marquée par la présence de poterie Lapita est discutée. Troisièmement, je note l'absence de comportements qui puissent être spécifiquement attribués à l'existence d'un système d'échanges. Et enfin, je conclue que l'évolution dans les techniques d'obtention et de façonnage de l'obsidienne à Talasea résulte de l' évolution lente et continue dans les modes de subsistance et de peuplement, plutôt que de l'arrivée soudaine de peuples, d'idées ou de cultures différentes.

Les tendances globales que nous avons pu observer dans la technologie de l'obsidienne ont été occasionnellement interrompues par des fluctuations locales de l'environnement, telles que variations du niveau des mers et activité volcanique. En dépit des effets très certainement catastrophiques à court terme qu'ont pu avoir les éruptions volcaniques sur la vie des populations résidant à Talasea, il n'en demeure pas moins que, à travers une période étendue de l'histoire, la production d'obsidienne est surtout remarquable pour la régularité et la lenteur de son évolution.

ABSTRACT

Recent fieldwork in the Talasea area of West New Britain has provided some new information which can be used to evaluate the position of the `Lapita' period within its wider chronological context. The purpose of this paper is to assess the nature of changes in the production of obsidian artefacts in this region during approximately the past 5,000 years. Firstly, the nature of change in obsidian procurement and production is summarized in terms of (1) the choice of raw material sources, (2) spatial patterns of production, and (3) methods of tool manufacture. Secondly, the question of whether there is anything significantly `new' about behaviour during the time of Lapita pottery is addressed. Thirdly, the absence of behaviour specifically referable to the presence of an exchange system is noted. Finally, I conclude that changes in the way obsidian was obtained and manufactured at

Talasea can best be explained as the result of a long-term, slow, continuous change in subsistence and settlement patterns, rather than the sudden arrival of different people, ideas, or material culture. The overall trends observed in obsidian technology were nevertheless interrupted occasionally by local fluctuations in environmental variables such as sea level changes and volcanic activity. Despite the undoubtedly disastrous short-term effects that volcanic eruptions must have had on the lives of people living at Talasea, the long-term history of obsidian production is remarkable for its steady, slow pace of change.

IS LAPITA NEW?

Current debates about the importance of Lapita pottery in the prehistory of the Pacific region (e.g. intrusive `people' or indigenous development ; part of a `cultural complex' or just a pottery type ; e.g. Kirch 1988b) could be more easily resolved if the archaeological record containing Lapita could be compared thoroughly with what came before and what happened after. Until recently, however, the impoverished data have not permitted archaeology to view Lapita in its chronological context. Fortunately the situation is changing rapidly (e.g. Allen and Gosden 1991 ; Kirch 1991 ; Gosden 1989 ; 1990 ; Gosden et al. 1989 ; Roe, Galipaud this volume).

Fieldwork in the Talasea region of West New Britain has been especially successful in locating a number of sites with deposits which bracket the time of Lapita pottery (fig. 1 ; Specht et al. 1988 ; 1991 ; Torrence et al. 1990). Archaeological research in this area has been facilitated by the existence of a regional sequence of soil horizons which are separated by distinct tephras. Using these volcanic marker beds, Specht et al. (1991, acknowledging the assistance of Blong and Machida) have identified three distinct periods of human occupation which can be recognized at a number of locations within the region :

(1) pre-Lapita, dating from before about 3600 years ago and sealed by the Wk-2 tephra from Mt. Witori ;
(2) `Lapita', beginning about 3600 years ago and overlain by tephra from Mt. Dakatau, which is dated to about 1100 years ago ;
(3) post-Lapita, dated from after 1100 years ago up to the present.

It should be noted that the second period, called `Lapita' at the moment simply for convenience sake, extends beyond the date of Lapita pottery in the Bismarck Archipelago. In the future with better radiocarbon dating it should be possible to subdivide this stratigraphic unit, but for current purposes the analyses discussed below have been based on the regional stratigraphy, rather than on chronometric dating techniques.

On the basis of their preliminary analysis of settlement pattern, subsistence, and material culture for the periods before, during and after Lapita pottery, Specht et al. (1991) concluded that at Talasea there was very little that was new or unique during Lapita times. In other words, `Lapita pottery was but one element in a long and complex history of continuity and change' (Specht et al. 1991). The same conclusion was reached for obsidian at Talasea, but detailed data were not presented at that time. Following on from Specht et al. (1991), the purpose of this paper is to put forward a hypothesis to explain the nature of change in obsidian procurement and production at Talasea over the past 5,000 years or so. I begin with

a brief summary of the data on three aspects of obsidian technology : (1) choice of obsidian sources ; (2) spatial patterning of production ; and (3) nature of tool manufacture [1]. The analytical results are followed by an evaluation of whether there was anything significantly `new' in the way obsidian was extracted and produced in the Lapita period and if such behaviour could be ascribed to the arrival of people who were different from the previous inhabitants at Talasea. Finally, I conclude that the data are best explained as the result of a continuous, long-term change in behaviour occasionally interrupted by short-term perturbations caused by local environmental fluctuations.

CHOICE OF SOURCES

Fieldwork led by Specht over a number of years has revealed that a large number of obsidian sources are widely dispersed across the Talasea region and that both island and mainland locations are represented (Specht 1981 ; Specht et al. 1988, 3-7 ; Fullagar et al. 1989 ; Summerhayes et al. 1991 ; Summerhayes this volume ; Torrence et al. in press). Although there is a great deal of variability in the quantity of obsidian available within individual outcrops and in the ease with which it could have been extracted, adequate supplies of raw material occur within easy walking distance of any part of the region. Not surprisingly, it appears that consumers have tended to focus on particular sources where larger quantities of big, solid blocks of obsidian could be obtained with little effort (Torrence et al. in press). What is unexpected, however, is that not all of these high quality sources were exploited simultaneously.

The clearest archaeological evidence for a shift in the location of obsidian extraction occurs in Malaiol stream on Garua Island (fig. 1). At site FAP a very dense deposit of manufacturing waste is associated with an excellent source, which is comprised of an old landslide incorporating large obsidian nodules as well as fractured blocks of flow material (cf. Torrence et al. 1990, 459, 461). Fullagar`s excavation at FAP revealed two phases of obsidian-working sealed by the Wk-2 tephra and therefore dating to the pre-Lapita period. The first phase of extraction and manufacture at FAP is comprised of a dense layer of obsidian-working debris which is between 0.8 and 1.0 meters thick. It is overlain by the second phase which is represented by about 0.7 meters of deposit containing a significantly lower density of worked material. The major period of obsidian procurement at FAP, therefore, ended at some unknown time substantially pre-dating the Wk-2 eruption and was followed by a much less intense period of use. After the Wk-2 event, obsidian-working is virtually absent at FAP.

Although Lapita sites on Gaura Island contain obsidian from the local Baki outcrops (as indicated by the extremely distinctive cortex associated with these sources), by this time the nature of procurement had clearly switched from being targetted (e.g. at FAP) to a more casual use of a wide range of locations on Garua. Support for the archaeological data from Malaiol Stream comes from the results of chemical characterizaton analysis by Summerhayes using PIXE/PIGME of obsidian artefacts from a wide range of sites in West New Britain. Summerhayes et al . (1991) found only one artefact whose composition matched the Baki source group to which site FAP belongs ; this single find is from a pre-Lapita level at the Walindi plantation site (FRI). It therefore seems likely that obsidian was only exported from the Baki sources at a time when extraction was highly localized.

1 It must be emphasized that the analyses of the stratigraphy and assemblages from the sites reported here have not been completed. For this reason, detailed descriptions of the data will not be reported here. The final publication of these sites will be corried out jointly with J. Specht and R. Fullagar.

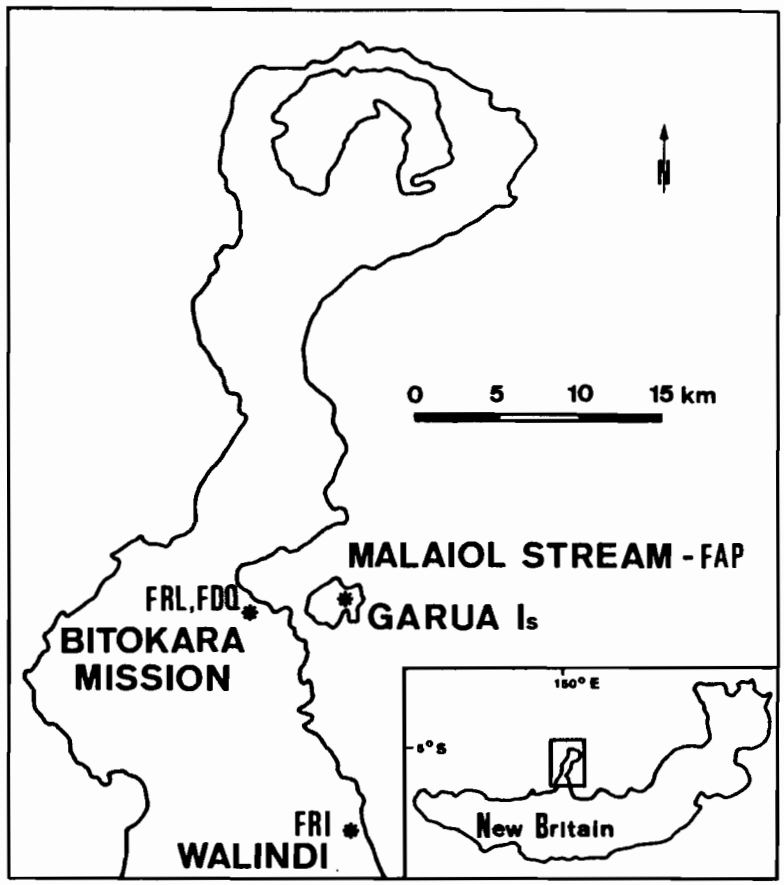

FIGURE 1 : Bitokara Mission and associated sites mentioned in the text.

In contrast to FAP where the most intense period of use ended well before 3600 bp, obsidian production at the sources on Mt. Kutau, located on the mainland near Bitokara Mission, appears to have been in full swing at the time of the Wk-2 event and to have continued up to the recent past. PIXE/PIGME analyses have shown that the Kutau sources dominated obsidian assemblages in West New Britain during all three periods, although a very few pieces from the Gulu flows near Talasea and from Lou Island in the Admiralty Islands have also been recognized in Lapita period collections (Summerhayes et al. 1991) ; the comparative history of use for the Mopir source is also proving to be extremely interesting (cf. Green 1987 ; Fullagar et al. 1991 ; Summerhayes this volume). Despite the consistently high popularity of the Kutau sources, recent archaeological data from Bitokara Mission, which is located near Talasea on the mainland just opposite Garua Island (figs. 1, 2), demonstrate that the specific pattern of how and where obsidian was exploited was not stable throughout prehistory. Furthermore, in the particular choices of outcrops from the many available, Kutau outcrops (cf. Torrence et al. in press) may be important for assessing the place of Lapita at Talasea.

In 1988 road-building activities on the hillslope above the mission buildings at site FDQ exposed in situ obsidian flows as well as thick layers of obsidian debris, all of which were sealed directly under the Wk-2 ash (fig. 2 ; Specht et al. 1988, 10 ; Torrence et al. 1990, 456-7). Further down the hill at site FRL excavations in 1981 (FRL II) and 1988 (FRL I) also revealed a concentrations of obsidian waste by-products in situ beneath the Wk-2 ash.

At FRL I another working floor was preserved under the Dakatau tephra and post-Lapita levels containing obsidian artefacts were also found (fig. 2 ; Specht et al 1988, 8-9 ; Torrence et al. 1990, 459). Since pre-Lapita levels have not been satisfactorily dated due to the absence of organic material, chronological relationships between the termination of the earliest phase at FAP and the onset of production at Bitokara cannot be assessed. The presence of two phases at Bitokara prior to the Wk-2 event, however, is extremely tantalizing (Layers 2 and 4 in FRL I ; cf. Specht et al. 1988, 8-9). Whether the focus of obsidian production shifted from Garua Island to Bitokara well before 3600 bp or whether the Garua source simply went out of use for some other reason remains an important question for further field research. Although the Bitokara source appears to have been used continuously throughout prehistory, the nature of obsidian extraction did not remain stable. During the pre-Lapita phase, obsidian was procured primarily from outcrops situated on the upper hillslopes at FDQ, although water-rolled cobbles, presumably from the nearby beach and streambed, are also present in small numbers at FRL (fig. 2). It appears that large pieces were prised out of heavily jointed obsidian bands which were exposed on the surface or collected from scree slopes just below the outcrops. Given that blocks from a pyroclastic flow which underlies the obsidian flow are mixed in with waste by-products of obsidian, it seems likely that people also dug shallow pits in order to obtain fresh, unweathered obsidian. After the Wk-2 eruption, however, the procurement of obsidian from flows on the hillside at Bitokara ceased. Deposits above the Wk-2 tephra at FDQ contain few if any artefacts. In contrast, at FRL, lower down on what may have been a flatter area, obsidian-working continued up to the recent past but decreased in intensity. During the Lapita and post-Lapita periods obsidian cobbles were collected from nearby stream courses or from the beach directly below the mission. Since gullies have formed along the edges of the obsidian flows, people could collect eroded cobbles from the base or sides of these or extract pieces from flows exposed within them.

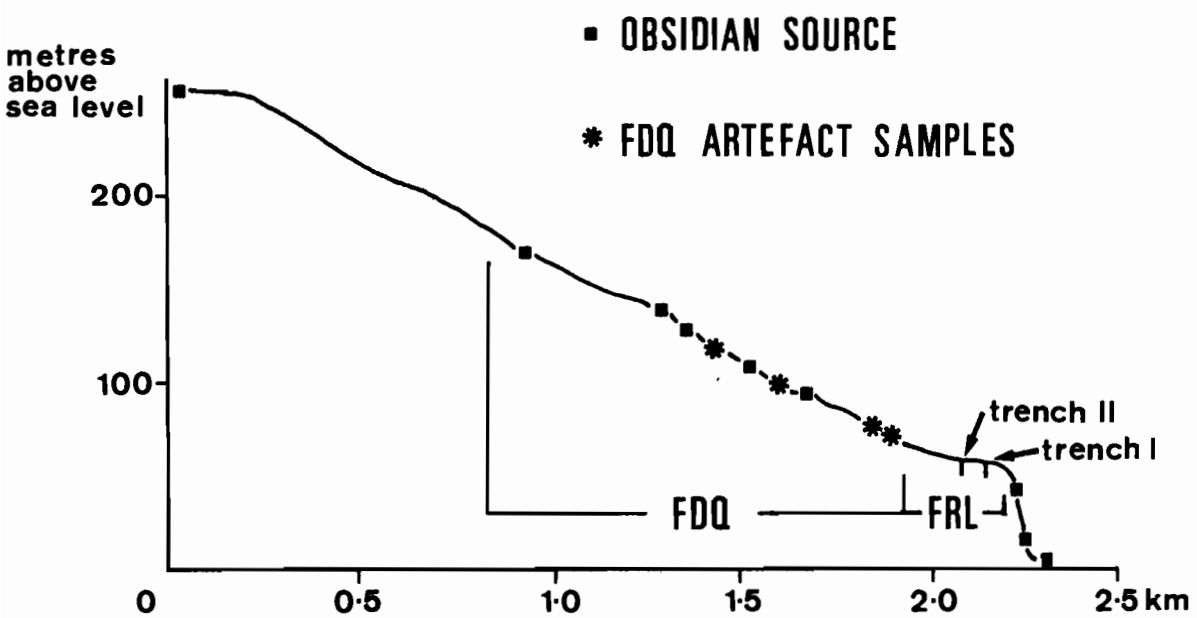

FIGURE 2 : Profile of Bitokara Mission showing the location of archaeological sites and obsidian sources. At present obsidian outcrops on the hillside are buried, whereas those lower down the slope are exposed within a streambed or are on the beach.

SPATIAL ORGANIZATION OF PRODUCTION

After the Wk-2 event at Bitokara, not only is there a shift in the choice of raw material sources, but the spatial organization of production also changes. In the pre-Lapita period some tools were manufactured on the hillslopes at FDQ not far from where the obsidian was collected or quarried (fig. 2). Many other artefacts were not completed at one time but were manufactured in discrete stages which were carried out in different localities. In these latter cases large flakes were first removed from cores near the outcrops. Then the pre-forms were carried downhill to a second location where they were retouched into final form. In addition, some cores were only partially reduced before they too were transported to another area where additional flakes were removed.

Support for these observations comes from a comparison of the assemblages collected at FDQ and FRL I. Firstly, the percentages of artefacts bearing original unflaked surfaces declines as a direct function of distance from the hillside sources. In addition, the flakes and cores collected from FDQ, which is near the outcrops, are generally larger and display a wider range of area and thickness than do those from the pre-Lapita levels at FRL I where the later stages of working are dominant. The data displayed in figures 3 and 4 show that the very large flakes removed in the first stages of flaking are more common at FDQ. In addition to being among the first flakes removed for cores, many of the large flakes at FDQ represent failed pre-forms discarded early in the manufacturing process. Similarly, the much bigger cores at FDQ, which produced the flake pre-forms, are absent from the FRL I assemblages. The considerable overlap in size and shape between FDQ and FRL I demonstrate that the stages of manufacture were not strictly differentiated in space.

In contrast to the organization and nature of obsidian production in the pre-Lapita period, during later periods all the manufacturing stages were carried out in the same place. The core which Fullagar (1990 ; cf. Torrence et al. 1990, 461) reconstructed from a Lapita level is a good example of this type of behaviour since nearly all the pieces from one knapping episode had been deposited together in one small area. In contrast, attempts to refit the pre-Lapita assemblages have been relatively unsuccessful ; even after searching for many hours, only rare pairs of flakes could be conjoined.

OBSIDIAN TECHNOLOGY AT FRL I

If one simply compares the Lapita period with what came before, it might be inferred that the changes in the selection of sources and spatial organization of behaviour indicate the arrival at Talasea of a new group of people who were unfamiliar with the area and/or treated obsidian in a different way. In line with this reasoning, there appears to be another sharp break in obsidian technology after the emplacement of the Wk-2 tephra. A distinctive form of retouched tool characterized by a protrusion or stem at one end is found in all sites at Bitokara only in pre-Lapita levels (fig. 6,d ; cf. Specht et al. 1988 ; Torrence et al. 1990, 460-1 ; Fullagar this volume). More recent fieldwork, however, has shown that this pattern is not typical of the entire region. Although large stemmed tools (c. 10-25 cm.) do seem to be absent during the Lapita period, a number of much smaller retouched flakes (c. 3-5 cm.) bearing identical stems have been recovered from Lapita period deposits at other sites in the Talasea area. One plausible interpretation for these finds is that Lapita period knappers continued to use the stem as a stylistic trait, but applied it to a different tool form. In other words, the stem represents continuity of a concept from one period to the next and consequently argues against replacement by a new group of people. It is also notable that stemmed tools have not been found in Lapita assemblages outside of Talasea, suggesting continuity of a local trait.

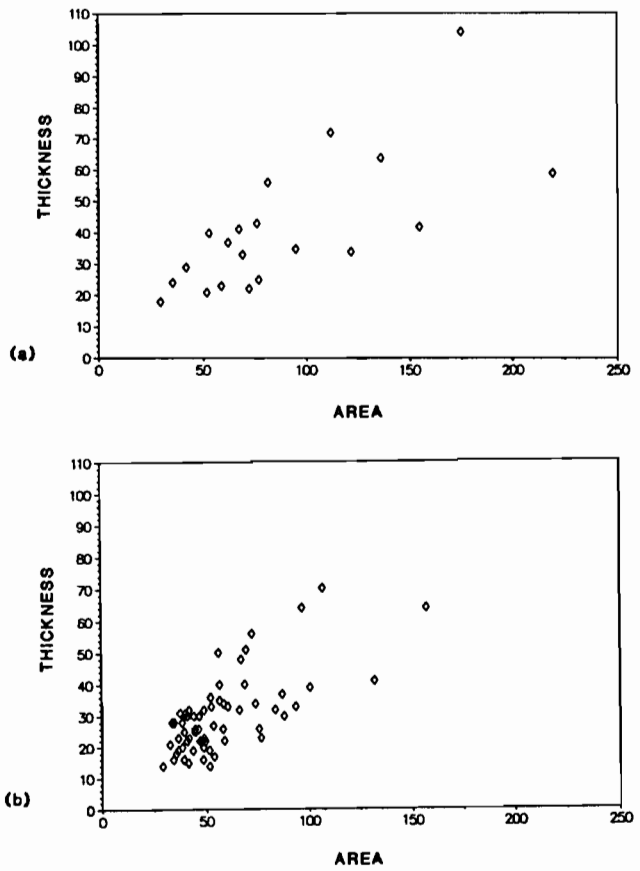

FIGURE 3 : Comparison of the size and shape of obsidian flakes from the pre-Lapita levels at (a) FDQ and (b) FRL I.

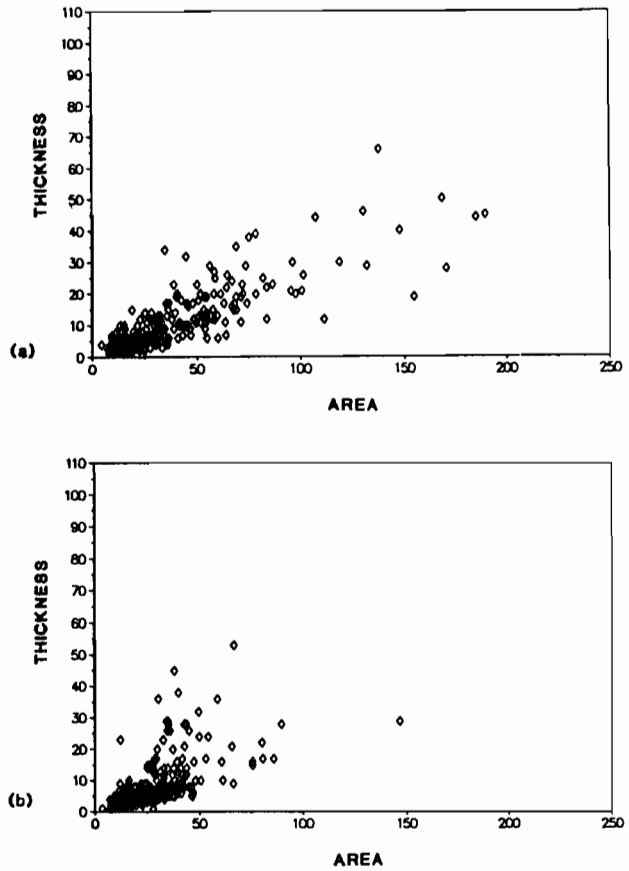

FIGURE 4 : Comparison of the size and shape of obsidian cores from the pre-Lapita levels at (a) FDQ and (b) FRL I.

A serious drawback in the analyses presented so far in this paper is that the assessment of what constitutes lithic technology during the Lapita period has been based solely on the presence or absence of traits (e.g. stemmed tools, spatial patterning, extraction at certain outcrops). By its very nature, the comparison of two categories overly stresses differences and obscures long-term processes. The analysis of the assemblages at FRL I offers an alternative approach which is preferable because it is based on looking at the position of Lapita in relation to changes in behaviour which may have already been taking place before the Wk-2 volcanic event. Since two distinctive layers are sealed beneath the Wk-2 tephra (cf. Specht et al. 1988, 9 which shows Layers 2 and 4 clearly separated by a redeposited tephra), one can look for trends begun before the Wk-2 event and therefore evaluate whether the Lapita period material represents continuity or a genuine break with the past. One can also compare Lapita with the later period, although the sarnple size at FRL I is quite small. In the remainder of the paper changes in obsidian technology at FRL I will be examined in terms of the following stratigraphic divisions :

pre-Lapita : Phase I (Layer 2)
Phase II (Layer 4)
Lapita : Phase III (Layers 6, 7)
post-Lapita : Phase IV (Layer 10-12).

A good example of the advantage of looking at large scale trends comes from an analysis of changes in spatial organization of behaviour. The shift at Bitokara from staged to expedient manufacture, which was inferred above by comparing the material at FDQ with FRL, can also be detected by studying changes in the obsidian assemblages recovered from FRL I. In the pre-Lapita levels, the final stages of production dominate the collections. In contrast, above the Wk-2 tephra early stages of manufacture, as represented by unmodified nodules and artefacts bearing original, unflaked surfaces, make up a larger proportion of the total samples (fig. 5, a, c). The contrast between Lapita and pre-Lapita manufacturing, however, should not be overdrawn because the relative proportions of these traits continue to increase beyond the Lapita phase through the post-Lapita levels, reflecting a continuous trend through time toward less concern to test or reduce nodules at sources before carrying them to the place of manufacture. When viewed over this longer time scale, the apparent break in spatial organization of production between pre-Lapita and Lapita levels disappears. The change in behaviour more profitably conceived of as a part of an ongoing long-term trend toward a more casual and expedient use of raw material.

Object of Manufacture

Long-term trends are also apparent in an examination of change in the nature of artefacts manufactured at FRL I. In the pre-Lapita phases stemmed tools are the most common form of retouched artefact and from the nature of the cores and waste by-products appear to have been the primary object of manufacture. Fullagar (1992 ; in press ; this volume) has proposed that stemmed tools were used for a range of tasks, although the evidence for processing tubers is the most clear at the moment. Notwithstanding the absence of stemmed tools in the Lapita levels at this site, it is important to note that the frequency of manufacture of this tool type had already begun to decline during the pre-Lapita period. In phase I stemmed tools comprise 40 per cent of the retouched artefacts, but in phase II the proportion has dropped to 22 per cent (fig. 6, d) As a consequence, the percentage of retouched artefacts made up by simple flakes increases steadily throughout the entire use of the site (fig. 5, d). It seems likely that the loss of stemmed tools in the Lapita levels is part of a long-term change from more to less shaping of tools by retouch and that this was already in progress before the Wk-2 and continued after the Lapita period into phase IV.

Alongside the production of stemmed tools, unretouched flakes struck from a different type of core were also intentionally made for use. Throughout the entire sequence at FRL I there is a gradual shift in emphasis away from stemmed tools to unretouched flakes. This trend is exhibited by the gradual decrease in the proportion of retouched artefacts of all types in the total assemblages (fig. 5). In fact, the greatest change in the relative quantity of retouched artefacts occurs between phases I and II, echoing the decrease in the relative frequency of stemmed tools.

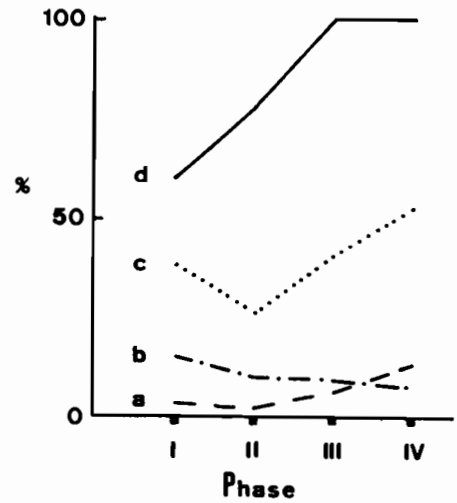

FIGURE 5 : Long-term trends in the obsidian technology at FRL I : (a) relative frequency of unmodified nodules ; (b) relative frequency of retouched artefacts (value multiplied by ten) ; (c) relative frequency of artefacts with one or more unflaked surfaces ; (d) relative frequency of simple flakes within the category of retouched artefacts.

Cores

The increase in emphasis on the production of unretouched flakes through time at FRL I is best illustrated by changes in the types of core employed. For the purposes of this analysis, cores have been defined as any artefact which has been used to produce flakes. The definition is based solely on technological criteria and does not preclude the possibility that cores were also used as tools. In fact, many of the stemmed tools are likely to have served simultaneously as cores and as implements. In this analysis of cores, however, the presence of systematic retouch, defined as a series of overlapping flake scars aligned along an edge, was used to discriminate between `cores' and `stemmed tools'. Two distinctive types of cores are relevant for discussion here : (1) unidirectional cores in which flakes have been struck consistently in one direction from a platform and (2) bifacial cores in which flakes have been struck regularly in two directions from the platform. On both types of core more than one platform may have been used, but the flaking will be either unidirectional or bifacial in all cases.

Bifacial cores are only found in the pre-Lapita levels. Their technological role is not completely clear. In some cases they represent failed stemmed tools abandoned at an early stage of manufacture, but in others they were clearly intended solely as flake cores. All of the bifacial cores were manufactured from large flakes, which had probably been struck off nodules by the sources at FDQ, selected for use as cores, and then transported down the hill for further reduction. Like stemmed tools, the bifacial cores are only found in the pre-Lapita levels and also decline in relative frequency between phases I and II (fig. 6, c). Once again the data do not support a sharp break but are more consistent with a gradual decline in the importance of systematic shaping by retouch which is carried further in the Lapita period.

As illustrated by the occurrence of unidirectional flake cores, the gradual shift toward systematic flake production also has its roots in phase I. In contrast to the bifacial cores, the former type are mainly made from small obsidian cobbles. In some cases the unidirectional cores were rotated once or twice so that additional platforms could be used (cf. Fullagar 1990 ; Torrence et al. 1990 : 461). Despite the increasing predominance of these cores through time at FRL I, the intensity of flaking per core, as measured by the number of platforms per core is greatest in phase I and decreases into phase III (fig. 6, b).

In summary, the apparent differences in obsidian technology between the pre-Lapita and Lapita periods as illustrated by the obsidian assemblages at Bitokara Mission and especially those from the FRL I trench are best envisaged as part of a long-term, gradual change in behaviour from a relatively organized manufacture for stemmed tools to a more casual and expedient production of unretouched flakes for immediate consumption. As a result of the decline in stemmed tool production, different types of obsidian were selected, the number of stages in manufacture were reduced, and consequently the spatial segregation of different activities is abandoned. Underlying the change in emphasis in what was produced is a fundamental shift in the whole structure of how obsidian was treated. This change in attitude towards obsidian production is important because it should be reflecting differences in the social and/or economic systems of the producers and consumers.

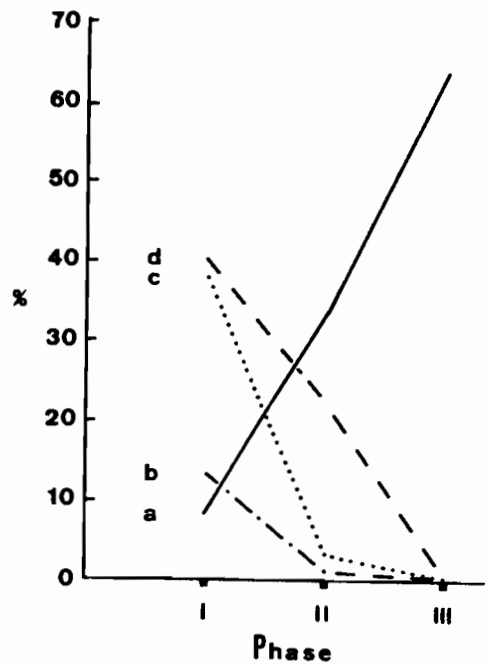

FIGURE 6 : Long-term trends in obsidian cores and stemmed tools at FRL I : (a) relative frequency of cores with unidirectional platforms ; (b) relative frequency of rotated cores with three unidirectional platforms ; (c) relative frequency of cores with bifacial platforms ; (d) relative frequency of stemmed tools within the category of retouched artefacts.

A THEORY FOR CONTINUITY

As demonstrated above, the obsidian technology employed during the Lapita period at Bitokara Mission is not fundamentally different from the previous periods. Instead, the expedient flake technology typical of Lapita assemblages at Talasea and elsewhere (e.g. Sheppard this volume), is the result of a slow, gradual change in behaviour that had its roots in the pre-Lapita period. On the basis of obsidian alone, there is nothing `new` or exceptional about the Lapita period at Talasea, and therefore there is no evidence that the people who returned to Bitokara after the Wk-2 event had changed significantly from their predecessors. In contrast, it appears that they had largely continued the same trends that had begun previously.

In opposition to ascribing change to immigration or a mixing of ethnic groups, as suggested by some scholars to explain Lapita assemblages (e.g. Green 1991), an alternative theory is required to explain the patterns in obsidian manufacture represented by the Bitokara assemblages. In other words, what can account for the steady, long-term change in behaviour along a continuum from organized to expedient production? Previously, I have proposed that changes in the structure of risk are important for understanding shifts in

the organization of technology (Torrence 1989). The hypothesis put forward stated that higher levels of risk lead to a greater emphasis on planning, which in turn will be reflected in the way tools are made, used and discarded. Since the short-term risk relevant to stone tools is unlikely to be faced by people living in the tropical forests of West New Britain, it is not surprising that when measured on a world scale, all the obsidian assemblages from all periods at Bitokara reflect very low levels of planning. Nevertheless, the subtle changes at the site can be understood in terms of a trend away from producing a stemmed tool before it was required to a system of manufacture aimed at instant use, as represented by the Lapita and post-Lapita assemblages. Given that obsidian artefacts in West New Britain were probably primarily used as processing tools (e.g. for cutting plants, carving wooden objects, etc. cf. Fullagar 1992 ; in press ; this volume), in order to understand why the decrease in planning occurred, one needs to identify the variables associated with the kind of risk which was involved.

At this stage my hypothesis is that the major factor in changing attitudes toward obsidian production was a gradual reduction in the numbers of villages occupied per year by a single group. The change in mobility, I believe, was caused by an intensification in the management of resources, in such a way that more food was derived from a smaller amount of land. In other words, before the Lapita period when people were moving their settlements around relatively frequently, they would have been too busy carrying out the extensive system of land management to find adequate time and energy to make special trips in order to obtain supplies of obsidian whenever a tool was needed. Consequently, the acquisition of lithic supplies would need to be `embedded' within other activities which are more crucial (e.g. Binford 1979). Carrying around a bag of heavy nodules for making tools on the spot between settlements would also not be a feasible option. In order to budget the amount of material that they would need to carry with them I suggest that people (1) made finished tools at the obsidian source and (2) employed multi-purpose tools. The pattern of stemmed tool production at Bitokara fills both these options since these artefacts can be used simultaneously both as processing tools and as portable cores for producing additional flake tools when they are needed.

In contrast, through time as groups became more dependent on domesticated resources and therefore villages were more sedentary, it would have been easier to schedule special-purpose trips to sources and to acquire large quantities of raw material which could then be stockpiled and used as needed. An alternative solution for people who resided a long distance away from Talasea would have been to obtain supplies through exchange. Once the pressure to organize production to fit patterns of mobility was released, there would have been no reason to continue to manufacture multi-purpose, portable tools like the stemmed tools or to maximize the amount of flakes removed from a core by rotating it. Consequently, as settlement mobility was reduced, increasingly tools would have been made as and when they were needed, used once, and discarded. Since there was less and less need to prolong use-life, the incidence of retouched edges would drop off.

The data from Bitokara mission offer support for the hypothesis that there was a gradual increase in sedentism beginning before the time of Lapita pottery and continuing up through to the post-Lapita period. Since Bitokara was used for procuring obsidian and as a place where people lived, what I think we are witnessing at FDQ and FRL I in particular is the result of changes in both these activities. I suggest that in the pre-Lapita period groups visited the sources when they happened to have settlements in the near vicinity. At this time they prepared a number of core tools which were carried away with them and used judiciously until they could return to the sources. On admittedly poor data caused by the lack

of contemporary sites, stemmed tools appear to be extremely rare outside of the Talasea region. One reason for their apparent absence elsewhere may be that the tools were completely consumed as cores before they were discarded. As one moves through the sequence at FRL I, I propose that because the site has been occupied for increasingly longer periods of time, there was less and less attempt to make tools ahead of their use. By the Lapita period, the assemblage at FRL I is similar to those from other settlement sites in the region. Current data, then, support the hypothesis that over time the use of Bitokara has shifted from primarily a source of obsidian where pre- forms were made by visitors, to a permanent village.

PRODUCTION FOR EXCHANGE

If obsidian technology during the Lapita period is not new or unique, one might ask whether there are other aspects about obsidian that could indicate a sharp break with the past. One of the traits that is frequently associated with the `Lapita Cultural Complex' is the widespread distribution of obsidian (e.g. Green 1979), much of it derived from the Talasea sources. One assumption commonly made by Lapita scholars is that exchange of obsidian and other commodities was an integral part in the lives of people with Lapita pottery (e.g. Green 1979 ; Kirch 1990 ; 1991). Since obsidian is found on pre-Lapita sites in the Bismarck Archipelago (e.g. Summerhayes this volume), it seems reasonable to predict that exchange may not be unique to the Lapita period.

Although the existence of obsidian exchange cannot be satisfactorily demonstrated at present, my very preliminary comparison of production over time in the Talasea area raises a number of interesting questions. Firstly, it is clear that unlike the previous phases at Bitokara, obsidian procurement and production during the Lapita period was not systematic and selective, as one might expect if the economy was geared toward export (cf. Torrence 1986, 48-50, 171-86). Secondly, Kirch (e.g. 1988a ; 1990 ; 1991) has proposed that the localized production of a commodity is one way to identify prehistoric exchange. On these grounds, one might expect to find evidence for specialized production of obsidian at the Talasea sources. When one looks at the Bitokara sites for data comparable to the putative specialized production of shell artefacts on Mussau (Kirch 1988a ; 1990 ; 1991), however, there is very little support for the production of obsidian artefacts for exchange and at best the current data are equivocal. The density of obsidian in the Lapita levels (as measured in grams per cubic meter of soil) is much reduced from the previous period, suggesting a decline in the amount of manufacture. If the amount of manufacturing waste is an appropriate measure of the amount of exchage that took place, then the decrease in production during the Lapita period is surprising since it occurs when obsidian from the Kutau sources was distributed over the widest geographical region of all the time periods. Furthermore, since the least amount of obsidian production debris was deposited at Bitokara in the post-Lapita period, at a time when there is ethnographic evidence that obsidian from the Kutau sources was traded (Specht 1981), one ought to be suspicious of quantity of waste as an accurate index of exchange.

Quantitative comparison of output using density of waste by- products has serious limitations because different objects were produced in these periods. If by the Lapita period obsidian was used at reasonably permanent settlements in a very expedient manner, as I have argued above, then there would have been no need to produce pre-forms for export. It seems most likely that during the Lapita period, obsidian left the Kutau sources at Bitokara as unmodified nodules, in much the same way as it travelled through recent trading systems in West New Britain (local informants ; Specht, Gosden and Fullagar, pers. comm.), through

to the Huon Gulf (Harding 1967) and to a large extent in the Admiralty Islands (Fullagar and Torrence 1991, 139-40). Sheppard's (this volume) analyses of obsidian from Lapita sites in the Reef/Santa Cruz islands support this hypothesis.

Since by the Lapita period, if not somewhat before, obsidian use had become expedient, specialized production is an inappropriate measure of the presence or absence of obsidian exchange. In order to evaluate the relationship between obsidian exchange and the Lapita period, archaeologists need to apply different techniques within a regional analysis of the nature of production and consumption at settlement sites (e. g. Torrence 1986, 115-38).

ENVIRONMENTAL PERTURBATIONS

Given the drastic effects that the Wk-2 eruption must have had on plant life in particular, it is remarkable that the long-term trends in obsidian technology begun at Bitokara before the tephra fell continue so smoothly afterward. Since rapid recolonization of the area could not have taken place if subsistence was based on natural regeneration of the forest, it seems likely that recolonization during the Lapita period was facilitated by a dependence on heavily managed plant foods. Following this line of reasoning, one implication of the direct continuity in obsidian production is that the management of plant resources in the pre-Lapita period was already fairly intensive when the volcanic event occurred.

Not all the changes in obsidian procurement at FAP and Bitokara, however, can be easily explained as the result of a gradual reduction in settlement mobility. Although the long-term trend dominates the data, there are short-term changes caused by environmental perturbations. For example, the abrupt cessation of quarrying on the hillslopes at Bitokara cannot be accounted for completely by a shift in behaviour away from production at source to the removal of unworked nodules. It seems more likely that when the heavy fall of tephra covered up these outcrops, people shifted their efforts to the streambeds and beaches where abundant supplies could be obtained.

Another anomaly in the proposed long-term trend is the decline in obsidian-working which took place at FAP at some unknown date before the Wk-2 event. If settlement mobility is hypothesized as the major variable affecting obsidian technology, however, one way to explain the variation at FAP may be to identify factors which would have affected Garua Island in a different way than at Bitokara. One obvious possibility is a change in sea-level. Since the current Talasea harbour is very shallow, it is likely that Garua did not become an island until just about the time the sea reached its current level (although the effects of local uplift are currently unknown). At this point, people may have stopped visiting the obsidian sources at FAP because they fell outside the `normal` patterns of mobility. Furthermore, the effects of being isolated would have been magnified if the area of the island was too small to support a group practicing an extensive system of land management. If this hypothesis is correct, then after it became an island, the Garua sources were used only rarely if at all until groups lived there permanently, possibly not until the Lapita period. At this point the pattern of obsidian use had shifted so far towards expedient production that only unmodified nodules were procured from surface deposits. Since the FAP sources had been buried by the Wk-2 tephra, they were not reused when the island was reoccupied.

In such a volcanically unstable area, one would predict that environmental perturbations must have played a role in altering subsistence systems and settlement patterns in the Talasea region. On the contrary, it is quite remarkable how stable the long-term, gradual trends in obsidian production appear to have been. Outside of a few minor

fluctuations in the choice of sources, the history of obsidian production is best characterized by slow, gradual changes.

It has been proposed here that the pattern of change observed at Talasea is best explained as the result of a gradual increase in sedentism caused by a long-term intensification in land management systems. In other words, changes in lithic technology point to the operation of a single process, which unfolded slowly over a very long period of time, rather than the relatively sudden appearance of new people. One unexpected result of the analyses of the Bitokara mission sites has been the notable absence of behaviour that can specifically related to the presence of an exchange system. The nature of the processes responsible for the distribution of Talasea obsidian in the past remains a project for future research.

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RECENT ADVANCES IN MELANESIAN OBSIDIAN SOURCING : RESULTS OF THE 1990 AND 1991 PIXE/PIGME ANALYSES

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RÉSUMÉ

Récents développements dans l'analyse des sources d'obsidienne de Mélanésie : résultats des analyses PIXE-PIGME de 1990-1991.

L'extraction et la distribution de l'obsidienne ont 20.000 ans d'âge dans le Pacifique occidental. Pour identifier les schémas de distribution diachroniques, plus de 600 sources et échantillons archéologiques d'obsidienne ont fait l'objet d'analyses chimiques par la méthode PIXE-PIGME. Ces analyses ont permis de différencier des sources proches en Nouvelle-Bretagne et d'attribuer des échantillons archéologiques à ces sources. Les résultats font apparaître les changements intervenus dans l'exploitation, l'échange et la consommation au cours des dernières vingt mille années et l'influence des évènements volcaniques et des facteurs sociaux sur ces changements.

ABSTRACT

Obsidian extraction and distribution have a 20,000 year history in the Western Pacific. In order to identify patterns of distribution over time more than 600 source and archaeological obsidian samples were chemically analysed using PIXE-PIGME. The analysis was able to discern between discrete obsidian sources in West New Britain, and allocate archaeological samples to those sources. The results identify changing configurations of extraction, exchange and consumption patterns over a 20,000 year period, and the importance that volcanic histories and social factors had on them.

INTRODUCTION

Within the Western Pacific obsidian sources are few in number yet archaeologically obsidian is distributed widely in time and space. The chemical characterisation of obsidian from the source area where it was extracted and the archaeological site where it was deposited provides important information on obsidian production, exchange and consumption patterns. Studying these patterns over time and identifying changing

exchange patterns or social links. As part of a larger project studying the prehistoric settlement, social and economic systems of West New Britain (see Specht et al. 1988 ; Gosden 1989 ; Torrence et al. in press) obsidian characterisation analyses was undertaken at ANSTO, Lucas Heights. During 1990 and 1991 over 600 source and archaeological samples have been characterised using PIXE-PIGME. The aim of this paper is to briefly outline the context of the analysis and the results.

BACKGROUND TO THE 1990 ANALYSES

The major aim of the 1990 analysis was twofold :

1. To refine the chemical fingerprint' of source areas within the Talasea and Hoskins region, West New Britain, and
2. To identify trends in production and consumption patterns in the West New Britain region. For a detailed outline of the 1990 analyses see Summerhayes et al. (in press).

Source resolution

Previous PIXE-PIGME analyses undertaken in 1989 recognised three source groupings within the Talasea samples (Bird et al. 1988 ; Fullagar et al. 1989) :

1. Kutau/Bao
2. Gulu and Mt Hamilton
3. Baki.

Unfortunately samples from Garala Is. overlapped with those from Baki and Gulu. With additional samples collected in 1989 from the Talasea area (Torrence et al. in press) . and in 1990 from Mopir (Fullagar et al. 1991) it was hoped that a finer discrimination between sources would be achieved.

PIXE-PIGME measurements were made using a 2.5 MeV proton beam from the ANSTO 3 MV Van de Graaff accelerator. In order to obtain better discrimination between sources, a beam current of 300 nA was obtained by increasing the beam defining aperture to 2#mm diameter. Using the ten minute measuring time, the dose for each sample was increased by a factor of 3. Other parameters were the same as in previous New Britain studies (Fullagar et al. 1989). Wekwok obsidian from the Admiralty Islands (AD 2000), the standard used in all previous analyses, was used to check the efficiency of the measurement system.

1990 Source Resolution Results

As outlined in Summerhayes et al. (in press), five source groupings were distinguished by correspondence analysis using nine ratios (F/Na, Al/Na, K/Fe, Ca/Fe, Mn/Fe, Rb/Fe, Y/Zr, Sr/Fe, and Zr/Fe) :

1. Gulu
2. Kutau/Bao
3. Hamilton
4. Baki and Garala
5. Mopir

The Hamilton source was separated from Gulu, and Mopir formed a well defined separate source. It is important to note that such a discrimination is only possible with the addition of extra source samples and new machine conditions.

Trends in Production and Consumption

To ascertain trends in production and consumption 328 obsidian samples from stratified sites in the West New Britain region were analysed in the 1990 PIXE-PIGME run. Stratified sites were selected from the the north and south coasts and inland spanning the last 11,000 years (see table 1). The results were compared with the source groups using correspondence analysis which creates a nearest neighbour table and allocates an archaeological sample to a source sample.

TABLE 1. SITES SAMPLED FOR THE 1990 PIXE-PIGME ANALYSES
(for sample numbers see Summerhayes et al. in press.)

REGION	SITE NAME	PNG SITE CODE	PERIOD COVERED
1. Talasea	Boduna	FEA	Lapita
	Walindi	FRI	Pre-Lapita/Lapita/Post-Lapita
2. Mopir	Buvussi	FRK	Pre-Lapita
3. Kandrian/ inland	Misisil	FHC	Pre-Lapita/Lapita/Post-Lapita
	Yombon	FGT	Pre-Lapita/Lapita/Post-Lapita
4. Kandrian/ coastal	Apugi	FFT	Lapita/Post-Lapita
	Yimilo	FLB	Pre-Lapita/Lapita/Post-Lapita
5. Arawes	Paligmete	FNY	Lapita/Post-Lapita
	Apalo	FOJ	Lapita/Post-Lapita
	Lolmo	FOF	Pre-Lapita/Lapita/Post-Lapita
	Adwe	FOH	Lapita/Post-Lapita

Some general trends in West New Britain obsidian consumption will be outlined here and developed later in this paper. First is that with the exception of three samples from Buvussi which are expectedly Mopir in origin, the predominant source for consumption in the last 11,000 years is Kutau/Bao. Only four samples come from the Gulu source - 2 from Misisil (FHC - post Witori), 1 from Paligmete (FNY - Lapita) and 1 from Apalo (FOJ - topsoil). The only sample from the Baki source is found in a pre-Lapita context from Walindi (FRI).

Secondly, three obsidian pieces from the Arawes found in Lapita contexts can be sourced to Lou Island - one each from Adwe (FOH), Paligmete (FNY) and Apalo (FOJ).

Thirdly, Mopir obsidian does not seem to be associated with Lapita age deposits in these West New Britain sites. It was found in Lolmo (FOF), Misisil (FHC/II) and Yombon (FGT/I) in association with Kutau/Bao obsidian in the earliest (pre-Lapita age) and latest levels (post-Lapita age). No Mopir obsidian was found in association with Lapita assemblages from the well stratified Arawe sites.

It is argued (Summerhayes et al. in press) that the hiatus in the exploitation/consumption of Mopir obsidian corresponded with the Witori volcanic eruption at around 3,500 years ago which would have had a devastating effect on the local landscape (see Torrence et al. 1990). Source accessibility therefore at this time would have had a role to play (Fullagar et al. 1991). However before and after the explosion there might have been a different set of contacts and exchange linkeages. Also of interest is the dominance of Kutau/Bao consumption outside the Talasea area. Within the Talasea area obsidian from Baki and Gulu are of equal quality to that of Kutau/Bao and all sources are in a relatively close proximity to each other (Fullagar et al. 1991 ; Specht et al. 1988) yet why choose mainly Kutau/Bao obsidian for exchange outside the area over a such a long period? If geographic and quality variables in the selection of obsidian are negated, then social factors must take on a serious role.

1991 PIXE-PIGME ANALYSES

The aim of the 1991 analyses was to :

1. Reconfirm the absence of Mopir consumption during Lapita deposits and the predominance of Kutau/Bao consumption using extra archaeological samples from southwest New Britain, and

2. To examine production and consumption further in the Pleistocene.

To achieve these aims :

1. 113 samples were selected from seven test pits from FOH on Adwe Island in the Arawes, spanning Lapita and post-Lapita age deposits

2. 40 samples were selected from FLF, a rockshelter in the Lumiello area located near Kandrian, which covers pre-Lapita and Lapita deposits.

3. 49 samples were selected from Matenbek, a cave in south east New Ireland, extending the coverage of consumption patterns back to 20,000 years.

Machine conditions were the same as noted above, and correspondence analysis was used to attribute archaeological samples to source groupings.

1991 Obsidian Consumption Results

A full description of the results will be presented in the respective site reports and only the major points will be noted here.

The results reconfirmed :

1. The predominance of Kutau/Bao in the Holocene deposits of West New Britain,
2. The presence of Mopir in the pre- and post-Lapita levels and,
3. Its absence in the Lapita period.

Of the 113 obsidian samples from FOH, Adwe Island, all but four originated from Kutau/Bao. Of these four, three are recent and comprise two samples from Mopir and one from Gulu. The fourth, also from Gulu, was found in a Lapita context.

From FLF Lapita ceramics are found in layer 6. Of the fourteen obsidian samples from this layer, 13 source to Kutau/Bao, while one sources to Mopir. This is in contrast to the preceding (pre-Lapita) and subsequent layers (post-Lapita) where the percentages of Mopir obsidian are 42% and 50% respectively. The one piece found in layer 6 was found in spit one, the top third of the layer.

The results from Matenbek are important as they demonstrate the predominance of Mopir as a source in the Pleistocene. Of the 17 Pleistocene obsidian pieces analysed (46% of the total Pleistocene assemblage) 12 came from Mopir, 1 from Gulu and 4 from Kutau/Bao. This unit is dated from c.20,500 B.P. to c.18,500 B.P.. The Holocene units are later in time and date to mid to late Holocene, 6-8,000 B.P. Of the 401 Holocene obsidian pieces, 32 were analysed (8%). These also show a preponderance of Mopir obsidian (n=25), and a lesser amount of Kutau/Bao (n=5) and Mt Hamilton (n=2).

See Summerhayes and Allen (in prep) for more detail on the Matenbek results.

DISCUSSION - OBSIDIAN DISTRIBUTION IN THE PLEISTOCENE AND HOLOCENE

A) Pre-Lapita Obsidian Consumption

There are few sites to compare with Matenbek's Pleistocene obsidian distribution and the dominance of Mopir obsidian :

1. Obsidian from the late Pleistocene site of Matenkupkum, New Ireland, was thought to have come predominantly from Talasea with a few from Mopir (Gosden and Robertson 1991 : 42). These were analysed previous to the 1990/91 PIXE-PIGME runs as part of the Lapita Homeland Project and are in deposits dating from c.12,000 - 10,000 B.P. (Allen et al. 1989 : 554). Subsequent revision of these earlier results (not available to Gosden and Robertson) however show a different picture. Of the 103 samples analysed, Mopir obsidian accounts for 64%, with Talasea accounting for 30%. Six percent were assigned to the unknown sources TT and UU (see Summerhayes and Allen, in prep).

2. From Misisil, also late Pleistocene in age, both Mopir and Kutau/Bao obsidian is found, however in too few samples to ascertain dominance. The earliest date for Misisil is 11,400 ± 1200 B.P. (SUA-1490) (Specht et al., 1983 : 92).

Early to middle Holocene sites are also few in number :

3. No Mopir obsidian was found from the early to middle Holocene New Ireland sites of Balof and Panakiwuk, only Talasea obsidian (both not analysed in the 1990/1991 runs) (Marshall and Allen, 1991 : 71 ; Allen et al., 1989 : 555 ; White et al. 1991 : tables 2 & 11 ; Downie and White 1978 : table 12 ; White et al., 1978 : 877-8).

4. Mopir obsidian was however found from the mid Holocene sites of Lolmo and Yombon although Kutau/Bao obsidian dominates (Summerhayes et al. in press). A similar situation exists at Kandrian in FLF Layer 7 which may have a pre-Lapita component (see above) and further investigations are underway (Specht, pers comm).

5. The pre-Lapita deposits of Walindi have expectedly no Mopir obsidian, and those from Bitokara are also expected to produce no Mopir obsidian due to their close proximity to the Talasea sources.

From the above review of obsidian consumption patterns the dominance of Mopir as

From the above review of obsidian consumption patterns the dominance of Mopir as a source in the Pleistocene is evident. The early to mid Holocene assemblages present a different pattern with Talasea dominating in the West New Britain assembalges. In New Ireland on the other hand a regional north/south dichotomy in obsidian distribution may be evident with Mopir dominating in Matenbek and Matenkupkum, and absent in Balof. Further PIXE-PIGME analyses of Balof material will be performed in 1992 to confirm the absence of Mopir obsidian.

B) Lapita Obsidian Consumption - Lou Island : A piece of the Action?

The 1991 PIXE-PIGME analysis of a large Arawe sample from Adwe, and a sample from FLF near Kandrian, reconfirms the absence of Mopir obsidian during Lapita contexts in West New Britain. As mentioned earlier this hiatus corresponded with the Witori volcanic event and might have initially led to a suspension in Mopir obsidian extraction. However it is stressed that the distribution of obsidian before and after the explosion may have been determined by social factors. This may also be borne out by the following. In northeast New Britain, Mopir obsidian is found in mid to late Lapita contexts in the site of Watom (Green and Anson, 1991 : 177) and may indicate a different distribution network to the northeast. The small numbers found and its absence elsewhere in New Britain at this time however could point to its unimportance.

The consequence of the Witori explosion may have had other far reaching effects in particular in explaining the emergence of Lou Island obsidian. The relationship between volcanic histories and the dominance of one obsidian over another has been noted before (Ambrose and Duerden, 1982 : 84-85 ; Fullagar et al., 1991). Whether the Witori event led to a vacuum regarding obsidian production which Lou Island subsequently filled remains unknown. Yet the association between the two was probably significant. Lou Island obsidian is only found in two areas in New Britain : the Arawe Islands and Watom. In the former only three pieces are known, and probably represent random events. In the latter there is patterning in the assemblage. Watom SAC is a mid to late Lapita site with equal amounts of Talasea and Lou obsidian in the lower levels and a dominance of Talasea obsidian in the upper level (Green and Anson, 1991 : 177). Mopir, as mentioned earlier is also found, although in smaller amounts. This is in contrast to similar aged sites in New Ireland and Nissan in which Lou Island obsidian predominates. The consumption of Lou Island obsidian outside Manus for the first time in Lapita contexts throws light on what Gosden et al. (1989) speculate may be the "existence of geographically distinct distribution of sources" (Gosden et al. 1989).

CONCLUSIONS

The 1990 and 1991 PIXE-PIGME analyses of obsidian have not only refined the identification of subsources within West New Britain, but have contributed to our understanding of consumption patterns in the prehistoric past. Further analyses will be directed at refining the distribution patterns of obsidian with the aim of assessing the nature of the links between prehistoric producers and consumers.

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LITHICALLY LAPITA : FUNCTIONAL ANALYSIS OF FLAKED STONE ASSEMBLAGES FROM WEST NEW BRITAIN PROVINCE, PAPUA NEW GUINEA

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RÉSUMÉ

LE LITHIQUE LAPITA : ANALYSE FONCTIONNELLE DES ASSEMBLAGES SUR ÉCLATS RECUEILLIS DANS LA PROVINCE DE NOUVELLE BRETAGNE OCCIDENTALE DE PAPOUASIE.

L'étude de la technologie et de l'utilisation de l'obsidienne peut fournir une référence de comparaison pour permettre d'évaluer les effets plus étendus associés à la poterie Lapita. Dans cette communication, j'analyse les fonctions des outils d'obsidienne recueillis sur six sites archéologiques de Nouvelle Bretagne Occidentale et représentant trois périodes : avant, pendant et après la présence de poterie Lapita. L'usage des outils d'obsidienne préhistoriques comprenait le découpage et traitement de plantes et d'animaux, ce qui diffère des observations ethnologiques qui tendent à noter des usages pour ces objets ayant plutôt une relation avec le corps humain. J'identifie une tendance intéressante, et qui suggère que la fonction des sites devient de plus en plus similaire au cours du temps. L'intégration de l'analyse fonctionnelle et de l'étude technologique suggère un mode de peuplement et de subsistance devenant de moins en moins itinérant.

ABSTRACT

The study of obsidian technology and use can provide a comparative reference for assessing wider impacts associated with Lapita pottery. In this paper I analyse the functions of obsidian tools from six West Britain archaeological sites according to three phases : before, during and after the presence of Lapita pottery. The function of prehistoric obsidian tools included plant and animal processing, in contrast with ethnographic observations which record obsidian for uses mostly related to the human body. A significant trend is identified, suggesting that site functions become more similar through time. Integration of functional analysis and technological studies suggest an increasingly less mobile subsistence and settlement pattern.

INTRODUCTION

Are stone assemblages contemporary with Lapita pottery distinct from what comes before and after ? Is there such an entity as a typical Lapita stone assemblage, based on function and technology (cf. Green 1990 ; Allen and Bell 1988) ? To consider these questions, I focus on flaked obsidian (and some chert) tools from archaeological sites in West New Britain, PNG. From a theoretical viewpoint, I see the significance of this approach in terms of the relationships between stone technology, tool function, subsistence, exchange and human mobility. My expectation, based on previous lithic studies in Australia and Papua

New Guinea is that tool design and the nature of tool production are less related to function than to exchange systems, risk management and other expressions of culture, such as social and symbolic influences (e.g. White 1977 ; Jones and White 1988 ; Torrence 1989 ; Tacon 1991). On the other hand, I expect tool function to reflect specific evidence of resource use and settlement history.

The specific aims of this paper are to summarise use-wear and residue analyses for six sites and to outline prospects for deriving a long term history of resource use based on three different spatial scales :

1. comparison of broadest functional classes between sites
2. more detailed comparison of broad functional classes between two sites (Misisil and Bitokara)

and 3. comparison of more specific functional classes for one site (Misisil).

Archaeological sites and sampling

I have selected artefacts for use-wear and residue analysis from at least 10 archaeological sites in West New Britain. Analyses are incomplete and I present here summary data for only six sites (Figure 1). Dating of levels within these six sites is complex and based on radiocarbon dates, thermoluminescence and relative age estimates for a series of tephras spanning the Holocene. Details of the dating will be reported in a later publication and is the subject of current analyses by archaeologists, geomorphologists and vulcanologists. For the purposes of this paper the levels at each site have been grouped according to three phases following Summerhayes et al. (In preparation) :

phase I : >3500 years ago, pre-Lapita
phase II : 3500 - 2000 years ago, contemporary with Lapita,
phase III : 2000 years ago to present, post-Lapita.

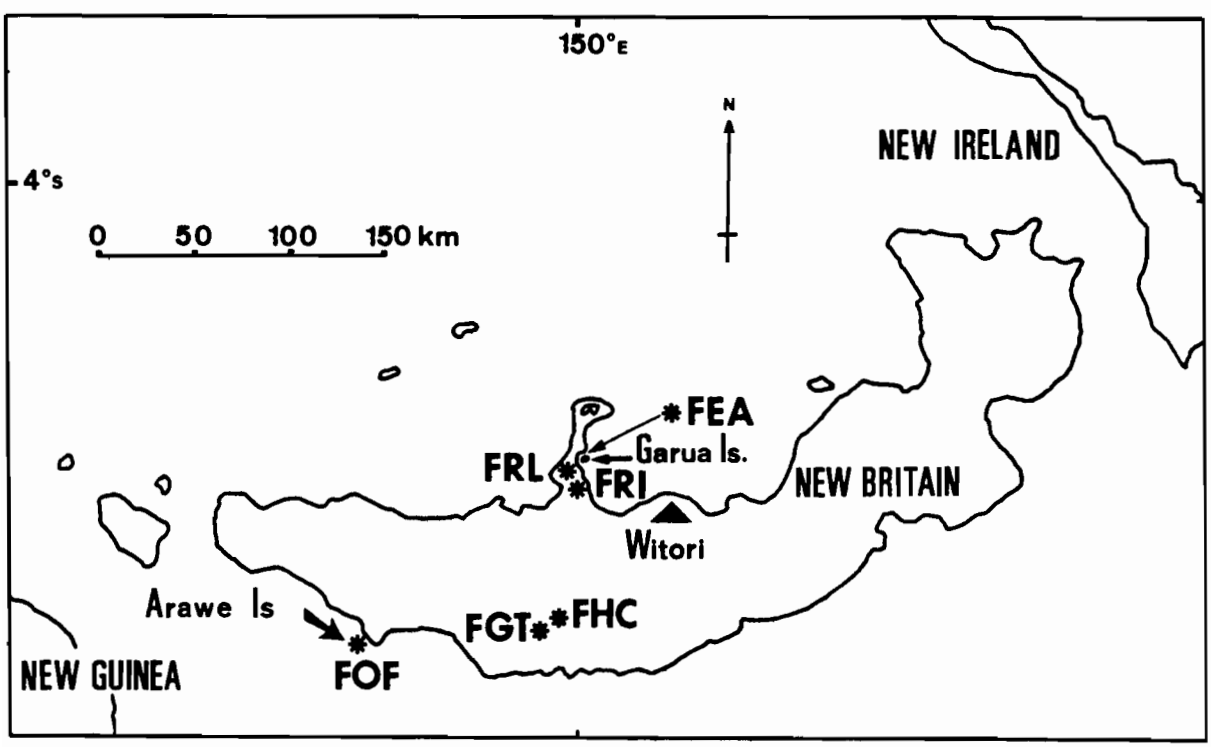

Figure 1 : West New Britain showing sites analysed.

Site locations are shown in Figure 1. FEA (Boduna) is an open site on a small island (Boduna) between the Willaumez Peninsula and Garua Island. It has been excavated twice (Ambrose and Gosden 1991 ; Specht et al. 1989) and contains a vast amount of pottery including highly decorated Lapita ware. Despite problems with thermal alterations to the site, investigations suggest that Lapita and post-Lapita levels are partly intact (phases II and III). FRL (Bitokara) is an open site on a ridge of Kutau, a volcano with massive obsidian flows and prehistoric quarries (Specht et al. 1988 ; Torrence et al. in press). No pottery was found in the excavations but radiocarbon and thermoluminescence dates provide reliable estimates for three Holocene tephras and distinct cultural layers with abundant obsidian and small amounts of other flaked stone. FRI (Walindi) is an open site on a ridge some 15km south of the Talasea obsidian flows. FRI has several distinct cultural layers separated by tephras, spanning the three phases. There is abundant obsidian and a few fragments of pottery including Lapita. FOF (Lolmo) is a cave site on Kumbun Island in the Arawes group (Gosden et al. 1989). The deposits contain obsidian, shell and bone, spanning at least phases I and II. FGT (Yambon) is an open site and FHC (Misisil) is a cave site, both about two days walk inland from Kandrian (on the south coast) of New Britain (Specht et al. 1981,1983). In FHC, the levels span at least the last 11,000 years and contain, shell, bone, chert and obsidian. FGT is very close to prehistoric chert sources with human occupation spanning phases I, II and III.

The sampling of artefacts for use-wear and residue analysis is based on grab samples during excavation and selection of washed pieces with possible macroscopic evidence of use. Except for sites FHC, FGT and FOF, most of the 956 artefacts reported here (Table 1) were selected during excavation without direct contact with hands or other material apart from plastic. On these pieces, at least, contamination from contact with materials since excavation has been minimised. In addition, all retouched pieces from all levels of square SEd at FRL were examined for use-wear and residues. Artefacts from FHC, FGT and FOF were washed although the traces of use have been sufficiently well preserved for reliable identification. Artefacts from FGT including obsidian and chert from trench V were sampled and analysed by Brown (1988).

PNG		Artefacts analysed				
Site Code	Site Name	No.	Total	Sample % of Phase I	Phase II	Phase III
FEA	Boduna	55	4	0	37	18
FRL	Bitokara	420	32	85	101	34
FRI	Walindi	63	n.a.	0	52	11
FOF	Lolmo	31	n.a.	14	7	0
FHC	Misisil	302	78	39	64	199
FGT	Yambon	85	26	22	26	37
Total		956		360	297	299

Table 1 : Archaeological sites and artefacts analysed.

The sampling procedures at FRI, FRL and FEA undertaken during excavation were based on selecting approximately ten artefacts from each excavation unit. An attempt was made to include a range of artefact sizes. The FGT artefacts were sampled after excavation on a statistical basis (Brown 1988). All chert artefacts from trench II and most of the obsidian

from trench I were examined (Fullagar 1992). The FOF sample represents a selection after excavation of artefacts with possible macroscopic evidence of modification.

Methods

All artefacts were examined with stereomicroscopes with oblique incident light (x6 - x40). Most were subsequently examined with a metallographic microscope with vertical incident light with bright- and darkfield (x50, x100, x200 and x500). Functional determinations, particularly material worked were made on the basis of experiments (Fullagar 1991), reference collections of some plant materials from New Britain (Fullagar In preparation a,b), and limited chemical tests for blood, following Loy (e.g. 1983, 1987).

Cleaning of artefacts was kept to a minimum and an attempt was made to correlate use-wear and residues. Most artefacts had many kinds of residues, including phytoliths, starch and plant fibres. Most obsidian edges had some degree of damage. The problem was to distinguish what amounts to a background of wear and soil contamination from what is clearly evidence of use. For a positive attribution of tool-use residues had to be related to a particular edge. Consequently I devised four categories of tool-use : (1) no evidence ; (2) possible evidence ; (3) probable evidence ; (4) definite use. In the analyses presented below I only include probable and definite categories of use. More precise categories of function were also identified on the basis of material worked and classified into three scales of confidence : possible, probable, reliable. So, for example, a particular tool might be classified in terms of tool-use as "definitely used" and in terms of its material worked as "probably woodworking".

Results

Figure 2 summarises results for the six sites to compare broad functional classes between sites. The general impression is that in terms of animal : plant ratios for individual sites, there are marked changes for the three phases. I have not been able to distinguish uses related to the human body and other animal processing. The plant processing tools can, however, be further categorised into woodworking and processing of starchy tubers (see below). Nevertheless, my interpretation is that a greater degree of animal or plant processing reflects the extent of task specificity at a particular site. Whatever the relationship of animal : plant ratios to site function it is apparent that there is an overall trend for sites to become more similar through time. Secondly the proportion between plant and animal processing becomes more even at each of the sites. In combination these data indicate that sites become less specialised suggesting a convergence in site function. Rates of change cannot be assessed at this stage, although a preliminary analysis for FRL suggests that changes were in place well before the first appearance of Lapita pottery in the region (phase II).

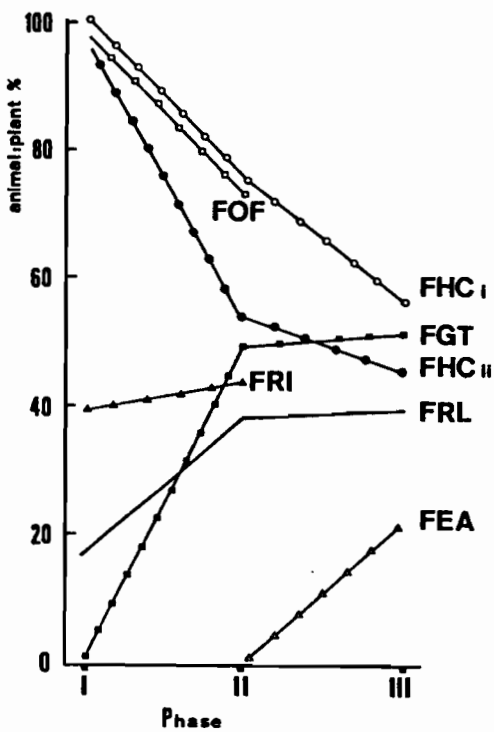

Figure 2: Animal : Plant ratios for West New Britain sites.

Figures 3 and 4 compare more detailed categories of tool function for FRL and FHC in quite different geographic settings, the former close to obsidian sources and the latter close to chert sources. I have distinguished here woodworking from other plant-working tools and also indicated multifunctional tools (with evidence of both plant and animal processing). The trend at these two sites shows clearly that through time there is a more even distribution of more detailed tool functions. One anomaly is woodworking which is absent in phase I levels at FHC, present in phase II and then decreases relative to other functional categories. In contrast, at FRL, woodworking is present in phase I, then decreases in phase II and subsequently increases. An explanation for this may be sought in distinguishing raw materials, chert and obsidian. A preliminary examination suggests that there may be a relationship between chert and woodworking at FHC. The amount of woodworking may thus reflect fluctuations in the amount of chert being used at the site.

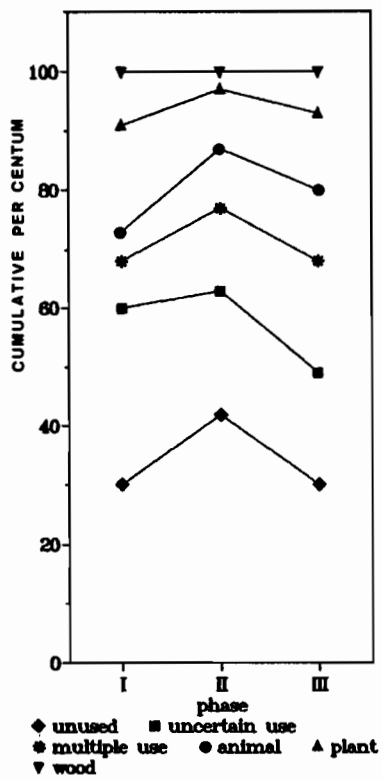

Figure 3 : Use-wear and residue analysis of site FRL (n = 420).

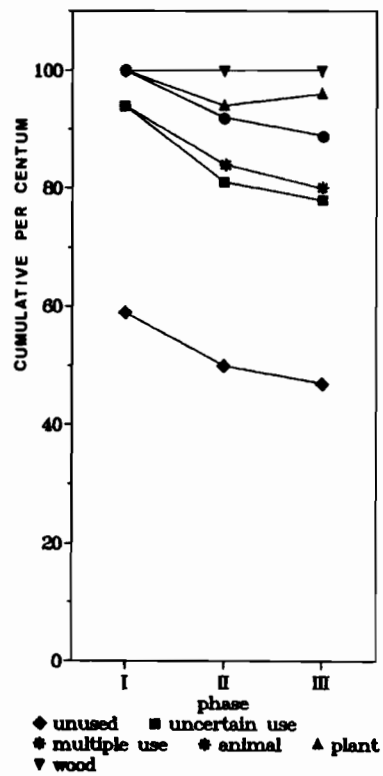

Figure 4 : Use-wear and residue analysis of site FHC (n = 302), obsidian and chert.

A further explanation for differences may be found in the relative importance of obsidian as reflected in the degree of retouch at FRL (close to obsidian and distant from chert sources) and FHC (close to chert and distant from obsidian). The incidence of retouch on obsidian tools from FHC steeply increases through time compared with FRL (Figure 5). This is in contrast with chert trends at FHC. One explanation may b an increase in scarcity of obsidian since phase II (contemporary with Lapita pottery). Given the volcanic history and tephra correlations at various sites this scarcity may have arisen because obsidian supplies were cut off after a particularly violent Witori eruption (Summerhayes et al. In preparation). On the other hand an increase in obsidian retouch may be related to technological requirements related to mobility and subsistence (see Torrence, this volume).

Figure 6 compares a more detailed level of functional classes at one site, FHC, where the frequency of tool classes are shown for each cultural layer. In addition to trends noted above, it is also apparent that there is an expansion in the range of more precisely identifiable materials in the later periods. This is may be related to better preservation of plant materials in more recent times, although one of the distinguishing features of tools used intensively to process bamboo, palm and wood is the nature of polished surfaces, rather than residues. Perhaps in contrast with FRL (see above and Torrence, this volume), the timing of changes at FHC begin in phase II, the period contemporary with the presence of Lapita pottery at other sites. A further difference in the nature of the tools at FHC compared with FRL, is in the evidence for processing starchy tubers (Fullagar In preparation a). At FHC, there seem to be far fewer tools for this kind of task. The detailed nature of changes to site function for inland sites like FHC may be different from coastal sites like FRL. On the other hand, the difference may have more to do with the less stable landscape of the north coast compared with the inland and south coast. Landscape stability may have been a limiting factor on subsistence and settlement history.

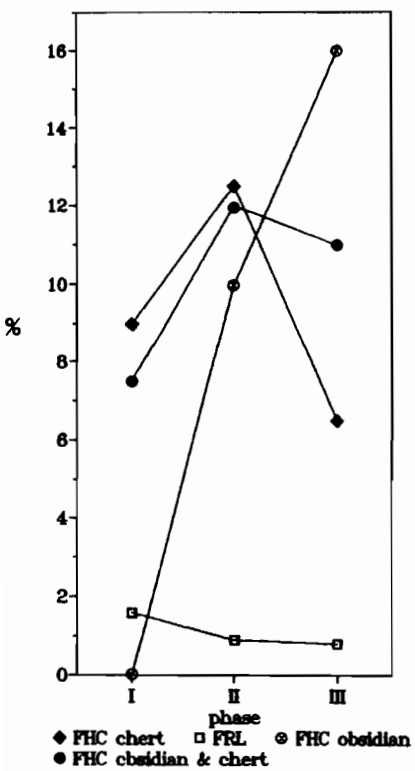

Figure 5: Proportion of retouched flakes at sites FHC and FRL

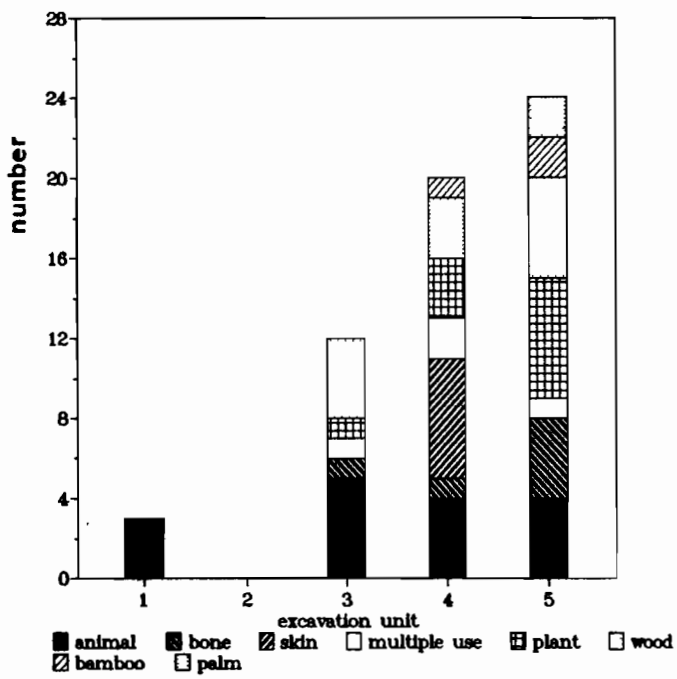

Figure 6: Use-wear and residue analysis of site FHC, trenches I and II, obsidian and chert.

CONCLUSION

At the broad scale there appears to be a convergence between sites in terms of indicators of site function. One explanation offered is that sites become less specialised in terms of activities, suggesting reduced mobility. A more detailed level of analysis suggests that this trend cannot yet be related to a single phenomenon, although possible explanations include geographic differences between north and south, volcanism and access to obsidian.

Functional analysis in combination with the degree of retouch has not been explored in detail here, but the decline in retouch and a concomitant more even distribution of materials processed by stone tools supports an argument for more expedient use of obsidian at FRL. This seems to be in contrast with the evidence at FHC, suggesting more complex shifts in site function than can be explained by uniform changes to subsistence and mobility.

A final speculation might relate the most recent phase of archaeological data with ethnographic evidence for obsidian utilisation (see Specht 1981 ; also Fullagar In preparation b). Although processing of starchy tubers and other plant material dominates tool use at FRL, the trend is towards more frequent use of animal materials, which category includes uses related to the human body. Past uses related to the human body are the most common tasks attributed to obsidian by people living in the Talasea region today. In contrast shell tools are the main implements for processing plant foods, although obsidian and glass are also used expediently for some such tasks. Although shell tools are absent in the archaeological record because of poor preservation at most sites, it may be that use of shell tools became common during the most rapid changes associated with stone tool use. On Figure 2 this appears to be phase I to phase II, the period associated with the presence of Lapita pottery at many sites.

As suggested by the title, I have explored the possibility of a typical Lapita toolkit by contrasting three phases of site function. For the West New Britain sites analysed here, it appears that there are differences identifiable in terms of general trends rather than discrete and abrupt changes. Moreover, the changes vary in degree and kind for each site, and we are still plagued by the meaning of "Lapita" in West New Britain. Indeed, can any of these sites be called Lapita? Of the six sites analysed here only FEA (Boduna) has significant quantities of Lapita pottery. Perhaps a solution of sorts is to admit from the outset that Lapita sites in West New Britain are so diverse that the idea of a typical Lapita site is simply a nonsense (cf. Specht 1991, Specht et al. in press).

Acknowledgements

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Fieldwork has been an integral component and I thank especially the WNB government (particularly the Cultural Centre), the Institute of PNG Studies, the University of PNG and the PNG National Museum and Art Gallery, and Walindi. In the course of collecting reference material for residue studies I am particularly grateful to Kavon Kekes (Lou Island), Meru (Arawes), Leo Mette (Bitokara), Doug Yen and Tom Loy. Finally, I thank Jean-Christophe Galipaud and other participants at the ORSTOM workshop. Perhaps I should apologise to Nancy Sharp and Terry Hunt for not having the time to follow up their very useful comments in this paper.

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A REPORT ON THE FLAKED LITHIC ASSEMBLAGES FROM THREE SOUTHEAST SOLOMONS LAPITA SITES (SE-SZ-8, SE-RF-2 AND SE RF-6)

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RÉSUMÉ

L'industrie lithique sur éclat de trois sites Lapita des îles Salomon (SE-SZ-8, SE-RF-2, SE-RF-6)

Cet article présente une analyse brève du matériel lithique sur éclat de trois sites Lapita des îles Reef/Santa-Cruz (SE-SZ-8, SE-RF-2, SE-RF-6). Il inclut une discussion à partir des données disponibles, de l'extraction, du transport, de la taille et de l'utilisation du matériel lithique. Les données concernant les formes des outils retouchés dans ces sites sont présentées et une forme d'outil, que j'ai appelé "graver", non encore décrite à ce jour est définie. En conclusion, il apparaît que les données des îles Reef/Sant-Cruz apportent peu d'éléments pour la démonstration du modèle d'utilisation maximale des ressources lithiques. Pour tester définitivement ce modèle, qui pourrait être appliqué aux matériaux voyageant sur les longues distances du réseau d'échange Lapita, il faudra des données détaillées dans les sites de l'archipel de Bismarck et un ou deux points de référence intermédiaires entre les Reef/Santa-Cruz et l'archipel de Bismarck.

ABSTRACT

A brief analysis of flaked stone material from three Reefs/Santa Cruz Lapita sites (SE-SZ-8, SE-RF-2, SE-RF-6) is presented. This includes a discussion of available data on lithic raw material extraction, transportation, reduction and use. Data on the retouched tool forms from the sites are presented and a form which has previously not been described, which I have called a graver, is defined. It is concluded that the Reefs/Santa Cruz data provide little evidence to support a lithic resource maximization model. Complete testing of such a model, which might be applied to materials moving through the long distance Lapita trade/exchange network, will require detailed data from the Bismarck Archipelago sites and one or more points intermediate between the Reefs/Santa Cruz and the Bismarcks.

INTRODUCTION

In the following paper I will present a brief analysis of the flaked stone assemblages from three Reefs and Santa Cruz (SE Solomons) Lapita sites (SE-SZ-8, SE-RF-2, SE-RF-6) excavated by Roger Green (Green and Cresswell 1976 : 245-265) and previously studied briefly by Lawlor (1978). This analysis will provide primary data useful for future comparative studies, and also provide a brief overview of information on lithic extraction/production, transportation, reduction and use as it pertains to the materials from these sites.

Background :

The sites were excavated by Green in 1972 with further work on SE-RF-2 in 1976-77 (Green and Cresswell 1976 ; Green 1979). The two Reef Islands sites (RF-2, Nenumbo ; RF-6, Ngamanie) are located on low coral atolls while the third site (SZ-8) is on the high volcanic island of Nendo (Santa Cruz).

Proportions of the site excavated (Table 1) are comparatively small (SZ-8= 0.36% ; RF-2= 13.95% ; RF-6=0.19%), although the sampling procedures employed allow us to generalize to somewhat larger areas (SZ-8=3.28% ; RF-2=13.95% ; RF-6=1.67%). A positive correlation at RF-2 between the density of the surface pottery collection and the subsurface excavated collection of pottery and lithic artifacts, indicates that we have a very large sample from the most densely occupied part of the site, in close proximity to a large structure (Sheppard and Green 1991). It is also quite probable, based on the surface evidence, that the incidence of lithic materials is relatively low in the unexcavated portion of the small (1100 m2) RF-2 site. For the other two much larger sites (R-6=10,800 m2 ; SZ-8=14,000 m2 (Green 1991)), we have little information on how representative the areas excavated are of the larger site, or what activities were carried out in the excavated area, although excavations were located in central areas of high sherd concentration (Green and Cresswell 1976 : 252). In summary, we can be fairly confident in the representative nature of the RF-2 sample but generalizing from the other two samples to the complete sites must be under-taken with some caution.

Table 1 (after Green 1991 Table 2)

Site	SE-SZ-8	SE-RF-2	SE-RF-6
Size of surface area excavated	51 m2	153,5 m2	220 m2
Area of which the sample is representative	459 m2	153,5 m2	180 m2
Estimate of overall site size	14,000 m2	1100 m2	10,800 m2
Total Depth of deposit	40-50 cm	40-50 cm	40-50 cm
Total Excavated Obsidian in grams	864 gm	1319 gm	49 gm
Total Excavated Chert in grams	585 gm	1756 gm	84 gm

Dating :

Green (1991) has recently published a reappraisal of the dating of the Reef/Santa Cruz Lapita sites. The RF-6 site is clearly the youngest with a probable date in the early 7th century B.C. Calibrated ages of marine shell dates from SZ-8 and charcoal dates from RF-2 overlap considerably and it is difficult to order them chronologically using radiocarbon alone (especially given the problems of selecting an appropriate Delta-R and comparing marine shell and charcoal dates). However, the RF-2 dates do tend to average lower than SZ-8 and analysis of change in ceramic decorative motifs and pot forms tend to support a slightly older date for SZ-8. Therefore Green (1991 : 203) has argued that first occupation of SZ-8 occurred in the 11th to 12th century B.C. and a brief occupation of RF-2 occurred before the end of the 10th century B.C. The resulting time range for the sequence provided by the three sites is in the order of 500 years.

Lithic Raw Material Sources :

Material from the Talasea (Voganakai, Bumba and Schauman Island) obsidian source area located over 2000 km away to the north-west predominates (97.5% Total N=972) throughout the site sequence with a small quantity (1.13%) coming from the Lou source (Green 1987 ; nd). The closest obsidian source (400 km south-west) in the Banks Islands is used throughout the sequence in very small amounts (1.23%). The glass from this source (Losa Bay, Vanua Lava) is poor quality but certainly useful for unsophisticated flaking or use.

Chert sources in the nearby Duffs (Taumako, 100 km east) and South Malaita/Ulawa (400 km west north-west) were used throughout the sequence (Sheppard and Pavlish 1992 ; Sheppard nd) with material from South Malaita/Ulawa predominating. This is generally fine, high quality chert and although it would be more difficult to flake than obsidian, reduction to simple flakes would be extremely easy, producing sharp tough flakes with longer use lives than equivalent obsidian flakes. Obsidian flakes would have only one major advantage, they would be initially sharper than the chert.

Extraction :

There is some evidence (presence of angular cortex) to suggest obsidian was collected as angular blocks and at least by the time of its arrival in the Reefs and Santa Cruz it was in small blocks. It is difficult to say where in the Talasea region this blocky obsidian was collected. Although Lapita sites are associated with the Garua source (Specht et al. 1988), the Reefs/Santa Cruz material does not physically match the Garua material (R. Torrence pers. comm. 1992).

Judging from cortical chunks and cores, the chert appears to have been collected at least in part from beach sources and may have been transported as fist sized cobbles.

There is some evidence to suggest that little pre-processing of the material occurred before transport, or during stages of movement. Cortical and vesicular obsidian was moved from Talasea and cobble forms and cortex are commonly preserved in the chert assemblage.

Transport :

The amount of obsidian transported to the sites has fallen through time, possibly indicating steadily decreasing contact with groups supplying obsidian at some distance to the north-west or a decline in supply. The amount of chert transported to SZ-8 and RF-2 remained relatively constant, suggesting continuity in the rate of contact with the main Solomons.

The comparatively small amounts of chert and obsidian in RF-6, may argue for reduced contact outside the region and a sharp contraction of networks. However, this assessment is dependent on the amount that is most prone to sampling error.

Using the available data on the density and weight of excavated lithic material, it is possible to generalize to the entire site by multiplying the average weight per cubic meter of excavated material by the estimated volume of the total site (Table 1). This produces a total of 245 kilograms of obsidian for SZ-8, 9.5 kg for the smallest site RF-2 and 26.44 kg for RF-6. For chert the figures are SZ-8 : 161 kg, RF-2 : 12.6 kg and RF-6 : 45.36 kg.

Even if we reduce by nearly one-half the estimate of total obsidian in SZ-8 to 125 kg, we are likely looking at more than 1 colonizing canoe load. If we were to derive all the obsidian, from all the known (13 sites reported in Kirch and Hunt 1988 : 12) Reefs/Santa Cruz Lapita sites, from an initial colonizing supply the amount would be very substantial requiring multiple canoe loads. Therefore, the evidence directly supports at least an initial period of multiple return voyages. If we reduce the amount of obsidian in the RF-6 site to 13 kg, it is not inconceivable that it was collected from the surface of old sites. The obsidian from these sites does not have a well developed patina so it is not possible to say whether material has been re-used at different times.

Reduction :

Examination of both cores and flaking debitage, failed to provide a significant body of evidence for the use of bi-polar flaking as an important core reduction strategy in these assemblages. Most core working involved hard hammer free-hand reduction of single platform cores (Table 2), with smaller frequencies of opposed (same face opposite ends of flaking surface), alternate (striking from the same platform edge but onto different surfaces) and multiple (more than 1 striking platform not fitting other categories) cores.

Table 2 : Core Forms by Platform Number/orientation and Raw Material.

	Single		Opposed		Alternate		Multiple	
	N		N		N		N	
Site	Chert	Obsid	Chert	Obsid	Chert	Obsid	Chert	Obsid
SZ-8	1	6	0	0	0	0	1	0
RF-2	3	13	2	1	1	3	1	0
RF-6	1	0	1	0	0	0	0	1
Total	5	19	3	1	1	3	2	1

The average size and weight of chert cores declined through time (chert core mean length SZ-8 : 52.5 mm ; RF-2 : 35.4 mm ; RF-6 : 21.5 mm : obsidian SZ-8 : 14.5 mm ; RF-2 : 14.9 mm ; RF-6 17 mm). For obsidian cores average length remained quite small and relatively stable throughout the sequence, although weight declined somewhat from SZ-8 to RF-2. Obsidian cores were much more intensively worked than chert throughout the sequence, however circa 30% of the obsidian cores could have been easily reduced further.

Core reduction at the sites resulted in the production of assemblages of small flakes and shatter (angular debitage without any obvious bulb or platform) with a general flake/shatter ratio of roughly 2 to 1. Table 3 provides data on length (maximum dimension) and weight for all debitage (all artifacts minus cores). Although there is a decline in the mean length and weight for both obsidian and chert debitage, the large standard deviations and small sample size for RF-6 make it difficult to draw any significant conclusions from these data.

Table 3 : Size and Weight of Debitage by Raw Material.

Length mm		Obsidian			Chert	
Site	N	Mean	STD	N	Mean	STD
SZ-8	329	19.6	12.4	54	26.3	12.4
RF-2	625	18.6	7.0	425	22.2	9.4
RF-6	27	13.7	5.0	32	20.2	7.4

Weight Grams			Obsidian		Chert	
Site	N	Mean	STD	N	Mean	STD
SZ-8	329	2.39	3.09	54	7.35	9.43
RF-2	625	1.86	2.86	425	3.57	5.99
RF-6	27	1.06	2.37	32	1.78	1.99

Table 4 : Tool Types by Raw Material and Site.

	SZ-8				RF-2				RF-6			
Obsid.	Chert		Obsid.		Chert		Obsid.		Chert			
	N	gms	N	gms	N	gms	N	gms	N	gms	N	gms
Utilized Flakes	49	209.4	4	44.6	49	142.5	27	293.8	3	2.0	2	4.6
Utilized Chunks	2	2.1	2	29.5	6	14.8	11	60.8				
Points	2	5.0	1	12.5			11	88.7			2	2.2
Bi-Polar Chunk							2	15.5				
Gravers	50	123.2			83	202.3						
Other			1	37.6			1	2.5				
Total N Tools	103		8		138		52		3		4	
Total Tool Weight		339.7		124.2		359.6		461.3		2.0		6.8
Total Weight Assemblage		864.0		584.79		1318.9		1755.5		48.6		84.2
Total N Assemblage	335		56		642		432		28		34	
Proportion	30.75	39.3	14.29	21.24	21.5	27.27	12.04	26.28	10.7	1 4.12	11.76	8.08
of Assemblage	%	%	%	%	%	%	%	%	%	%	%	%

Retouched Tools :

Table 4 contains data on the retouched tools (defined as pieces with 5 mm or more of continuous edge damage/retouch) broken down by site and raw material. Although the RF-6 sample is extremely small, the data show a predominance in the chert assemblage, throughout the sequence, of utilized flakes/chunks and (drill?) points. In the obsidian assemblage a distinctive tool form which I have called a graver, makes up the bulk of the earlier site collections. These tools are, however, absent from the very small RF-6 sample. These tool forms are discussed in more detail below.

Utilized Flakes/Chunks :

These are defined as minimally modified pieces with 5 mm or more of continuous edge damage. Straight utilized edges generally predominate in all sites (circa 44%+), with notches and denticulated edges each half as common as the straight edges. Nibbled retouch is generally much more common than stepped or invasive retouch. The dimension of utilized pieces is the one realm of variation which does show systematic difference between raw materials. Chert tools are consistently larger in all dimensions than those of obsidian (mean length of chert 30 mm + ; mean length of obsidian 22 mm). There is very little in the way of formal patterning of the design of these tools, and it is probable that they were used in a range of cutting and light scraping tasks.

Points :

These tools resemble in form drill points used in pump drills in the Solomons up until the recent past. For the most part, they do not show, along the flaked margins, any direct macroscopic evidence of use in a rotary action. They have generally been formed by normal retouch, not alternate or bifacial retouch which might be considered to provide better cutting edges for a drill. There is, however, some evidence of edge rounding at the tip, and it is possible they have been used in piercing relatively thin hard material. The average length of these items is comparable to the size of utilized flakes.

Gravers :

The items which I have called gravers (figure 1) are extremely common in the two earliest sites and have not been reported from any other sites in the Pacific. These tools are always made on obsidian and the method of their production, which forms their most distinctive feature, is constant throughout the assemblages.

They consist of small points/edges (1-2 mm high and 2-3 mm wide), which have been isolated on an edge by normal (ventral to dorsal) retouch on one side of the point, and inverse (dorsal to ventral) retouch on the other. Careful examination of the location of the points on the flake edge, and the amount of adjacent retouch, strongly suggests that the retouch is not the result of wear, but is in fact purposeful retouch whose form and extent is designed to isolate the small sharp point and reduce any adjacent edge below the level of the point. Therefore points made on the corner of a flake might require very limited retouch to isolate the point, whereas points/edges in the middle of a flake margin might require considerable retouch to achieve the same effect. The fact that the points are not broken, and do not exhibit any macroscopic wear, would indicate use on a soft material possibly as an incising instrument.

The mean size (Table 5) of these tools is virtually identical between SZ-8 and RF-2, with a length and width of around 20 mm and a thickness of just over 5 mm. The retouched edges adjacent to the point are most commonly shallow single or double notches, formed from nibbled retouch, although straight lines of retouch are common, with the form of the retouched edge being influenced by the form of the original flake edge. The majority of these pieces carry only one point however larger flakes may have 2 or more points worked into different edges (Table 5).

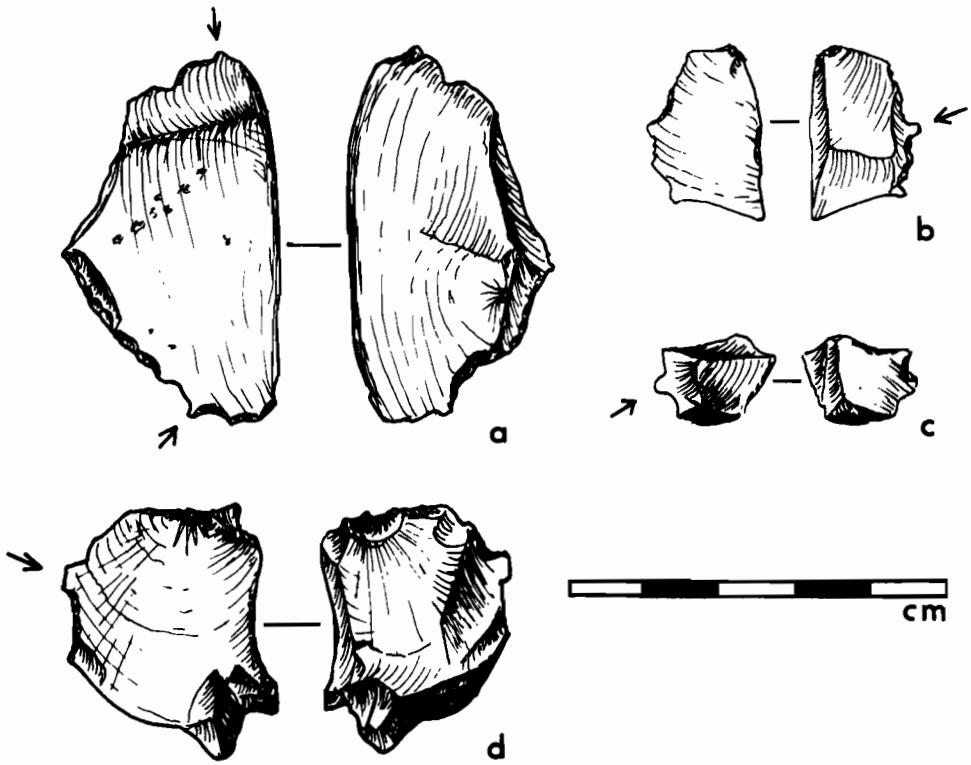

Figure 1 : Gravers from RF-2 and SZ-8. Double graver (a. RF-2). Single gravers (b.RF-2, c.RF-2, d.SZ-8). Arrows indicate the location of graver edges/point.

Table 5 : Graver Attributes

Site		RF-2			SZ-8	
	N	Mean	STD	N	Mean	STD
Length mm	83	20.5	6.5	50	20.9	6.6
Width mm	83	20.2	7.2	50	19.3	7.0
Thickness mm	83	5.4	3.0	50	5.5	2.2
Number of Points	1 point = 63			1 point =41		
	2 points= 19			2 points= 8		
	3 points= 1			3 points= 1		

Given the small size of these tools and the often minimal nature of the associated retouch it is conceivable that they have gone unrecognized in some Lapita assemblages. However, once the patterned nature of the retouch direction (inverse on one side of the point normal on the other) is recognized, analysts should have little trouble identifying this tool form.

Summary :

There is minimal evidence of economizing or maximizing return from the raw material in these assemblages. Chert may be somewhat less intensively used than obsidian, as abandoned chert cores tend to be larger than obsidian cores, although the much lower toughness of the obsidian may facilitate the reduction of smaller pieces.

There does appear to be a decline in the amount of obsidian per cubic meter deposited in sites through time, with chert remaining constant in the earliest sites and declining in RF-6. This may indicate fall-off through time in the degree of network interaction.

There are hints of but no conclusive evidence for an important change in the size of cores, debitage, etc. through time. This might well be effected by the nature of the samples from the sites. With increasing knowledge of the structure of Lapita sites (Sheppard and Green 1991) it is clear that small samples from large and potentially structurally complex sites could be biased in unknown ways. In such a case attaching significance to small variations in the data may well be unwarranted.

There is some selection in these assemblages of raw material according to the nature of the tasks for which the tools are designed. If the points are in fact drills then the predominant use of chert in their manufacture may reflect the selection of a tough material. Similarly the use of obsidian in the manufacture of gravers may relate to the need for a very sharp edge.

The gravers stand out both in standardization of design, use of a single raw material and quantity. If obsidian is being transported to the site with a specific task in mind then this form is associated with that task. This form, however, is not reported from any other sites. Also it is difficult to understand in purely technical terms why obsidian should be the sole material used. It may be that the association between obsidian and this tool reflects more than simple utilitarian requirements of use. If the use to which this tool is put is the main or focal reason for the movement of obsidian into these sites, then the Reefs/Santa Cruz data indicate no problem with supply as the material is used in a very 'uneconomical' fashion.

In conclusion simple models of trade/exchange based on strictly interpreted formalist economics would, on the basis of the Reefs/Santa Cruz data, appear to have limited explanatory power when applied to this Lapita system. Although we are lacking crucial data from points between the Reefs/Santa Cruz and the Bismarcks we might expect, according to the formalist model, material at 2000 km from the supply to be curated and economized, such does not appear to be the case. However, 'economy' is a relative term and even 'optimal' is extremely difficult to define in a strictly adaptative sense. Therefore, until we obtain more detailed data on the Lapita assemblages from the Bismarcks, and one or more intermediate points between the Bismarcks and the Reefs/Santa Cruz, it is difficult to assess any explanatory model applied to this long distance portion of the Lapita network.

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THE POTTERY FROM LASIGI, NEW IRELAND

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This contribution deals with my incomplete analysis of pottery from two sites in the village of Lasigi on the east coast of New Ireland, whose excavation is described in a chapter of the volume reporting on the Lapita Homeland Project (Golson 1991). The justification for a paper devoted solely to the ceramics is to be found in the discussion which concludes that chapter (Golson 1991 : 255-257). There is the immediate question of the relationship of the New Ireland pottery to broadly contemporary ceramic collections produced from other parts of the Bismarck Archipelago region by the Lapita Homeland Project. This matter will not be addressed in any depth here, if only because evidence of the necessary detail is not yet available. There are more fundamental questions, however, which are especially relevant in the present context, about the relationship of all these ceramic manifestations, on the one hand to "classic" Lapita, which is present, at an earlier stage, generally in the same localities and sometimes in the same stratigraphic sequences, and on the other to an ill-defined applied and incised decorative style referred to in discussions of ceramics as remote as the Admiralty Islands in the one direction and Vanuatu and New Caledonia in the other. The concluding sections of this paper will look in general terms at these issues from a New Ireland standpoint. The main parts, however, will deal with aspects of the essential data on which any wider conclusions must be based - the nature of the Lasigi pottery as a whole and the matter of the distributions of its particular features within and between the two Lasigi sites. A necessary first step, however, is to provide some information on chronology resulting from radiocarbon dating after the Lapita Homeland Project volume went to press.

CHRONOLOGY

The Dori Mound was the site of the main excavations at Lasigi in 1985. A 5x1m trench from the high point of the mound down the southern flank showed that the mounded form resulted from activities during the colonial period when adjacent ground was heaped on top of prehistoric deposits and sealed them in. Two strata were identified in these deposits, a lower one of varying thickness, 10-30cm, representing archaeological Phase 2, and an upper one 30-50cm thick, representing Phase 4, which was dug in spits up to 10cm in depth. On the surface of the deposits of Phase 2 and covered by those of Phase 4 was an episode of major construction activity characterised by the digging of large postholes nearly a metre deep and constituting Phase 3. On the surface of the underlying coral sand and covered by the deposits of Phase 2 was an episode of burial activity characterised by both inhumation and cremation and constituting Phase 1.

Some problems with the interpretation of this sequence appeared when the first batch of radiocarbon results was processed (Golson 1991 : 249-250). This was partly due to the fact that all charcoal samples dated modern, but mainly because one of the two shell samples chosen for dating was, ill-advisedly, from the fill of a deep posthole of Phase 3 and therefore of quite uncertain original provenance. It gave a calibrated age (at one standard deviation) of 780-542 BC, considerably older than the other shell sample, from a lower spit of Phase 4, with a calibrated reading (again at 1sd) of 131 BC-AD 64. The question addressed

in subsequent sample submissions was whether the earlier date was more likely to refer to the burial horizon of Phase 1, the midden horizon of Phase 2 or the construction horizon of Phase 3. The new dates indicate that Phase 1 is the truly early horizon and that Phases 2-4 cover a relatively short period at the end of the first millennium BC and the beginning of the first millennium AD.

The Mission site is the second of the two Lasigi excavations. It belongs to the same period as the main Dori occupation, by the evidence of the only radiocarbon date for the site, on shell from the third 5cm spit from the surface of a shallow deposit in sand without visible stratification. Division of the excavated materials for purposes of analysis was made on the basis of their vertical distribution and four phases, 1-4, defined, with the radiocarbon date belonging to the last stage of Phase 3 (Golson 1991 : 251). The concentration of materials at the site was such that although only about a fifth as much ground was excavated as at Dori, the recoveries did not fall far short of the Dori total.

THE POTTERY

In this presentation I discuss form and decoration only. Work on fabric, which is quite varied, is yet to be done, while as regards technology the only thing to be said at present is that slab-building is much in evidence.

On the whole the collections are miserable. At Dori the average weight of sherds is 2gm. At the Mission the sherdage is on the whole smaller and certainly more abraded. As a result, procedures must rely on the separate treatment of rims, which because of their small size and the frequent presence of lip modification are difficult to visualise in their original position on the pot ; distinctively shaped body sherds, of which there are few ; and decoration, regarding which there are problems, since the abrasion of surfaces may make designs difficult to identify and the smallness of sherds prevents the recognition of patterning and often of placement on the pot. In addition, the collections are not large, while the concentration of some sherds with particular formal and decorative features in a particular excavation square or level may mean that some of the pieces used individually in the analyses come in reality from the same pot.

Let us look, however, at some overall statistics. The figures given here for total rims and decorated pieces differ from those already published (Golson 1991 : 251) because of redefinitions on closer inspection, while the ones now used for the major categories and their subdivisions may be expected to alter in detail in the future as work proceeds. Sherds from the ground redeposited on top of the site to form the mound of the colonial period, Phase 5 of the archaeological sequence, as well as surface sherds, are used for purposes of characterising the pottery, but only there.

Morphology

Rims

We are dealing with some 220 rims overall, 125 from Dori and 95 from the Mission. Only 5 or 6 of these 220 pieces have any decoration below the lip on the part of the body preserved. One of these decorations is dentate-stamped.

However, we can make a distinction between rims where the lip is modified and where it is not. Plain lips appear on about 80 of the 220 rims, 50 out of the 125 at Dori and 30 of the 95 at the Mission, leaving 75 modified lips at Dori and at the Mission 45 lips which

are modified and 20 where it is impossible to tell. The modification consists in the main of what is known in the literature as "notching", but there is a variety of treatments involved, which need discriminating, as we shall see below.

Significant Body Sherds

Carinated sherds

Of these there are 12, 11 of them from Dori. Five of the carinations are sharp and 4 of these are decorated to one side of the carination, 3 in dentate stamping (e.g. Golson 1991 : Plate 2g) and 1 in small arcs in Lapita-like pattern (Plate 2j). Four of these 5 carinated pieces are angled so sharply that they could be the wall and base of flat-bottomed vessels, but there is not enough of the presumed base left to be certain.

The other 7 carinated pieces are much less acutely angled. Two of them have dentate stamping to one side of the angle and one of these is the piece from the Mission. The remaining 5 are notched at the carination in the manner of some of the modified lips (e.g. Golson 1991 : Plate 2i) or, in one certain case (Plate 2k), fingernail-impressed across the angle. As reserved, only one has body decoration, a horizontal row of horizontally opposed fingernail impressions (Plate 2i)..

Sherds of uneven thickness

Most of the carinated sherds are thickened inside at the angle by slab-building. This suggests that a class of sherd rather straight outside and reducing evenly in thickness may have belonged to carinated vessels. There are 8 such sherds, all with some form of decoration. Four of the 7 from Dori have dentate stamping and 1 has Lapita-like incision.

"Necked" sherds

Ranging from strongly to gently curved, these suggest the transition from a body to an everted rim. There are 9 examples from the Mission, all decorated, though none in Lapita dentate or incised style. From Dori there are 15, 12 decorated, 3 of these in dentate stamping.

Handling devices

These include 3 lugs, 2 from Dori ; 3 ledge handles, all from Dori ; and 5 loop handles, 4 from Dori.

Decoration

I exclude modification of lips and carinations from this section, which deals essentially with body decoration. The number of decorated sherds is not large : just over 50 at the Dori Mound and about 30 at the Mission.

I discuss decoration in three categories : impressed or stamped ; incised ; and raised or applied.

Impressed or Stamped

Dentate stamping

There are two varieties of this technique, fine and coarse, the latter twice as common as the former. Of the 16 sherds with dentate stamping (e.g. Golson 1991 : Plate 2f,g), 15 are from Dori. Three of these sherds are unplaceable on the pot, while the rest come from "fancy" vessels, being carinations, possible carinations and necks. The one example from the Mission is a carinated sherd. On none of the 16 pieces is the dentate stamping associated with decoration in any other technique, except perhaps incision of Lapita character in one or two instances.

Impressed arcs in Lapita configuration

There is one example, from Dori, and the sherd does not exhibit any other technique (Golson 1991 : Plate 2j).

Fingernail-impressed

There are 20 such sherds,18 of them from Dori. In most cases the impressions are single or scattered and such cases involve all types of sherd, except definite carinations but including handles and surfaces beneath rims and inside necks. At least one carination, from Dori Phase 4 (Golson 1991 : Plate 2k), has irregularly spaced fingernail impressions across the angle in the manner of notching.

There are 7 examples, including 1 from the Mission, where the impressions are opposed, vertically or horizontally. In 3 instances, all from Dori, these form rows ; they are all necked sherds, one being a neck above a notched carination (Golson 1991 : Plate 2i). Such opposed fingernail impressions can also be described, more strikingly, as pinched fingernail decoration.

There are only two other cases of fingernail impressions being combined with other techniques of decoration : a nail impression inside a necked sherd with a vertical applied band outside ; and an association with a possible amd rather unusual incision.

Other

These examples need not detain us. There are two possible paddle-impressed sherds, one from each site, and 3 thumb-impressed sherds, all from Dori.

Incised

Seventeen sherds are included in this category, which is very heterogeneous. I divide it as follows :

Lapita-like

The incisions are firm and definite, as wide as deep. The examples cited are where the incisions stand alone, not in combination with dentate stamping. There are 3 or 4 from Dori and 1or 2 from the Mission. The smallness of the sherds defeats more precise definition, but one Dori sherd carries the distinctive Lapita panel motif.

Other

With one exception, there is not much to say ; it is mainly a case of single narrow lines not apparently forming part of any composition. The exception consists of cross-hatching below the lip on the inside of a strongly everted rim with a large notch on the lip (Golson 1991 : Plate 2d). The only other combinations noted for this class of incision are shown by a necked sherd with a thin vertical incision inside and an applied nubbin outside and the not totally definite case, mentioned already, of possible, and unusual, incision above a row of nail impressions.

Raised or Applied

I recognise two categories, nubbins and bands.

Nubbins

There are 7 sherds from the the Mission and 4-8 from Dori. The nubbins are usually flat and occur singly, though only a few sherds are big enough to say with certainty that they are single occurrences, while on 2 or 3 small sherds the cases may not be nubbins but the preserved ends of applied bands ; this is especially so with the only (apparently) decorated example. There is one sherd with 3 small conical nubbins in a row ; Plate 2b of Golson 1991 shows a single conical example. Five of the sherds with nubbins are necked.

There is one rim sherd with stick nubbins below a notched lip (Golson 1991 : Plate 2c), the clay poked out from the inside of the pot.

Again there are few examples of combinations with other techniques of decoration on the same sherd and these are : a nubbin on the outside of a necked sherd which has a thin vertical incision inside ; a possible nubbin in association with paddle impression ; and one definite and one possible case of combination with applied bands.

Raised or applied bands

In some ways this is the most interesting category. There are 19 examples : 8 from Dori, 6 carrying notched decoration in the manner of some lips and carinations ; and 11 examples from the Mission, 3 of them decorated in the same way.

The class is a varied one, which I subdivide into 8 cases of undecorated bands, 5 from the Mission and 3 from Dori, in individual configurations, with the rest mainly single bands, plain (5 cases) or decorated (4 cases). I mention separately 2 necked sherds from the Mission with, in the one case, a vertical notched band and, in the other, a composition of vertical notched bands running across the neck (Golson 1991 : Plate 2a).

Again combinations with other techniques are few. They comprise a necked sherd with vertical band outside and nail impression inside and one definite and one possible case of combination of applied band and nubbin.

DISTRIBUTIONS

When we come to consider the distributions of the formal and decorative features discussed above within the two Lasigi sites and between them, it is impossible, because of

the smallness of the numbers within the categories established, to make definitive statements. The difficulty is compounded from the point of view of intra-site comparisons at Dori by the clear evidence there of the displacement of materials by the construction activities of Phase 3 (Golson 1991 : 248-250) and of the activities of coconut crabs, which have no doubt been equally active at the Mission site (Golson 1991 : 251). A further problem at Dori concerns the extent to which the (fortunately few) items attributed to Phase 1, the burial horizon in the top of basal coral sand, are in reality intrusive from the overlying midden of Phase 2 (Golson 1991 : 246-247), particularly in view of the large gap that now appears to separate the two phases. The only item present in possibly large enough numbers to circumvent these obstacles is the rims.

Before I take up discussion of the rims, however, I want to make some general comments about the representation at the two sites of the other features that I have been considering.

Features other than Rims

Dori

Here impressed and incised decoration is represented throughout the sequence, but applied decoration is restricted to Phase 4, as are handles and lugs.

Fingernail impressions which are opposed and form, or appear to form, rows are known from Phase 2 and the bottom of Phase 4.

Not only are incisions present throughout, but the few that have a Lapita look are similarly distributed.

This is conformable with the distribution of dentate stamping, and thus of what I have called (after Roger Green) the "fancy" pottery with which it is predominantly associated, represented by sherds with carinations, possible carinations and necks.

The Mission

Here sherds from "fancy" vessels are virtually absent, as also the types of decoration that go with them ; there is one piece with dentate stamping and possibly two with Lapita-incised.

There are only 2 or 3 examples of other kinds of incised.

Fingernail impressions are also few and only one sherd has them opposed.
Applied decoration is dominant, especially applied bands and this is true within the site and in comparison with Dori.

Rims

Interestingly in the light of the above, there are contrasts between Dori and the Mission in terms of rims, although there are also intriguing differences within the Dori site itself.

Rims with Plain Lips

At the Mission there are 30 plain-lipped rims, 45 rims with modified lips and 20 rims where it is impossible to tell. In Phase 2 of the Dori Mound, where there are some 30 rims, only 5 have plain lips, while in Phase 4 rims with plain and modified lips exist in equal numbers, around 35 of each.

Prominent among the plain-lipped rims of the Dori Mound is a class of everted rims with flat lips (Golson 1991 : Plate 3a,b). Commonly the walls of the rims diverge towards the lip and the lip may be further expanded by a beading of surplus clay inside, outside, inside and outside, and sometimes on top. Wall thickness is more than 5mm and up to about 8mm. These rims are restricted to Phase 4 at Dori and number only 5 or 6 among the 30 plain-lipped rims at the Mission.

Rims with Modified Lips

I recognise three classes, two of them minor. I shall discuss these first.

a - Class 1

The first minority class consists of only 8 sherds, so that its definition is difficult ; were the definition better, it might be possible to make two classes out of it. The thumb is used in some examples to depress the lip from the top, thus expanding it, and in others to press the lip in from both sides to form a peak. Overall the class is present at both sites and at Dori in both Phases 2 and 4.

b - Class 2

The second minority class, with 10 specimens, is also difficult to define, in this case because of the smallness of the sherds which represent it. However, it is highly distinctive and may prove important for comparative purposes. The thumb is used to displace the circular course of the rim alternately inwards and outwards to produce a wavy course when looked at from above (Golson 1991 : Plate 3l). The form is represented at both sites, but at Dori it does not appear in Phase 2.

c - Class 3

The major class of rim modification is that generally called "notching" and lips where this is regular and pronounced have a characteristic outline when looked at from the side, which has been called "crenation" and "crenated" or "crenellation" and "crenellated". Strictly speaking, "crenation" and "crenated" are the correct terms. However, "notching" and its associates, as they have been used, cover a wide range of practices, whose proper specification may prove to be analytically important. Plate 3 c-k of Golson 1991 illustrates the general points made below.

I propose to identify three types of notching : notching proper, which is a V-shaped indentation or incision in an edge or across a surface ; incisions or indentations that are not V-shaped, but narrow and parallel-sided, which I shall call cuts or cut notches ; and wide indentations, concave in form, which are impressions made by sticks and sometimes thumbs, which I shall call scallops.

In addition to the form of the modification, there is the question of its placement, whether on the inner edge of the lip, on its outer edge, on both edges or across its surface.

There is also the matter of the disposition of the notching, whether regularly or irregularly spaced, grouped and the like. This is not easy to be definite about in the case of small sherds.

Of the 75 rim sherds at Dori with modified lips of all types, 62 fall within the categories described above : 1 has regular, closely spaced cuts across the lip ; 5 are truly notched, with small incisions on one or both edges of the lip ; 4 are scalloped, with the scalloping definitely restricted to one or other edge of the lip ; 2 are special cases ; and the rest (50) are scalloped, and with sticks rather than with thumbs, across the lip or most of it, the impression is often more pronounced on one side than on the other, usually on the inside, and characteristically there is displacement of the clay outwards from the sherd wall and downwards.

This type of fully scalloped lip is absolutely dominant among the rims of Phase 2 at Dori, where among 30 items there are 5 with plain lips, 2 with notched lips, 1 with another type of modification and 23 with lips scalloped in this way. In Phase 4, where there are equal numbers of rims with plain and modified lips, the fully scalloped lip is still prominent, accounting for 24 of the 35 rims with modified lips.

At the Mission, on the other hand, where there are 45 rims with modified lips of all types, 7 belonging to the two minority classes, the fully scalloped lip so typical of Dori is present on only 4 of the remaining 38. The rest are rims that have scallops, or in a few cases notches, restricted to one edge of the lip, which is definitely a minority form at Dori.

At this stage I have no explanations to offer for the different ceramic manifestations shown to exist in the foregoing discussion between the Dori Mound and the Mission site and between Phases 2 and 4 at Dori. We must bear in mind that the excavations at both sites were very small samples of the whole The circumstances introduce additional problems when we come to consider wider parallels for the Lasigi materials.

COMPARISONS

The occurrence of dentate-stamped and incised sherds of Lapita style in the excavated deposits at Lasigi calls to mind the single sherd of Lapita found on the surface at Lossu on the east coast of New Ireland (White and Downie 1980 : 214, under the name of Lesu) and the discoveries under the Lapita Homeland Project at Lamau on the west coast (Gorecki et al. 1991). These latter consist of a sherd decorated in "classic" Lapita dentate fashion excavated above a level containing sherds allowing the reconstruction of a carinated bowl with wide neck and everted rim, rather coarsely decorated above the carination with Lapita patterns in incised technique. Residues in the bottom of this pot have given a technically unsatisfactory radiocarbon date of 1680 ± 200 BP, which calibrates, at one standard deviation, to AD 120-600.

As regards the Lasigi ceramics as a whole, there are two relevant prior investigations on New Ireland itself. These are Clay's excavations at Pinikindu, about 20km up the east coast from Lasigi, whose publication (Clay 1974) provides no description of the undecorated and undated ceramics apart from fabric, and White's work at Lossu, a further 30km up the coast, to which reference has already been made (White 1972 ; White and Downey 1980).

There are difficulties at Lossu with disturbance of deposits, but I have given reasons in my contribution to the Lapita Homeland Project volume (Golson 1991 : 257,258) for accepting the integrity of the 2m of deposit beneath Mound V, with a basal radiocarbon date on charcoal which calibrates to the wide range, because of multiple intercepts with the calibration curve, of 799-399BC, and perhaps the acceptability of one from Mound VI calibrating to AD390-544. If this is so, the two Lasigi sites fall well within the Lossu chronological range, at least as far as their main occupation is concerned.

I have had the opportunity only for a cursory look at the Lossu ceramics, but the close similarity of the less rich Lasigi materials is clear. I note the presence at Lossu (the references are all to White and Downie 1980) of the everted rims with walls diverging towards a plain lip which are so well represented at Dori (Fig.8b) ; rims with scalloped lips (Fig.8g,h) ; thumb-depressed rims (Fig.8a) ; wavy rims (Fig.9a) ; and the richness of the applied decoration, both single elements, including nubbins, and compositions, as well as decorated bands (Figs 9,10).

Looking somewhat further afield, I have been able to make use of Anson's (1983) studies of pre-Lapita Homeland Project date on Bismarck Archipelago pottery, especially that from sites on Watom and Ambitle, both of them exhibiting "classic" Lapita and ceramics of less defined associations.

For both Anson (1983 : 37, 44 ; Figs V, VI, VIII, IX) describes lip modification by "notching", but emphasises for Watom the presence of deep regular stick impressions at the lip giving rise to crenation ("crenellation") and resulting in outward and downward displacement of the clay in the Lasigi manner (1983 : Fig.VIII 16-17, 19-21 ; no.18 appears to be a wavy rim).

For Ambitle Anson (1983 : 47) describes a number of decorative features known at Lasigi - applied knobs or nubbins, stick nubbins, nail impressions - and contrasts them (1983 : 47-48) with features of applied relief and nail impressions found on Watom - flattened discs, applied bands, pinched (my "opposed") fingernail decoration - which, with the exception of flattened discs, are also known at Lasigi.

Subsequent work has provided more and better controlled data than were available to Anson, which will give the opportunity for a thorough comparative examination of the Bismarck Archipelago ceramics. This is especially true of Watom, where excavations under the Lapita Homeland Project (Green and Anson 1987, 1991) included reinvestigation of Specht's (1968) Site 6, resulting in the dating of two occupation horizons, C1 and C2, of interest in connection with the Lasigi ceramics, to the highly appropriate time range 400BC-AD100 (Green and Anson 1991 : 173).

As for Ambitle, although this was not included in the field programme of the Project, Ambrose's earlier collections from there at ANU, which formed part of Anson's study, have been one focus of Sharp's (in press) investigation of Lapita design, which the Project has taken on board. I have made a quick inspection of the materials. Modified lips are common on Ambitle and, contrary to the impression given by Anson (1983 : 37), over the full range known at Lasigi, so including the scalloped treatment of the lip surface with displacement of clay and the (rare) wavy rim. There are also nubbins and scattered-fingernail impressions, as at Lasigi, but an absence, in contrast to Lasigi, Lossu and also Watom, of fingernail impressions opposed ("pinched") and in compositions and of any decoration with applied bands.

As Kirch notes (Kirch et al. 1991 : 152), there are close parallels between the Lasigi ceramics and those from the EKQ rockshelter on the main island of the Mussau Group, excavated as part of Kirch's programme under the Lapita Homeland Project. The lip modifications illustrated in Figure 4a, b and d-f of Kirch et al. 1991 are identical with the Lasigi corpus (Golson 1991 : Plate 3c-k), while Figure 4c shows a sherd with stick nubbins below a notched rim which has a striking parallel in Dori Phase 4 (Golson 1991 : Plate 2c). Site EKQ is particularly important in the comparative context which I am now exploring, because it displays a deep and well-stratified ceramic sequence covering a period from about 1000BC to perhaps as late as 500-300BC and representing a phase of ceramic development subsequent to a "classic" Lapita manifestation beginning about 1500BC (Kirch et al. 1991 : 151). For Kirch and his colleagues (1991 : 160) the Mussau evidence shows this not to be a case of the replacement of Lapita communities by other cultural groups, but simply a stylistic change in the ceramic complex, which continued to be made by the same groups of people, and they see parallel changes as occurring elsewhere in the Bismarcks, for which they instance Watom (citing Green and Anson 1991) and the Arawe Islands (citing Gosden 1991).

Whatever the validity of this reading of the Mussau evidence, it cannot wholly explain the nature of the ceramic complexes at Lasigi and Lossu, or indeed at Watom, since applied relief decoration, relatively prominent there, is not mentioned in connection with the Mussau sequence. There is perhaps also some reason to suspect the wholly endogenous character proposed for the changes in that sequence, when, from the results of compositional analysis of small samples of sherds from the relevant sites, it is concluded that the ceramics contributing to it were imported from a variety of sources, only one of which, and an unimportant one, is to be found within the Mussau Group itself (Kirch et al. 1991 : 158-159). Among the sources said to be implicated is M'buke Island, off the south coast of Manus in the Admiralty Group. Obsidian from the Admiralty Islands was important throughout the period covered by the Mussau ceramic sequence, marginally more so than New Britain obsidian in the early phases but becoming increasingly dominant, if less abundant, over time (Kirch et al. 1991 : 157). At Lasigi obsidian, present in low numbers and small pieces, is almost exclusively from Admiralty sources (Golson 1991 : 255). From Lossu, where 17 out of 20 obsidian pieces analysed came from the Admiralties, there are also two broken obsidian artifacts of triangular cross-section from Mound VI, which are identified as fragments of points of Admiralties type and the only examples of such points reported from outside the Group (cf. Golson 1991 : 257).

I repeat these indications of connections between New Ireland and the Admiralties from my article in the volume of Lapita Homeland Project reports because of the mention of Admiralty Islands pottery in discussions of ceramic relationships within the region (Golson 1991 : 257). Collections of such pottery are currently under detailed study by Wahome at ANU and I have been able to take a cursory look at those from some of the older sites, from around the first century BC and the first few hundred years AD. While there is nothing in the ceramics to remind one of Lapita, no matter how modified from the "classic" original, there is a plenitude of rims with true notching, some rims are thumb-depressed and applied relief is common in the decoration.

IMPLICATIONS

I do not want to make too much of the matter of applied decoration, only to point out that in addition to the presences that I have noted in the region of the Bismarck Archipelago in the closing centuries of the first millennium BC and the opening ones of the first

millennium AD - at Lasigi and Lossu on New Ireland, on Watom off New Britain and in the Admiralties, there are notable occurrences further afield. Applied decoration is a central feature of Specht's (1969) long Buka sequence of the northern Solomons from about the birth of Christ, is prominent in the early phase, late first millennium BC to early first millennium AD, of Garanger's (1972) Mangaasi ceramics in central Vanuatu and makes subsequent appearances in New Caledonia (Gifford and Shutler 1956) and Fiji (Gifford 1951).

It was this widespread distribution, and even more so the association in it of incised decoration of non-Lapita character, that led me many years ago to propose the existence of a pottery tradition parallel to Lapita and chronologically overlapping its later stages, which I called "appliqué and incised" or "incised and applied" (Golson 1968 : 10, 12, further developed in Golson 1972 : 567-576). The concept was taken up by Garanger (1971) in his contribution on his work in central Vanuatu to a conference in 1969, explored in detail by Specht (1969) in his discussion of the pottery industries of Buka and, more recently, found useful by Kennedy (1982) and by Anson (1983) in considering the prehistoric ceramics of the Admiralties and the Bismarck Archipelago respectively.

I do not pretend to know the significance of the decorative features of which I am speaking in culture-historical or any other terms, but they represent a marked phenomenon over a vast area of the Southwest Pacific from late Lapita times and there are some interesting articulations with the Lapita tradition. I have considered in some detail one of these in this paper on Lasigi and made reference to another New Ireland locality, Lossu, which might well be relevant in this connection. Perhaps the most signal example, however, is Garanger's central Vanuatu site of Erueti, which some years ago (Golson 1971 ; cf. Garanger 1972 : 29, 40) I argued as a Lapita site, despite the dominance of the Mangaasi style among the decorated pottery and the mere handful of sherds with Lapita decoration. And do we have the same sort of thing at Kennedy's (1981) Kohin Cave on Manus Island?

There are some intriguing questions here and it may be that the answers are immanent in the results of the Lapita Homeland Project itself, from a suite of excavations (Gosden et al. 1989) of which only those on Mussau and Watom have been mentioned to any extent in the foregoing, but others in the Arawes.

(Gosden 1991) and on Nissan (Spriggs 1991) are obviously highly relevant. Whether this be the case or not, there are other sites in the Bismarcks which would repay investigation from the point of view of the ceramic relationships under discussion. I have just mentioned Lossu in this connection, where there is 2m of ground under Mound V with a basal date well in the first millennium BC, which, as mentioned before, I see as being undisturbed. Another instance has only recently been put on record ; it is the Mouk Cemetery site on an islet off Baluan Island in the Admiralties, where McEldowney and Ballard (1991) found Lapita pottery in the context of a long ceramic sequence.

What is needed now is the same attention to the form and decoration of the other early pottery of the Southwest Pacific, and to the archaeology of its field occurrences, as has been devoted over the last 20 or so years, with such rewarding results, to the Lapita phenomenon, with its mophologically more sophisticated and decoratively more structured ceramics.

Em tasol.

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CLAYS AND SANDS IN MELANESIAN POTTERY ANALYSIS

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RÉSUMÉ

Argiles et sables dans l'analyse de la poterie mélanésienne

Le but de cette communication est de présenter le travail en cours sur l'analyse chimique des argiles utilisées pour la fabrication de poteries préhistoriques dans les Iles Manus ; les résultats obtenus dans l'identification des principaux éléments présentent un intérêt pour d'autres travaux effectués dans l'Archipel de Bismarck et traitant de la classification des objets et de l'origine des matériaux utilisés. Des données seront présentées pour illustrer les variations chimiques des argiles à travers l'étude de trois facteurs : techniques de cuisson, état du site, et choix des argiles selon la fonction des objets.

ABSTRACT

This paper presents work in progress on the chemical analysis of clays used in prehistoric pottery from the Manus Islands ; the results from the major element determinations have relevance for other work in the Bismarck Archipelago directed toward the differentiation of wares and raw material sources. Data are presented to illustrate variations in clay chemistry related to three factors, namely pottery firing procedures, site conditions, and clay selection for different wares.

Petrology in pottery analysis

W.R. Dickinson's comprehensive petrological study of sand tempered pottery, beginning in 1965, examined 750 sherds from archaeological sites within 15 major island groups of the southern and western Pacific (Dickinson & Shutler 1979 :1646). This work concentrated on identifying the exotic sand tempers as indicators of long range dispersal in the region. The detailed results included distribution maps showing the extensive spread of pottery from its place of manufacture. For example pottery is reported to have been moved from the western Solomon Islands at Buka Island to Ontong Java, Nissan, and Teop ; from Palau and Yap in the Caroline Islands to Lamotrek 1000 kilometres east ; from Fiji to Tonga, and most remarkably from Fiji to the Marquesas Islands nearly 5000 kilometres east. Also considered were Spanish sherds found in the San Cristoval and Santa Cruz islands. These are remarkable maps of connections whose scale has not been superseded. The application of sand temper petrography is also capable of producing finer scale information on the source of the wares when distinctive regional tempers can be recognised, as is shown by Galipaud (1990) for the 400 sherds he related to the local glaucophane and ultramafic minerals of New Caledonia (Galipaud 1990).

Dickinson regarded each island as a point source of sand used for tempering purposes, but was not hopeful that clays would similarly provide a precise location for the manufacture of pottery (Dickinson & Shutler 1979 : 1659). It is likely that Dickinson's

preference for analysing the sand component of pottery was partly based on the technical difficulty of using standard petrological techniques for analysing clay in baked pottery. Sand on the other hand is easily identified mineralogically, but is so ubiquitous that only the exotic mineral component has real value in determining a clear location of its source rock. Clay also has the disadvantage that it may derive from different parent rocks but be mineralogically identical (Lewis 1984 : 157), and therefore share the same major chemical components. One objection to the use of sand fillers exclusively for identifying the source of pottery lies with the relative value that traditional potters place on their raw materials, and the different efforts the potters may exercise in procuring the two components, clay and sand filler. In Melanesia it is common for potters to go to some pains to acquire the ideal clay from particular localities, even if this means negotiations with other owners of a source some distance away. Clay sources therefore have an inherent value that ensures their prolonged use. Sand fillers conversely are often gathered locally from mobile beach or stream bank deposits without the same degree of selection given to clays. Potentially, this difference in selection will create different resource use patterns in the archaeological record. Each of the two patterns can be valuable and complementary in their contribution to understanding the prehistory of our region.

Clay analysis

The literature on locating the sources of pottery raw materials shows that the use of standard petrological methods gives the most direct route when exotic minerals are present. Instrumental methods have generally given poorer results because most analyses have not distinguished between the clays and mineral fillers ; the pottery being prepared as a homogeneous specimen in the same way as the natural glass obsidian. A moment's reflection shows that the inherent differences between these two materials requires a different approach in their analysis. It is not an easy task to locate the sources of the mixed ingredients in pottery when large accessible areas of the landscape may contain these materials, compared with the usually confined occurrence of obsidian. An appreciation of the need to chemically characterise the separate components has lead researchers to use the analytical microprobe to analyse prepared pot sherd sections, for both the clay matrix and the mineral fillers. As well, the search for the source of the raw material has given way to treating the pottery itself as the main problem for matching or differentiation. Anson (1983), Summerhayes (1987) and Hunt (1989) have adopted this strategy for wares from Melanesian sites. The main constraint on this approach is that the selection of the clay fraction is done at a microscopic scale which inevitably must produce an analysis on a very small fraction of the sherd.

In the present study I have used a different method for separating the clays and fillers on a larger scale to provide a more representative sample of the raw materials. This is achieved by crushing and disaggregating potsherds in distilled water using ultrasonic disintegration, followed by elutriation and centrifugal separation of the clay fraction (Ambrose 1991 : 110, 1992). The low temperature, short period, bonfire firing procedures traditionally used throughout Melanesia, makes the disintegration procedure practicable as only a poor degree of clay mineral sintering would have been achieved. As an initial part of this project, microprobe analysis has been completed on 150 separated clay specimens for eleven major and minor elements namely ; Si, Al, Fe, Mg, Ti, Ca, Na, K, S, Cl, P. The major elements have been analysed using the system SPEED (Software Package for Empirical Energy Dispersive spectroscopy) developed for electron probe or scanning electron microscope fitted with the Link Analytical PCXA energy dispersive spectrometer (Ware 1988). Not all samples yielded values above the detection limits for all the elements. For various samples Ca, Na, K, S, and

Cl could not be determined. Cases with missing data constrain the ability of many computer clustering programs from dealing equally with the definition of group divisions and membership.

As mentioned, the same major element composition of clays can result by weathering from different original rock sources. Trace elements on the other hand can be incorporated in clays in a way that reflects their distinctive geological origins, and can provide a means for identifying differences in otherwise similar material. In particular the rare earth elements tend to be carried over during weathering and metamorphic processes to give the derived clays the same rare earth pattern as the rocks from which they originated (Cullers et al. 1974 : 389). Neutron Activation Analysis is the standard method for the analysis of these trace elements and is being applied to the clays being used in this report. These results are not yet available for inclusion here.

As is well known some of the major elements listed above are unsuited for chemically defining sherd characteristics because they are capable of being either depleted or introduced into the fabric of the ware during manufacture, by cooking, product storage, or from weathering in the ground in which they lay. The elements of doubtful value include Ca, which may be introduced with coral sand as a tempering material and be leached and redeposited after firing ; Na and Cl, which may be introduced with sea water during clay preparation or later cooking procedures ; P, may be absorbed into the pot fabric during cooking of phosphate-rich foods, or from the place of burial of the sherds ; and Fe,S may be added to the sherd from organic decay processes in swampy conditions and this appears to have occurred with examples of the Manus wares from the brackish Puian River deposits.

An example of the changes in composition brought about by incidental processes can be seen in the case of a small pot made by traditional women potters at Boera, west of Port Moresby, in 1989. Clay separations from samples of unbaked clay and the fired pot made from it were prepared by crushing, sonification, and elutriation in the manner described so that two related clay fractions were analysed. The results can be seen in Figure 1, where the element oxide values are presented in logarithmic values. The diagonal line marks equal composition of the two samples. Half the elements show little variation and are within the measurement error of the analytical system (Table 1). The notable differences between the unfired and fired clay are depletion of Fe and enrichment of Ca, with the most pronounced increase being in Na and Cl from the Boera practice of adding sea water to the clay.

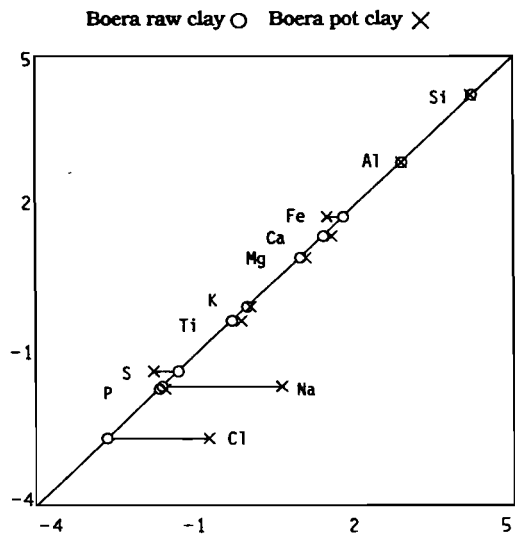

Figure 1. Logarithmic plot of clay element oxide values of clays separated from raw clay and the pot made from it. The diagonal line gives the composition of the clay fraction, with the offset showing relative difference of the pot clay.

Table 1. Percent element oxides, Boera raw clay and fired pot.

No	P	Si	Ti	Al	Fe	Mg	Ca	Na	K	S	Cl
318(clay) .19	67.4	.97	17.69	5.91	2.59	4.01	.20	.73	.27	.07	
323(pot)	.21	65.9	1.03	17.63	4.31	2.87	4.74	1.82	.87	.17	.48

On the basis of these results, or in cases where an identification of geological source is being sought on the basis of chemical affinity, it would be wise to avoid elements that deviate markedly in the transformation of clay to pottery. In the case of the Boera example the use of sea water has greatly increased the Na and Cl concentration, while the addition of Ca as coral beach sand has had a lesser effect. The loss of Fe in the fired specimen indicates that it too is susceptible to change, perhaps due to oxidation and bonding to produce larger particle sizes, that then settle out as silt during the clay separation procedure.

Manus pottery clays

The Manus pottery collections include many shell impressed and rolled rim sherds that have been referred to as Puian ware (Ambrose 1991 : 109), from the brackish outwash of the Puian River on the south coast of Manus Island. The dating of this material to 1660 ± 100 BP (ANU 6981) is within the same age range as pottery bearing the same decoration from the Pisik School site on Lou Island about 30 Km to the south. The School site is buried beneath 2-3 metres of ash and pumice lapilli from the Rei eruption. It could be expected, on the basis of site age and pottery style, that the two wares are from the same workshop and would have the same raw materials, but on the basis of the clay major element analyses they are different. Two of the sherds are compared in Table 2 ; the clustered groups are in Figure 2. The relative increase in S, Na, P, Mg and Fe, and the loss of Ca and K in sherds, might be expected in the brackish sediment at Puian estuary compared with those buried beneath volcanic ash at the School site.

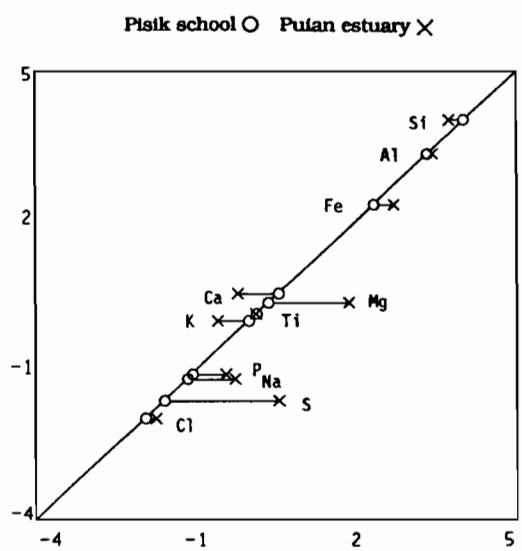

Figure 2. Logarithmic plot of clay element oxide values of clays separated from two shell-impressed Puian ware sherds indicating differences caused by different burial conditions over the last 1600 years.

Table 2. Percent element oxides, brackish and volcanic ash burial conditions of Puian ware.

No	P	Si	Ti	Al	Fe	Mg	Ca	Na	K	S	Cl
296(brak)	.64	42.1	1.11	31.03	14.89	6.23	.80	.76	.55	1.71	.17
306(ash)	.34	55.5	1.13	28.15	10.14	1.41	1.74	.31	.98	.20	.14

As many sherds have been analysed the comparison have been made in multivariate form on the main components Si, Ti, Al, Fe, Mg. A correspondence analysis plot (Greenacre 1984) clearly shows two groups (Figure 3). Additionally the brackish sediment set has a comparatively wider dispersion, probably as a result of weathering in the esturine environment of the Puian River which seems to have had a significant effect on the chemistry of the clay in the sherds of these two collections. Therefore, although the use of clays as the analytical focus for archaeological purposes seems operationally sound, there may be difficulties in making comparisons between sites with different weathering conditions. The same problem of sherd diagenesis is reported by Snow et al (1983 : 771) where soft weathered mineral grains are present in sherds from a Philippines site ; attemps to separate the clay fraction would be contaminated by the weathered tempering components. These are cases where a separate examination of the characteristics of the sandy tempering material could be very useful in confirming the results from clay analysis. This has not been done in the present study.

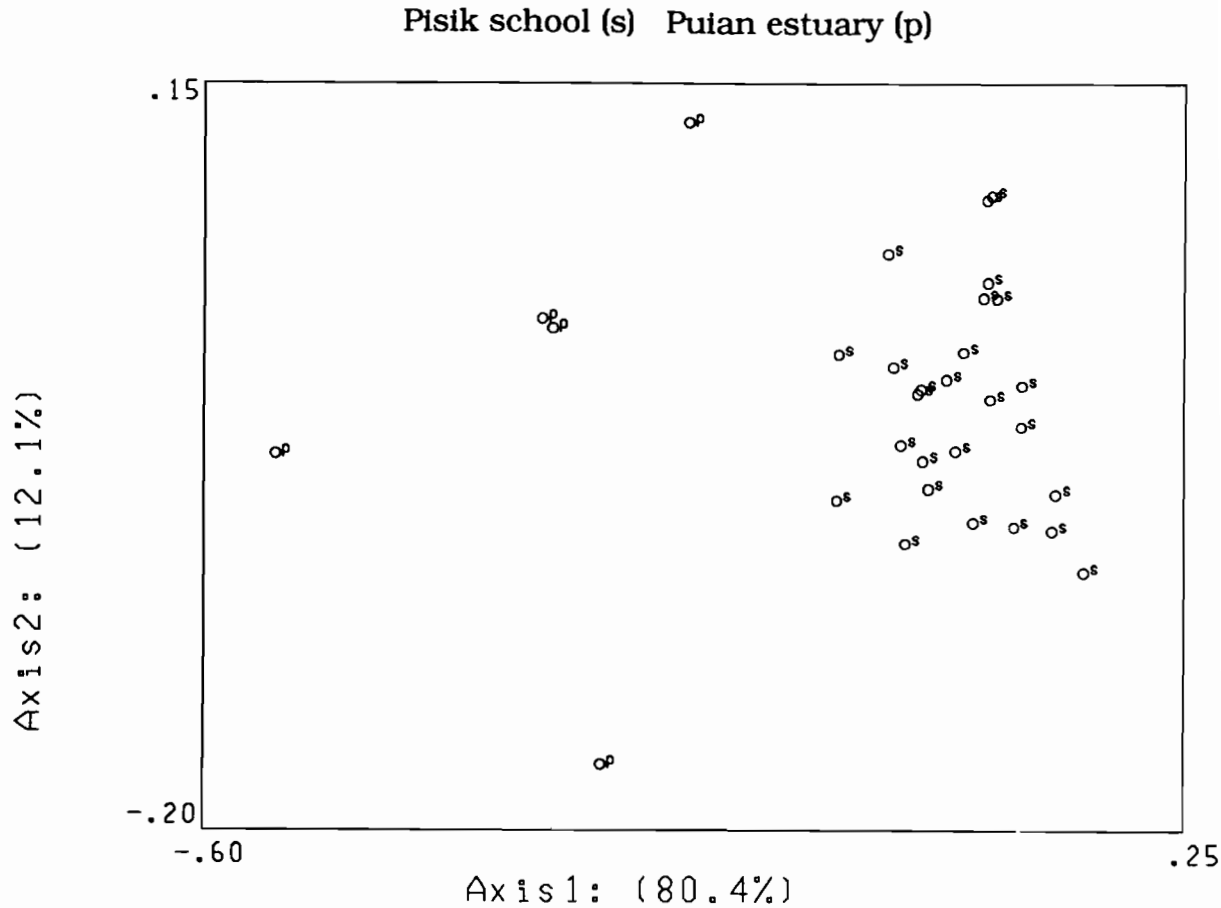

Figure 3. Correspondence analysis plot of Puian ware sherds from (p) the Puian estuary and (s) the Pisik school volcanic ash, showing clear separation and a relatively larger dispersion of values for the estuary location. Based on Si, Ti, Al, Fe, Mg.

A different weathering environment exists at an earlier site dated to 2100 BP at Sasi on the south coast of Lou Island where there are two forms of pottery each appearing to be made from different raw materials as evidenced by X-radiography and visual inspection (Ambrose 1991 : 107). One ware is ornamented, has flat platform rims with incised decoration, is relatively thicker, has a coarse grained texture, and bears the marks of being

exposed in a cooking fire ; the other ware is lighter coloured, without decoration, with a clean surface, finer grained texture, and includes constricted necks as might be found in a water container. As the site is from beneath about 5 metres of volcanic ash a comparison of the chemistry of the two wares should show whether different clays were used to produce the two wares, or whether the difference is a function of tempering material.

The element oxides Si, Ti, Al, Fe and Mg, were used for correspondence analysis on sherds from the Sasi site (Figure 4). The two wares are well separated with the coarser grained (c) sherds having a much wider dispersion than the finer grained (f) group. This pattern might be expected if two different clays are involved where the coarse variety includes a more heterogeneous raw material compared with that from the finer textured ware. Although there is a similarity with the clustering of the Puian ware in Figure 3, the latter includes a post-depositional weathering effect accounting for about twice the difference in the variance accounted for by axis 1 on the correspondence analysis plot.

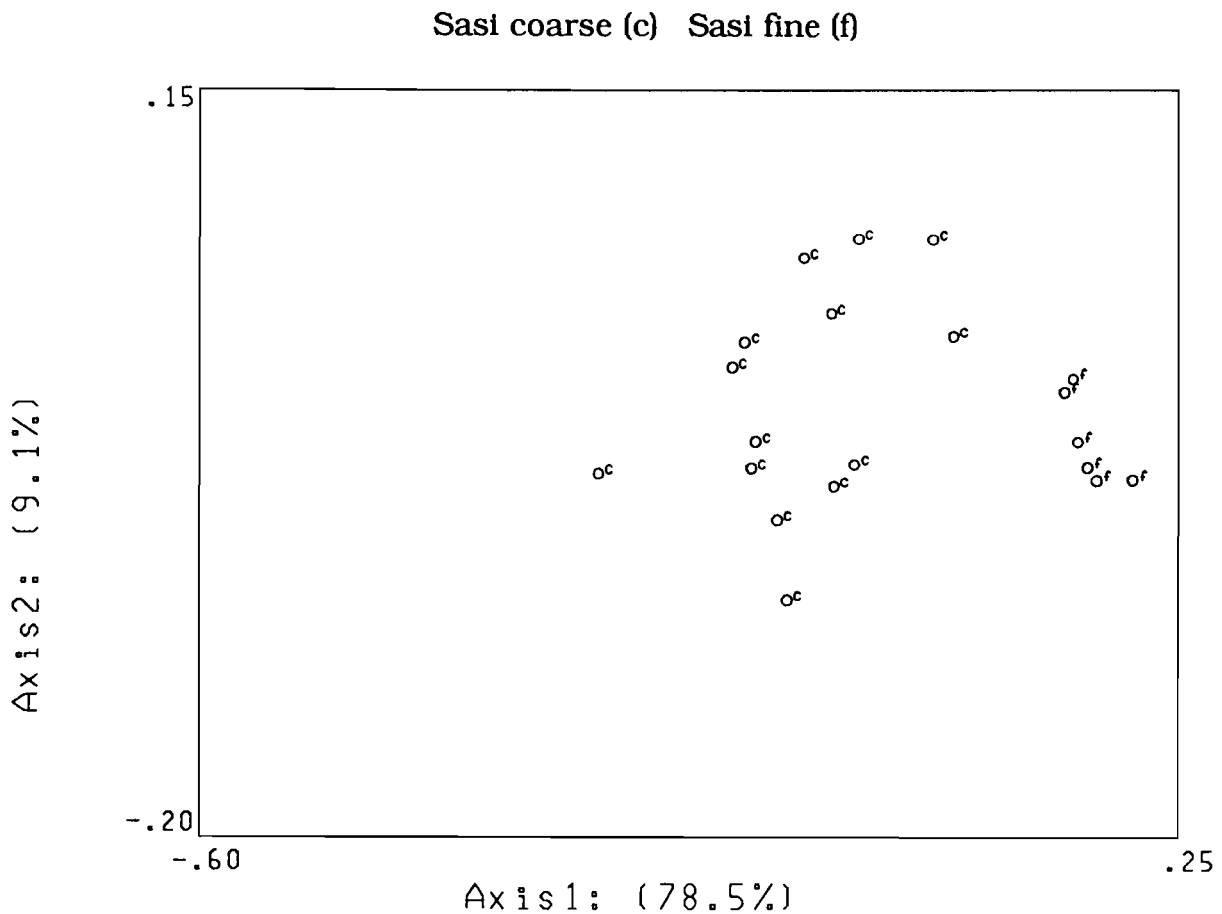

Figure 4. Correspondence analysis plot of two wares from the 2100 BP Sasi site. The coarse ware clay (c) is separate and has a wider dispersion than the finer ware clay

CONCLUSIONS

The modern Boera clay-pottery pair (Figure 1) reflects differences caused at the time of transforming raw clay to fired pottery ; the two figures 3, 4, present superficially similar sets of cluster pairs, but the difference between the two has been accounted for by different circumstances. Figure 3 shows the effects of, probably, weathering the same ware over 1600 years in contrasting burial conditions ; Figure 4 presents a case of two different clays used for different style wares, made 2100 years ago and sealed since that time beneath 5 metres of rhyolitic ash. In the first two cases an analysis of the clays, based on the major elements, could possibly indicate that the paired clusters represent different clays. But only in the third case would such a conclusion be warranted. These data underline the difficulty of asserting affinities between clays in archaeological sherds based only on major elements. It will be interesting to review these results in the light of further rare earth element data that is presently being undertaken.

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FIRING TEMPERATURES AND THE ANALYSIS OF OCEANIC CERAMICS : A STUDY OF LAPITA CERAMICS FROM REEF/SANTA CRUZ, SOLOMON ISLANDS

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RÉSUMÉ

Les températures de cuisson et l'analyse des céramiques océaniennes : Une étude des céramiques Lapita des îles Reef/Santa Cruz, Iles Salomon.

Cette étude examine notre capacité à déterminer avec précision la température de cuisson des fragments de céramique recueillis sur les sites archéologiques d'Océanie. Nous nous pencherons particulièrement sur les aspects suivants des céramiques : l'évaluation des températures de cuisson des terres-cuites fabriquées à basse température, utilisant pour cela les assemblages recueillis sur les sites Lapita de l'archipel salomonais des Reef/Santa Cruz. Nous examinerons les dégraissants calcaires et non-calcaires. Les données obtenues seront présentées, et nous discuterons des problèmes et des limites imposées, en tenant compte de l'évidence ethnographique et archéologique, et des particularités des échantillons utilisés.

ABSTRACT

This study examines our ability to determine accurately the firing temperatures of ceramics from archaeological sites in Oceania. In particular the following aspects of ceramics are addressed : the assessment of firing temperatures in low-fired earthenware using the assemblage from Lapita sites in the Reef/Santa Cruz group, Solomons, examining FM (non-calcareous tempers), and calcareous tempers. This information is then presented and the problems and limitations discussed with considerations of ethnographic evidence, archaeological evidence, and the specific sample set examined.

Keywords :

PREHISTORIC ARCHAEOLOGY, PREHISTORIC CERAMICS, FIRING TEMPERATURES, REEF/SANTA CRUZ, OCEANIA, POTTERY TECHNOLOGY, XRD, ESR, EXPERIMENTAL FIRINGS, SHELL TEMPER

INTRODUCTION

The reason for analysing ceramics from archaeological sites is to provide dating and cultural information pertaining to trade, economy, technology, and social groupings (Irwin 1985, Graves 1990 n.d.). The majority of studies on Oceanic ceramics relate to chemical sourcing, in an attempt to resolve a primary interest of Oceanic archaeologists : trade and exchange (with origins and migrations lurking in the background!) (e.g. Dickinson 1978 ; Dickinson and Shutler 1971, 1979). Other studies have concentrated on ceramic design or

decorative elements with a similar endpoint in mind (Spriggs 1990, several papers ; Vanderwal 1973) and there have been some inroads into the study of ceramic technology (Rye 1981 ; Irwin 1985 ; Key 1971).

Analysis of Oceanic Ceramics

Both archaeological and ethnographic ceramics from Oceania for the most part are characteristically low-fired earthenware. Clays extracted from small localised deposits are often blended with sands, shell or grog as temper materials to strengthen the body of clay. Sedimentology of temper types suggests that variable sources were utilised, such as beach sands, stream sands, colluvial sands, volcanic ash, placer concentrates, calcareous sands and broken sherds (Dickinson 1978). As a result of variations in source and manufacturing technique, the ceramics are mineralogically complex and of variable composition, which includes mixtures of clays, quartz, feldspars, pyroxenes, spinels and other mineral phases. Such heterogeneity complicates any analysis of the ceramics as do further changes during firing, use and deposition. It is therefore necessary to assess the influences of three classes of minerals in any interpretation of analyses : primary minerals relating to the original source material ; firing minerals (transformations on firing) ; and secondary minerals formed after deposition.

Effects of Weathering

Any analysis of ancient ceramics must take into account weathering processes as there is clear evidence that they will affect the interpretation of the results (e.g. Heimann and Maggetti 1981). Such processes affect both the composition of the original clays and the archaeological ceramic, especially in the tropics where there is high temperature and rainfall (e.g. in the Reefs/Santa Cruz : 26°C, 4200mm and 5080mm respectively). In addition the archaeological ceramics are often buried in variable conditions from 100's up to 4000 years. Ceramics examined in this study come from deposits dating to 2500-3200 years ago which have strongly alkaline conditions with pH as high as 11 (Green 1976). It should be noted that small clay peaks were observed in some samples and that this could represent non-destruction (of the original clay), reformation, or weathering and the formation of new clay particles. It is certain that weathering was considerable, as fractured surfaces which originally exposed a reduced core had been oxidised to a reddish surface. Also significant was the presence of iron oxy-hydroxides (goethite-FeO(OH)), which is a low temperature weathering product and not formed during the firing process, and is therefore indicative of significant post-depositional change. A similar phenomenon has recently been observed in chert artifacts from the same region (Sheppard et al. n.d.).

In such conditions it is highly likely that remaining rock particles or temper could weather to clay minerals, as could transformation minerals such as anorthite. It is also likely that many of the more soluble, low temperature eutectics, originally bonding much of the matrix and temper, would have gone into solution. This would leave a weaker and more porous ceramic whose composition only partly reflects the original, and any analysis of the current state of variables such as porosity, toughness and firing temperature would not reflect those originally present.

Firing Techniques

It is assumed that prehistoric potting communities used only the variety of simple firing techniques observed ethnographically, a view reinforced by the absence of

archaeological evidence for more sophisticated techniques such as kiln firing. However, vitrification occurring in a few of the sherds examined in this study from the Reef/Santa Cruz group suggests that, at times, these open firings resulted in temperatures high enough to cause fusion of the ceramic constituents. Vitrification occurs at varying temperatures depending on the composition, and the use of fluxes (such as salt in salt water) can drastically lower the vitrification temperatures, and in particular give rise to surface sintering (bonding) between particles. For the most part only superficial sintering was observed, delicately bonding the fabric together. Occasionally heavy vitrification occurred, where the body texture was lost in an amorphous glassy state.

The occurrence of high temperatures and the fact that they could be attained with simple techniques should not be surprising, as the palm frond method of firing used by many Melanesian potting communities (Rye 1981 ; Irwin 1985) to some extent simulates a shaft furnace, with the fronds having a similar effect to the walls of the shaft. This design would promote a natural through-draught, thus increasing the heat output from an already high calorific fuel.

However, this method of firing also gives rise to one of the major problems of thermal analysis : heterogeneity. Heating is fast and noticeably uneven in both temperature and oxidization potential. Thus, while parts of the pot will reach temperatures as high as 900°C, other areas will at times be lower than 600°C, resulting in some parts reduced (smudged) black while others are oxidised red (Rye 1981 table 3, p. 102ff.).

The most commonly manifested differences in oxidation potential of the firing atmosphere are the black reduced or carbonised interior of the sherds with a red oxidised surface. This could be due to differing oxidation states of iron compounds between ferrous (Fe2+) and ferric (Fe3+), or to unoxidised or deposited carbon. As a consequence of this, analysis of small sherds which could come from any part of the pot, and therefore from areas exposed to variable temperatures during firing, will form an unreliable guide to the overall firing technology (though representing one particular state).

Techniques of Analysis

Assessment of firing temperatures of ancient ceramics has been of interest for many years and numerous techniques have been employed to investigate them (Rice 1987 : 386 ff.). Intoh, in her study on Pacific ceramics, outlined many of these methods (Intoh 1982). Clearly, most of the techniques are inapplicable to Oceanic ceramics owing to the generally low firing temperatures achieved by the `open firing' technique or because of the complexity referred to above. For instance, the use of differential thermal analysis (DTA) for temperature determination of low-fired ceramics, particularly complex mixtures, is extremely difficult (Rice 1987 : 387). Another inappropriate analysis is that of vitrification fronts (Tite and Maniatis 1975).

XRD analysis

X-ray diffraction is a well established technique for mineralogical identifications and has been of value in determining mineralogical changes occurring in heated ceramic materials. It is not thought to be a satisfactory technique for ceramics fired in the intermediate range of 550°-900°C (the usual firing range of Oceanic ceramics). This is because of the lack of mineralogical change occurring over this temperature range : below this temperature clay retains its lattice structure, while above 900°C we see the formation of

mullite and the onset of vitrification (Rice 1987 : 432). However, while this is true of kaolinite clays, illite clays are informative between 500°C and 950°C (Isphording 1974).

In the present study a Philips diffractometer was used to determine the crystalline mineral constituents of powdered ceramic samples from sites SE-SZ-8, SE-RF-2 and SE-RF-6 in the Reef/Santa Group (Green 1976), and the phase transitions on heating shell particles. Each mineral phase produces a characteristic diffraction pattern which is then identified by reference to standard patterns. However, minerals in small amounts will not be detected, many minor ones will be masked by the bulk phases and interpretation of the major phases is often confused by overlapping diffraction lines. As a result, not all samples could be characterised with any certainty, but it was possible to classify the samples into predominant temper groups : feldspars, pyroxene and shell tempers.

The technique was also used to determine the mineralogical changes occurring during both the refiring of archaeological samples and the firing of experimental ceramics and shell particles over a range of temperatures.

ESR analysis

Electron spin resonance spectrometry (ESR) is finding increasing uses in the field of archaeology, primarily in dating, where it has been applied to materials such as sediments and bone (see Ambrose and Mummery. eds. 1987). A brief review of the techniques is given by Ikeya (1987). It is based on the fact that radiation gives rise to electron defects which increase with time, and it is essentially the characterisation of the paramagnetic behaviour of electrons trapped in the lattice structure of the materials (location, intensity, etc.) It has also been applied to the study of heat treatment on flint (Robins et al. 1978), and to the measurement of firing temperatures of ancient ceramics (Warashina et al. 1981). The latter study employed two properties of fired clay : the relative intensities of its signal types and a second method known as colour centre ESR whereby fired clay matrices, when irradiated, show colour centre signals dependent on firing temperature.

In the present study it was intended to use this technique to obtain both dating and thermal information from the Reef/Santa Cruz ceramics, particularly as they derive from deposits with three significantly different C14 dates (Green 1976, 1991).

The main aims were to provide a means of assessing the dating technique and to discern any changes in firing technology. The analyses failed to provide dating evidence, but did provide some insights into firing temperature (see below).

Refiring Experiments

In theory, when ceramic sherds are refired at various temperatures they will remain unchanged (structurally, chemically and mineralogically) until the original firing temperature is exceeded. Such changes thus provide a means of evaluating the thermal history of the sherd. In reality, however, this will rarely be the case owing to changes incurred on use and deposition.

Earlier experiments have been carried out in an electric kiln and the accompanying mineralogical changes reported (e.g. Segnit, E. appendix G. in Intoh 1988). On this occasion refiring times of 1 hour were used (Intoh 1988 : 169), while in a previous occasion a 30 minute soakage time was used to observe colour changes (Intoh and Leach, 1985 : 93). As

mentioned above, much of the data relating to ceramic materials is based on pure minerals and equilibrium conditions. Segnit used similar techniques in experimental firings of some of the Yap clays and ceramics. The use of refiring times of one hour resulted in the appearance of hematite at 800°C with a strengthening of the feldspar pattern indicative of a reaction between the lime and the clay matrix at this temperature. Calcite was observed to decompose at this temperature. One of the problems here, is that both refiring time and soakage time at maximum temperature were not reported as although the latter is possibly most important, both will influence the kinetics of mineral transformations. In addition, the refiring and soakage duration was considerably longer than observed in ethnographic open firings in Oceania (see Rye 1981, table 3, p102). The latter have a total duration of ca.25 minutes and only around 5 minutes at maximum temperatures. Thus, while indicative of trends, these hour long experimental results must be treated with caution. For instance, in the short open firings, there would be very little interaction between lime and the clay matrix and the breakdown of calcite would not necessarily be marked (as seen in Rye's experiments (below)).

We know that phase change in ceramic and similar systems is not only dependent on composition and temperature, but also on duration at particular temperatures (see shell XRD results). The multiplicity of factors affecting the course of chemical reactions upon firing include the following :

composition (mineralogical and chemical),
particle size and distribution,
temperature (a principal consideration),
rate and duration (almost as important),
mass of material,
pressure,
vapour pressure,
atmosphere,
surface phenomena,
crystallographic structure and properties,
changes of state (solution, fusion, etc.),
intimacy of association,
(After Grimshaw 1971 : 569).

In view of the above, in particular the importance of temperature and the rate and duration at specific temperatures, firing times of one hour would greatly exaggerate the extent of mineralogical change and effectively reduce the perceived firing temperature.

In the decomposition of calcite,

$CaCO_3 = CaO + CO_2$ (decomposition reaction)
(calcite = lime + carbon dioxide),

the pressure of carbon dioxide is the rate determining factor. For this reason a high partial pressure of CO_2 will inhibit the reaction unless the gas is removed. In an electric kiln, carbon dioxide partial pressure would be less than that encountered in an open firing and thus would move the equilibrium of the reaction above to the right (effectively speeding up the breakdown), again tending to reduce the estimated firing temperatures (and the breakdown temperatures of the carbonates concerned).

Ethnographic Insights

Our understanding of prehistoric pottery technology in Oceania relies almost totally on ethnographic information, and with regard to firing technology, valuable studies have been carried out by several researchers (Irwin 1985, Rye 1981, Lauer 1971).

Such sources of data have been used to guide the experimental and analytical methods and conclusions of this study.

Irwin, during his observations on the potters of Mailu, measured and recorded aspects of the firing technology - temperature and duration of firing. After drying and preheating, pots were fired by covering them with palm fronds and applying a torch. Firing times were around 25 minutes with a rapid temperature increase of around 100°C/minute.

To measure the temperature, thermocouples were placed on or as near as possible to the surface of the pots, `never more than a few millimetres away' to ensure that the temperature recorded was not merely that of the heated gases (Irwin 1985 : 29). However, without actually inserting the thermocouples into the ceramic this cannot be assured, especially as it is near the surface of the pot that convectional currents would be prevalent. The author has carried out numerous experiments in small furnaces and observed that small adjustments to the thermocouple position could drastically (±100°C) alter the recorded temperature. Pots were removed from the fire when they had reached the required redness (Irwin 1985 : 49).

In examining the recorded temperatures several points are evident. There is as much as 300°C variation in the maximum temperature achieved in various parts of the pot, with the base recording the highest (c.900°C) and parts of the rim the lowest (c.600°C). Interior temperatures at the base were over 100°C lower than those of the exterior, while elsewhere on the pot they tended to be slightly higher. This was the case when the pot was inverted in the open fire and different patterns would be expected with variations in firing position (such as multiple pots or stacked on base or side).

The average duration from maximum temperature to withdrawal of the pot was ca.4 minutes, and as the pots were withdrawn soon after the temperature began to fall one can assume that this time represents the duration at maximum temperature.

What is also important is that different parts of the pot heat at different rates with faster rises at the shoulder than any other monitored area (Irwin 1985). This would enable certain reactions, such as sintering, to progress further. It was also observed that there was a significant variation between potters in maximum temperatures achieved at any point on the pots, and this was often greater then 100°C. (see tables 2-4, Irwin 1985 : 32-33).

A study of potters on Yap indicated that there was considerable variability in the chemical and mineralogical composition of the clays chosen by the potters. This is particularly highlighted in the silica : alumina ratios of clays used within and between villages (Fig. 1)(derived from data presented by Claridge in Intoh and Leach 1985).

The principal clay component was montmorillonite, with illite and vermiculite present in some samples and kaolinite in small quantities in all. Such a mixture of clays would affect firing properties and analysis thereof. It would also undermine the use of simple ratios for the sourcing of clays/ceramics, a point often overlooked in such studies.

Thermal Changes On Firing of Clays

Clays and tempered ceramics undergo several mechanical, chemical and mineralogical changes during the firing process : loss of organics ; loss of absorbed and combined water ; expansion ; shrinkage ; phase transformations ; etc (for an extensive discussion of these changes see Rice 1987 : ch. 4).

Many of these changes have been employed in studying the thermal history of ancient ceramics. For example, clays lose their crystalline structure and hence ability to diffract X-rays upon dehydroxylation at temperatures c.500°C-600°C, and thus if fired above these temperatures ceramics will not exhibit characteristic peaks for the clay minerals.

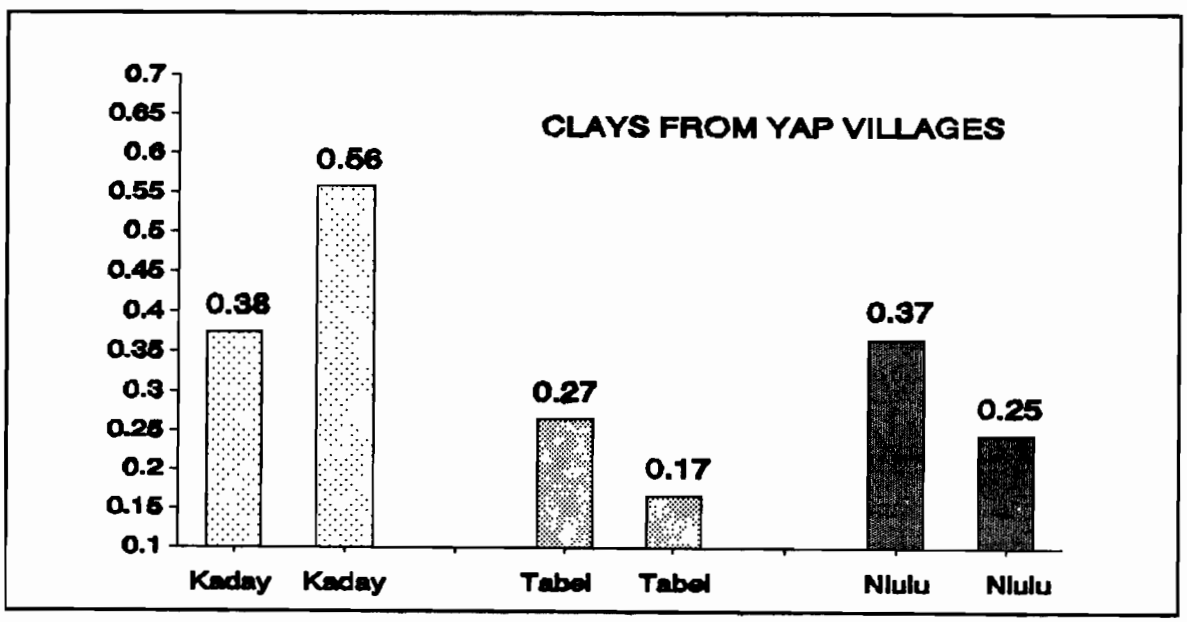


Figure 1. Variations in silica : alumina ratios - inter and intra village

However, as often is the case, such studies are complicated by the complex nature of the changes, and in the case of the above reaction there is some evidence to indicate that it is in part reversible (Grim & Bradley 1948 and Magetti 1982). In fact, clay minerals have been known to rehydrate even when heated to c.800°C, though this depends on conditions and may take several years (Grimshaw 1971 : 570). The conditions under which this occurs, however, are easily achieved in archaeological deposits. Thus diffraction patterns (d-spacings) relating to the presence of clay minerals could derive not only from the formation of clays from weathering of the ceramic minerals, but also from this reversible reaction.

The Problem of Shell Temper

Calcareous or shell tempered pottery is commonly found in Oceania and its technological significance has been the focus of several studies (e.g. Rye, 1976 ; 1981 ; Stimmell et al. 1982 ; Maggetti 1981).

The use of any particular temper may relate to functional considerations, raw materials available, firing technology or other cultural reasons. In some cases the use of shell appears to be associated with the production of cooking vessels, owing to its thermal properties (shell tempered pottery is considerably more resistant to thermal shock than sand

tempered - Bronitsky and Hamer 1986 : 96). It is also possible that the change from predominantly calcareous temper to plagioclase feldspathic tempers, such as observed at the Reber-Rakival site on Watom (Green and Anson 1987), might relate to a change in firing technology (e.g. firing at higher temperatures in order to produce pottery suited to different functions). This has been suggested because shell deteriorates at temperatures above c.800°C, and consequently would be unsuitable temper material for ceramics fired at higher temperatures.

The thermal changes associated with calcite have been widely commented on, but there is considerable variation in the temperatures reported for its breakdown. Figures ranging from 500°C to 900°C can be found in the archaeological literature.

At times these are just inaccurate (e.g. 650°-750°F Bronitsky and Hamer 1986 : 97), but the variation reflects the use of equilibrium reactions, i.e. those observed with pure minerals are held at the temperatures in question for at least an hour. Certainly, at 900°C the breakdown from the carbonate to the oxide (lime) is rapid, but at the lower temperatures (<750°C) it is considerably slower.

Rye carried out a series of experiments designed to test the effect of shell tempers on the stability of ceramic fired over a range of temperatures and the effect of salt water and varying proportions of sand temper : 0% - 40% at 5% intervals (high content of shell) and at intervals of 100°C from 650°C to 1000°C. The results purport to illustrate the considerable deleterious effect of lime breakdown and rehydration resulting in severe disintegration of the experimental blocks. However, this was only manifest in the clays worked with fresh as opposed to salt water. (Particularly at temperatures above 850°C)

Several ethnographic potting communities state a preference either for or against the use of salt water and there have been various suggestions as to how the salt inhibits the breakdown of the ceramic (Rye 1976 & 1981 ; Stimmell et al. 1982). It seems most likely that the strong fluxing action of sodium promotes low temperature onset of sintering or vitrification, resulting in a stronger and less porous ceramic. The ternary eutectic of the sodium-silica-alumina system is less than 740°C while that for the potassium system is lower still, at 695°C (Grimshaw 1971 : 570 ; Rye 1976). This means that at certain compositions of these elements a liquid phase will be formed.

What is curious is the observed deterioration of the unsalted blocks at the higher temperatures, for by 950°C and especially 1000°C, the lime should have interacted with the surrounding clay matrix to form calcium-silicates, thereby preventing the effects of rehydration. The deterioration is indicative of the slow reaction kinetics and the short duration of firing at those temperatures. And it confirms that the temperatures required for the breakdown of shell are rarely achieved.

Firing Temperatures : Experimental Results.

ESR results

A Varian ESR spectrometer was used to detect the electron spin resonance of powdered samples at room temperature . Initial measurements failed to produce the sharp paramagetic signals detected by Warashina's study (Warashina et al. 1981. Fig.1) and instead produced very intense broad peaks. The broad peaks seen in Fig. 2 relate to the ferromagnetic behaviour of mineral phases in the ceramic and effectively block out any

paramagnetic signal that might have been used for dating or temperature determinations (15 samples all produced similar broad peaks). When two samples were refired through a range of temperatures at intervals of 100°C from 600°C to 900°C (soakage of 5 minute at peak temperature), this broad peak was seen to diminish and eventually disappear by the latter temperature. The peak (on the left) began to reduce noticeably between 700°C and 800°C (Fig. 2). Refiring is assumed to 'reset the clock', and when fired above the original firing temperature the electron defects in the ceramic will disappear, thus reducing the ESR signal.

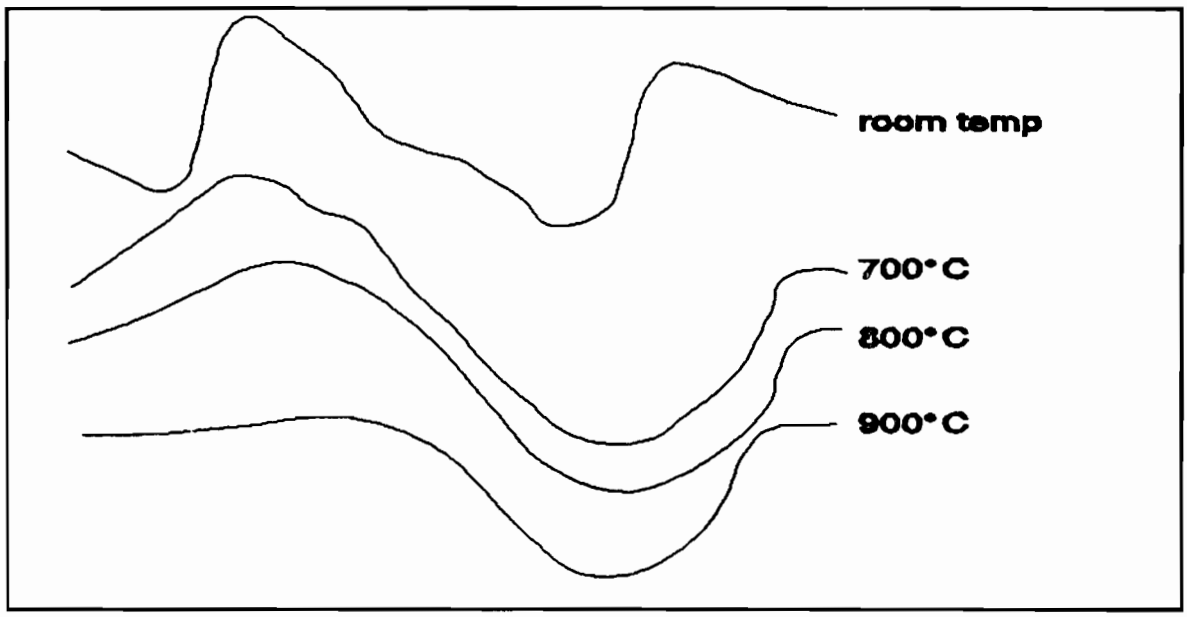


Figure 2. Effects of refiring on the ESR signal

This magnetism could derive from ferromagnetic minerals in the clay, but as magnetite is not known to occur to any great extent in potting clays it is possibly a product of firing. A more likely source is that of the temper minerals (magnetite, maghemite, ilmenite), as these ferromagnesian (FM) minerals have been identified as one kind of temper source used in Oceania (Dickinson and Shutler 1979). The immediate question relates to the significance of the diminishing effect of refiring : how does it relate to the original firing temperature?

Magnetite has a Curie point at c.590°C, above which (owing to disorder) it loses its magnetism. On cooling beneath this point it regains its magnetic properties. With the refired samples, this magnetism was not regained and thus a phase change must be assumed (i.e. transformation to a non-magnetic phase such as hematite). As previously mentioned, the magnetism could derive from temper minerals or be produced during firing under slightly reducing conditions. The black core, seen in section in many freshly fractured sherds, is indicative of such conditions. Scrapings were taken from the brick-red outer surface and from the core, which were then tested for magnetism. Only the latter displayed magnetic properties. Thus, if this magnetism was produced during firing (usually only retained in the coarser particles), we can assume that the firing did not exceed the conditions (temperature and atmosphere) required for the change to a non-magnetic phase. It is assumed that the beginning of the peak (signal) reduction represents a point below which the original firing occurred. Which, together with the lack of diffraction peaks for clay minerals, suggests a firing range between 600°C and 750°C.

However, the refiring tests were carried out under oxidising conditions, and as the thermal stability of particular minerals is a function of kiln atmosphere it then became necessary to carry out another series of tests with a controlled atmosphere, neutral to reducing, to confirm whether the same phenomenon occurred.

Shell Temper - Results of Firing Experiments

It should also be considered that all the information regarding these chemical/mineralogical changes derives from carefully controlled equilibrium firings of pure clays (Rice 1987), a far cry from the heterogeneity of raw materials and variable firing methods observed in Oceania. Thus, such information should be applied with caution to the study of archaeological ceramics.

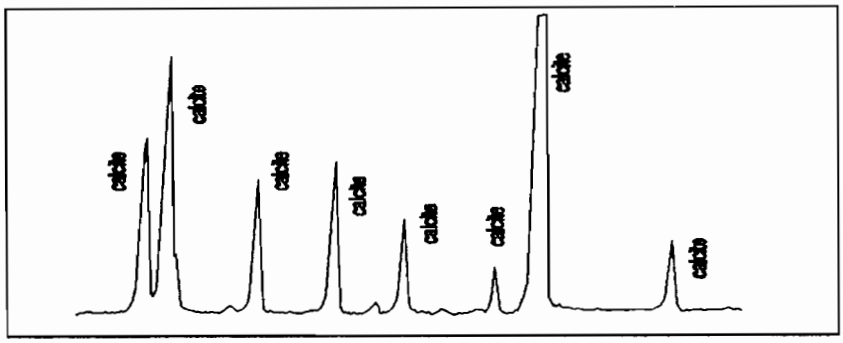
The author carried out experiments with shell particles to assess the behaviour of calcite on heating. Particles 1-2mm in size were heated to various temperatures with a soakage time of 5 minutes at maximum temperature (it was attempted to hold total firing time as close as possible to 30 minute). An attempt was made to approximate the rates of temperature increase observed ethnographically, i.e. c.100° per minute was calculated from Irwin's (1985) Mailu results. However, 30°/minutes was the maximum possible rate of increase for the kiln used for the experiments. To overcome this problem and more closely approximate the observed 100°/minute, samples were put in the kiln at elevated temperatures.

At 750°C there was no significant breakdown and the XRD pattern showed that calcite was the predominant mineral phase present with extremely weak development of the two strong peaks (d-values) for lime (Figure 3). By 800°C and 850°C, while we can observe a slight increase in the proportion of lime (CaO) the predominant phase is still calcite. At 900°C, while CaO was the major phase present, there was still a large proportion of calcite. Tests were carried out on shell rather than shell temper in ceramic and thus were in conditions more favourable to breakdown of carbonates with carbon dioxide being removed from the reaction surface and none being produced in the combustion of the fuel. Also, the shell particles were not sealed within a ceramic matrix and thus would be more prone to breakdown. Therefore it would appear unlikely that the breakdown of calcite was a common occurrence in pots fired by the open technique. I also observed that test blocks (clay with shell temper) appear to break down before rehydration and the formation of the hydroxide. In view of these findings it would appear necessary to re-examine some of the assumptions about the role of shell temper in Oceanic pottery.

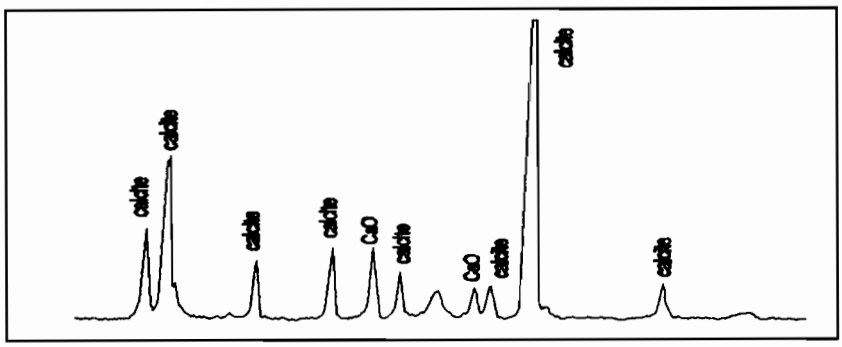
It has been suggested that the rehydration of lime causes the structural breakdown of the ceramic and because of this potters changed to different tempers or used salt water (Rye 1981 : 107 ; Bronitsky and Hamer 1986, and others). It is assumed that the breakdown is the result of the increase of volume as calcia (CaO) hydrates to calcium hydroxide (Ca(OH)2). However, what is overlooked is the overall reaction and its environment :

$CaCO_3 = CaO + CO_2$ (breakdown of calcite)
(37) -> (17) (approximate molar volumes)

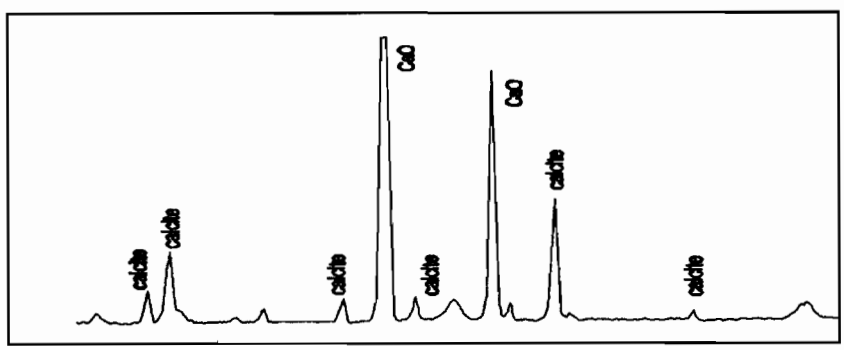
$CaO + H_2O = Ca(OH)_2$ (hydration of lime)
(17) -> (34) (approximate molar volumes)



Shell fired at 750°C for 5minutes.



Shell fired at 850°C for 5 minutes.



Shell fired at 900°C for 5 minutes.

Figure 3. XRD demonstrates the mineral changes in shell on heating

The above reactions represent the breakdown of calcite and the subsequent rehydration of lime. The units below each phase represent the volume changes occurring in these reactions (see Fig. 4).

The experiments above indicate that there will be very little breakdown of calcite under the firing methods predominant in Oceania. However, where breakdown does occur, it will do so after the clay matrix has been fired and the shell particles are occupying a defined space within it (Fig. 4). Therefore, considering the reactions and volume changes above, the initial breakdown product (CaO) will occupy approximately half of the space defined by the original shell particle. If and when rehydration occurs (depending on porosity), the hydroxide (Ca(OH)2 will occupy a space comparable (or slightly less) to that of the original volume.

As a result of these considerations the reactions of calcite breakdown seem unlikely to exert significant structural stress on the ceramic. It was observed that test blocks with similar percentages but different sizes of shell inclusions reacted differently on exposure to the atmosphere. Those with larger shell particles (c.3-5mm) rapidly degenerated while those with particles <1mm were relatively stable. These findings would suggest that the larger particles are, by their size and inert nature, introducing structural weakness into the ceramic. This accords well with a recent study on the effects of various tempering materials on impact and thermal shock resistance. Results indicated that ceramics with a fine-grained shell temper were considerably more resistant to cracking than those with coarse grained temper (Bronitsky and Hamer 1986 : 94).

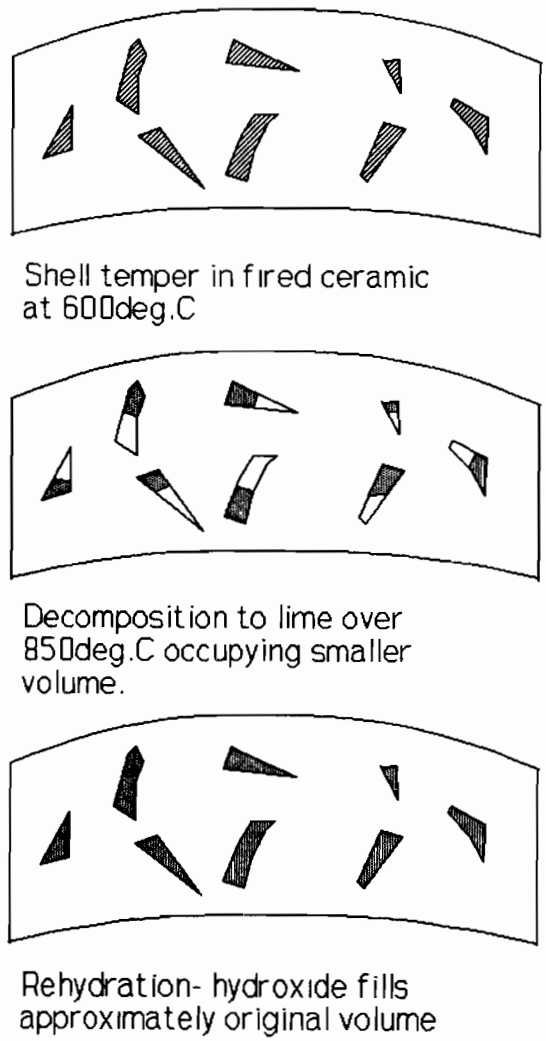


Figure 4. The effets of firing on shell temper

Such findings are also suggestive of the role of salt in ceramics (as in the use of salt water in the clay). Salt is not necessarily reacting with the shell, as suggested by Stimmell (et al. 1982), but strengthens the clay matrix by enabling lower temperature sintering of the clay particles as suggested by Rye (1976).

XRD analysis of numerous sherds and observed optical properties indicated the heterogeneous nature of the sherds under study. Because of heterogeneity even within a single sherd, the same sample must be used for refiring to the different temperatures. To ensure homogeneity the sherd must be ground, blended, and portions used to heat to the required temperatures. However, the use of powdered samples alters properties such as particle size and distribution, surface phenomena, intimacy of association and porosity, and undoubtedly influences reaction rates, thus complicating interpretation of results.

While complicating analysis, the results indicative of heterogeneity are, however, also indicative of the level of clay mixing. They suggest that the clays and temper were only roughly worked prior to forming the pot.

Analysis of sample RF2/161 suggests that two different types of tempered clay were used in construction of a decorated pot, shell and non-shell tempered, with the latter clay used for the formation of the rim. These observations could be interpreted in various ways. For instance, are there a) two tempers in the same clay, b) two differently tempered clays, c) two clays, one with natural temper, the other with added shell, or d) is it just a case of poor mixing? The analytical expectations would also vary for each case : in case a), analysis of the clay matrix would indicate a similar composition with minor quantities of the source rock being petrologically similar and the petrology or analysis of the tempers markedly different. In b), both temper and clay will differ in composition, while in c), effects will be similar to (b) but the native inclusions should indicate a relationship with the clay matrix. Case (d) will be similar to (a) and the intentions of the potter will only be revealed if specific parts of the pot are consistently with or without temper such as in the case of separate clays being used for forming the rim of the pot. In case (d), poor mixing will be evident throughout the pot. If (a) is the case, then does the use of different clays/tempers have a functional significance or can it be explained by the method of production, such as the rim being added at a later date using a different batch of clay?

CONCLUSIONS

Ethnographic studies by Irwin, Rye, and others provide insights into reconstructing the thermal properties of Oceanic ceramics. From the results of such studies one can infer that strict control over location of the sample on the pot (rim, shoulder, etc,) would be required if any accurate reconstruction of firing technology was to be achieved and changes through time assessed. Even where this could be achieved, it would be hindered by the unknown variable of single versus multiple pots in a firing. In the latter case it cannot be assumed that all rim sherds, for instance, would be exposed to comparable temperatures.

However, the problem has many complex strands that will only be disentangled when a considerable number of experimental firings have been carried out. As yet, while there are ethnographic observations of temperature attained on various regions on a pot (rim, etc), there is no test for consistency. That is, measurements from numerous points on the rim, shoulder, base, etc. To overcome the problem of heterogeneity (so evident archaeologically) a number of rim, base, and shoulder sherds from each collection would have to be analysed for trends to be discerned. Such testing is time consuming and expensive, and in the light of individual and group firing variability, it seems that the outcome of such studies may not really warrant the time and effort required.

Archaeologically the lack of evidence for kilns indicates that we are dealing with low-fired earthenware, fired in simple open fires which give rise to extremely heterogeneous conditions of atmosphere and temperature, and consequently a large (but low) range of firing temperatures, typically from c.500°-900°C. XRD results and observations of some sherds which indicate poor sorting and mixing of the original clays and tempers, plus in some cases at least the production of composite pots, must make one circumspect of any ceramic analysis based solely on a small sample of individual sherds.

ESR spectrometry has potential for determining firing temperatures of ceramics and is possibly also of value in dating them. However, in this study the strong ferromagnetic character of the Reef/Santa Cruz ceramics made the latter impossible but did provide another technique for assessing firing temperatures within the otherwise difficult range of 600°C-900°C, and suggested a firing temperature of c. 600°C-750°C.

Experiments with shell temper indicated that its breakdown and rehydration is unlikely over the firing range used in Oceania and thus it is unlikely to be the cause of ceramic deterioration. However, size of the shell particles is obviously influential in the strength of the ceramic : the larger the particles, the weaker the structure. The use of salt water in preparation of the pot to some extent offsets this effect by strengthening the clay matrix of the vessel. It would be of interest to investigate the effect of periodic reheating of shell tempered pots (as in the case of cooking vessels), for while shell-tempered ceramic has good thermal shock properties, such reheating may well contribute to the breakdown of shell, especially if combined with exposure to food acids. The results are suggestive rather than conclusive and further experiments are presently being conducted to evaluate other variables such as atmosphere (reducing vs oxidising) and thickness of sherd.

On occasion some samples will be obviously superior with respect to their technical properties - toughness, hardness, density and strength - and represent a fairly rare combination of high quality clays combined with firing at higher temperatures.

Any study or model of ceramic technology in Oceania must incorporate considerable heterogeneity : in paste and temper, at intra and inter assemblage levels. It is evident that there is not a firing temperature for Lapita pots but a range in which firing temperatures may be expected for individual sherds and that these may relate to partial pots, functionally different pots with varying paste and temper, and to whole assemblages.

Short of assessing complete archaeological samples, studies of a small number of sherds will probably prove to be of limited value to archaeological reconstruction of the firing aspects of ceramic technology in Oceania. And where whole pots do exist they are unlikely candidates for destructive analysis required for temperature determination.

Perhaps one of the more interesting observations / conclusions drawn from this study is the versatility (flexibility) of the technology. The firing procedure is simple, without kilns or high temperature requirements things can rarely go seriously awry. Even broken or misfired pottery can be recycled into the next batch. This simple low-firing regime accommodates considerable variation in composition (both clay and temper) and allows the use of any small deposit of clay often with little modification. Higher temperature regimes (processes) have far more stringent requirements of the raw material used - greater homogeneity, fewer incidental inclusions, better mixing, etc.

What is generally lacking in Oceania is the ability to produce impervious ceramics - the stonewares, glazed wares, bone china, porcelain of the high temperature kilns. However, the need for high temperatures here is largely overcome by the use of sealings : slips and resins which overcome the inherent porosity and replace the role of sintering or fusion in high temperature firings. It is possible that the use of salt enabled incipient fusion, thereby reducing porosity and strengthening the ceramic. With such an adaptable, flexible technology it is hardly surprising that we find so little change over throughout hundreds of years of Oceanic pottery production.

Acknowledgments

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ANALYSE TEST SUR LES DECORS DES BANDEAUX PRINCIPAUX DE LA POTERIE LAPITA DU SITE WBR001 DE NOUVELLE CALEDONIE

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RÉSUMÉ

Cette étude, effectuée sur du matériel céramique provenant du site de Nessadiou à Bourail, nous a permis de tester notre méthode d'analyse des motifs principaux dans la décoration de la poterie Lapita. Elle est réalisée à partir d'un programme informatique de saisie de données extraites individuellement de chaque tesson de poterie provenant de ces fouilles archéologiques.

Après de rapides pourcentages sur la quantité et la position générale des matériels décorés, cette analyse fait apparaître la fréquence des différents "Caractères-thèmes" retenus dans la décoration lapita, par raport à leurs positions sur la poterie. Elle permet ainsi de vérifier que la conception de cette méthode reste logique, même si elle met en évidence une différence entre certains décors. Il est à noter que dans cette analyse, il n'est pas tenu compte, ni du niveau, ni du diamètre de la poterie.

ABSTRACT

This study, based on ceramic material from the Nessadiou site, near Bourail, allowed us to test our method for analysing the major decoration motifs in Lapita pottery. It was done by entering data observed on individual sherds found in the course of these excavations into a computerized data processing program.

Following a brief presentation of the percentages obtained for quantity and position of decoration on the sherds, this analysis shows the frequency of the various "Theme-Characteristics" used in the decoration of Lapita pottery. It provides the means of checking that the method's conception retains its logic, even where it brings out a difference between certain patterns. Note that the analysis does not take either the level or the pot's diameter into account.

INTRODUCTION

Cette étude des décors de la poterie Lapita de Nouvelle Calédonie porte sur l'ensemble du matériel recueilli sur le site de Nessadiou (WBR001) par D.FRIMIGACCI. Elle prend en compte également la fouille du sondage "A" situé plus à l'ouest, qui a été réalisée en 1977 lors de la reconnaissance de ce site.

I - PRESENTATION DU SITE

En 1976, une personne du village de La Foa qui s'était fait livrer du sable en provenance de Nessadiou, y découvrit par hasard des tessons de poterie. Quelque temps après, au cours d'une visite du site, MM. Chevalier et Frimigacci trouvèrent des fragments d'une poterie originale. Il fut décidé d'exploiter scientifiquement cette partie de la zone

dunaire, utilisée depuis plusieurs années comme carrière de sable. Après des sondages positifs, une aire vierge à l'abri de la forêt fut délimitée afin de procéder à la fouille de niveaux en place non remaniés. Ces fouilles effectuées à partir du mois d'août 1979 au milieu des pelleteuses et des camions de l'exploitant de la carrière furent conduites par D.Frimigacci. Laissons le les décrire

-" Il restait encore en place une portion de dune vouée à la destruction. D'autre part, le décapage superficiel d'une portion de la dune par les engins mécaniques m'a incité à rechercher sur cette très grande surface, des structures laissées au sol. La fouille des chantiers A, B, C menée sur la dune en place a permis de connaitre la stratigraphie du site ainsi que les différents niveaux culturels venus s'installer là. Elle a surtout permis de situer dans le temps et l'espace les importantes structures au sol trouvées dans la carrière par la fouille des chantiers D, E, F, G, H, I, J et K. Le site se trouve sur une formation dunaire et on constate une occupation continue de cette dune jusqu'à la période contemporaine. Les chantiers A, C et B mettent en évidence les séquences suivantes : en surface de la dune, on trouve des tessons de poterie caractéristiques des ensembles culturels melanésiens. Une surface d'occupation en place a été observée sous 0,10 m. d'humus. Dans ce niveau 1 on trouve également quelques tessons de poterie Lapita. Un remplissage archéologique sépare ce niveau 1 du niveau 2 suivant, qui apparaît par endroits à 0,25m et 0,30m de la surface. Le décapage a permis de mettre en évidence, également, une surface d'occupation dans un sol bleuté, caractérisé par de la poterie Lapita et imprimée au battoir. A la base de la séquence (niveau 3) on rencontre une plus grande densité de vestiges. Ce niveau se trouve à des altitudes diverses selon le cas mais toujours à la base du remplissage archéologique. Le sable dunaire stérile vient ensuite. Ce niveau se rencontre à 0,54m de la surface au chantier A, à 0,45m au chantier B, en a2 tandis qu'il apparaît à 0,60m en a7 de ce même chantier. C'est à ce niveau ancien 3 qu'appartiennent les vestiges mis au jour dans la carrière : chantier D, E et F pour la poterie."- (Frimigacci, D.,1979)

Les chantiers G, H, I, J et K présentent des restes de structures d'habitat sans aucun tesson de poterie ; le chantier F contient les vestiges d'un fond de four et les chantiers D et E sont deux fosses à détritus.

II - MISE EN PLACE DE L'ANALYSE

A. LES MOTIVATIONS

Un long travail de traitement des nombreux tessons de poterie a été entrepris. Outre le nettoyage, les remontages possibles et évidents, il fallut emmagasiner, dessiner et noter les quelques huit mille tessons de cette fouille sur fiches perforées. Ce travail, échelonné sur trois ans, fut réalisé par plusieurs vacataires.

Plus tard, après bien des difficultés, nous avons mis en place un programme informatique d'analyse originale des décors. Ce programme, léger en saisie de données , peut être utilisé sur le terrain. Seule la restitution graphique du décor n'a pu être réalisée. Elle est à l'étude. Elle permettra de visualiser les décors à la saisie des données, et de corriger les erreurs.

B. LES PREMIERES CONSTATATIONS

Le matériel archéologique du site de Nessadiou a servi de test pour ce programme dont les données ont été saisies à partir des fiches perforées, accompagnées des tessons correspondants.

Le premier constat quant à l'utilisation du programme, fait apparaître une faiblesse au niveau de la saisie des tessons sans forme ni décors. En effet, l'indexation automatique, très rapide au début, ralentit considérablement la saisie vers les mille tessons enregistrés, de 30 secondes à 2 minutes vers le numéro 2000 sont nécessaires après chaque nouvelle entrée

Il serait possible de transférer les données acquises sur un fichier extérieur libérant ainsi le fichier résident. Les données sont saisies sur un portable PC 8088 de 640k de mémoire avec disque dur sans coprocesseur ; il est possible d'améliorer la rapidité de réponse par l'adjonction d'un coprocesseur ou l'utilisation d' un XT 286 ou un AT 386.

En second la saisie elle-même des données présente des défauts. En effet des erreurs ont été notées, dues à divers facteurs dont le premier est le nombre des vacataires ayant opéré la saisie. La lecture manque de rigueur et les interprétations réalisées sur les tessons et sur les fiches varient d'une personne à l'autre.

Les erreurs de dactylographie sont nombreuses.

Les tableaux utilisés dans le programme, concus pour analyser le maximum d'information sur le décor, laissent à l'usage trop de marge à l'interprétation personnelle.

L 'ensemble de ces observations a permis de restructurer les tableaux de saisie et de leur adjoindre une représentation graphique basée sur le même système de codification.

III DESCRIPTION DE L'ENSEMBLE DES TESSONS

A. NOMBRE ET SITUATION

Sur un total de 8175 tessons numérotés, 7875 d'entre eux ont été analysés. En effet deux erreurs se sont glissées dans la numérotation des tessons au moment de leur prise en compte. La première par le passage direct du numéro 1439 au numéro 1640 sur le registre des entrées. La deuxième par l'impossibilité de retrouver une boîte contenant 100 tessons sans forme ni décor. L'ensemble des tessons analysés se répartit de la manière suivante :

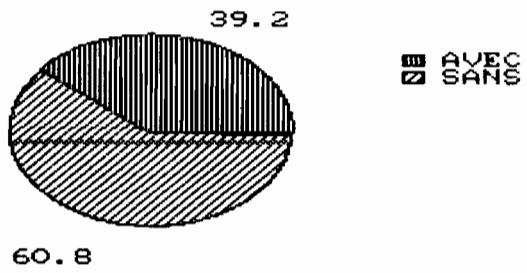

Figure 1. Tessons décorés ou non décorés

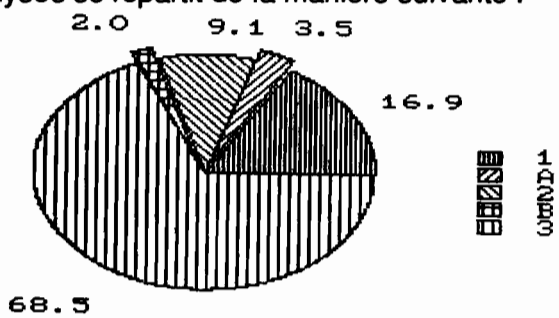

Figure 2. Répartition des poteries suivant les niveaux du site

Le nombre des tessons décorés analysés s'élève à 3069, ce qui représente 40% de l'ensemble. (fig 1). La majorité d'entre eux se trouvent dans le niveau 3 (68%) (fig 2). Dans le chantier E les tessons décorés sont plus nombreux que les tessons non décorés (fig3).

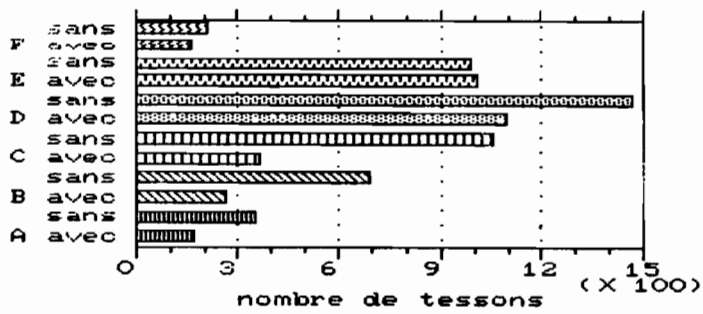

Figure 3. Répartitions des tessons décorés (avec) et non décorés (sans) par chantier

B. POSITIONS ANATOMIQUES

Les fragments de poteries remarquables ont été regroupés en 9 familles (les termes entre parenthèses renvoient au code utilisé dans la programmation) : les bords (BORDS), les encolures (ENCOL), les épaulements (EPAUL), les carènes (CAREN), les hauts et bas de carène (HTCAR et BSCAR), et les coupes (COUPE). D'autres éléments tels que les fonds plats, anses et accessoires utilisés pour la préhension ont été regroupés dans la catégorie (AUTRE). La catégorie indéterminée (INDET) regroupe tous les tessons décorés, dont la position n'est pas discernable du fait de leur surface trop réduite.

Table 1 - Répartition des familles par chantier

CHANT	INDET	CAREN	BORDS	ENCOL	EPAUL	COUPE	HTCAR	BSCAR	AUTRE	Total
A	113	19	27	5	3	0	0	1	0	168
	7,7	3,8	5,6	1,7	1,2	0	0	5,0	0	5,5
B	183	27	43	3	6	0	0	0	1	263
	12,5	5,4	8,8	1,0	2,5	0	0	0	5,0	8,6
C	254	53	50	6	3	0	0	0	1	367
	17,3	10,6	10,3	2,0	1,2	0	0	0	5,0	12,0
D	404	195	184	140	148	0	2	12	12	1097
	27,5	39,0	37,9	46,8	61,4	0	11,1	60,0	60,0	35,7
E	423	180	146	144	76	16	16	7	5	1013
	28,8	36,0	30,0	48,2	31,5	100,0	88,9	35,0	25,0	33,0
F	92	26	36	1	5	0	0	0	1	161
	6,3	5,2	7,4	0,3	2,1	0	0	0	5,0	5,2
	1469	500	486	299	241	16	18	20	20	3069
Total %	47,9	16,3	15,8	9,7	7,9	0,5	0,6	0,7	0,7	100,0

Table 2 - Répartition des familles par niveaux

NIV	INDET	CAREN	BORDS	ENCOL	EPAUL	COUPE	HTCAR	BSCAR	AUTRE	Total
1	165	38	46	2	5	0	0	0	2	258
	11,2	7,6	9,5	0,7	2,1	0	0	0	10,0	8,4
A	64	10	10	2	1	0	0	0	0	87
	4,4	2,0	2,1	0,7	0,4	0	0	0	0	2,8
2	158	31	35	4	1	0	0	1	0	230
	10,8	6,2	7,2	1,3	0,4	0	0	5,0	0	7,5
B	58	8	8	0	0	0	0	0	0	74
	3,9	1,6	1,6	0	0	0	0	0	0	2,4
3	1024	413	387	290	234	16	18	19	18	2419
	69,7	82,6	79,6	97,0	97,1	100,0	100,0	95,0	90,0	78,8
	1469	500	486	299	241	16	18	20	20	3069
Total %	47,9	16,3	15,8	9,7	7,9	0,5	0,6	0,7	0,7	100,0

Les tables 1 et 2 montrent la fréquence de chacun des groupes définis dans les chantiers (table 1) puis par niveaux (table 2).

Comme on pouvait s'y attendre les éléments remarquables sont très abondants dans les chantiers D et E ; ils sont moins fréquents dans les chantiers B et C ; il y en a très peu dans les chantiers A et F.

Dans les chantiers D et E, les encolures sont très abondantes, elles apparaissent essentiellement dans le niveau 3 (97%). Les carènes viennent ensuite dans le chantier D ou elles sont également représentées dans le niveau 3 (82%) mais aussi dans les niveaux 1 et 2 (7,6% et 6,2% respectivement). Les bords respectivement au nombre de 38% dans le chantier D et 30% dans le chantier E, sont abondants dans le niveau 3 (79%), également représentés dans le niveau 1 (9,5%) et 2 (2,7%), et très peu fréquents dans les niveaux A et B.

La tendance observée pour ces 3 catégories remarquables peut être généralisée : la majorité des tessons significatifs se trouvent dans le niveau 3 des chantiers D et E. Les autres niveaux se partagent le reste.

C. LES DECORS

Les tessons décorés observés dans le site représentent plusieurs traditions que l'on peut classer en plusieurs types : L'incisé de la période de Naïa Oundjo (INCI) (Galipaud 1988), la tradition Lapita de la période de Koné qui comprend trois variantes : le Lapita géométrique (GEOM) (Frimigacci 1978), le Lapita pointillé d'accompagnement (PNTA) et le pointillé du bandeau principal (PNTB) (Siorat 1990). Les tessons décorés trop petits sont classés dans les indéterminés (INDT). Le dernier groupe comprend les tessons sans décor (SANS) mais dont la forme est signifiante.

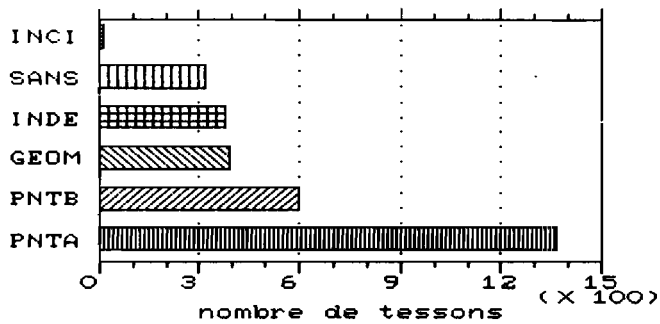

Figure 4 - Fréquence de chaque type de décors

Table 3 - Table de répartition des décors en fonction de la position

DECOR	INDET	CAREN	BORDS	ENCOL	EPAUL	COUPE	HTCAR	BSCAR	AUTRE	Total
PNTA	497	247	337	86	148	16	12	13	10	1366
	33,8	49,4	69,3	28,8	61,4	100,0	66,7	65,0	50,0	44,5
PNTB	291	63	11	159	68	0	4	3	0	599
	19,8	12,6	2,3	53,2	28,2	0	22,2	15,0	0	19,5
GEOM	221	87	21	44	17	0	2	0	1	393
	15,0	17,4	4,3	14,7	7,1	0	11,1	0	5,0	12,8
INDT	310	38	19	6	5	0	0	1	0	379
	21,1	7,6	3,9	2,0	2,1	0	0	5,0	0	12,3
SANS	141	65	93	4	2	0	0	3	9	317
	9,6	13,0	19,1	1,3	0,8	0	0	15,0	45,0	10,3
INCI	9	0	5	0	1	0	0	0	0	15
	0,6	0	1,0	0	0,4	0	0	0	0	0,5
	1469	500	486	299	241	16	18	20	20	3069
Total %	47,9	16,3	15,8	9,7	7,9	0,5	0,6	0,7	0,7	100,0

IV ANALYSE DU DECOR "BANDEAU PRINCIPAL" LAPITA

Nous avions déjà décrit deux types de décors pointillés, (Siorat, J.P., 1990 : 61-63) :

L'un, composé, est constitué d'un ensemble de traces d'outils différents formant un thème qui se répète sur la partie la plus visible de la surface de la poterie. Il est appelé "bandeau principal". Ce type de décor composé se subdivise en plusieurs "caractères". Lorsque toutes les traces sont rectilignes, il porte le nom de linéaire (LINE). Dans le cas ou elles sont curvilignes, il est appelé courbe (COUR). L'association des deux, est définie comme composite (COMP).

L'autre, simple, est constitué par le déplacement d'un seul outil d'estampage suivant un mode et un rythme continuel tout autour de la poterie. Il est appelé "frise d'accompagnement". Il existe différents motifs, suivant que l'on utilise des outils droits ou courbes. Ces motifs s'étagent de part et d'autre du bandeau principal de la poterie. Il en existe un très grand nombre. La fréquence d'occurence et la position des différents types de décors ont été testés lors de l'utilisation du programme informatique. Les résultat de ce test apparaissent à la table 4.

Table 4 - Caractères associés aux positions

CARAC	INDET	CAREN	BORDS	ENCOL	EPAUL	COUPE	HTCR	BSCAR	AUTRE	Total
LINE	131	72	25	63	36	16	3	2	1	349
	37,5	20,6	7,2	18,1	10,3	4,6	0,9	0,6	0,3	40,4
COUR	14	4	4	7	7	0	0	0	0	36
	38,9	11,1	11,1	19,4	19,4	0	0	0	0	4,2
COMP	194	29	41	137	71	0	5	2	0	479
	40,5	6,1	8,1	28,6	14,8	0	1,0	0,4	0	55,4
	339	105	70	207	114	16	8	4	1	864
Total	39,2	12,2	8,1	24,0	13,2	1,9	0,9	0,5	0,1	100,0

339 tessons, soit 39% de l'ensemble des motifs pointillés du bandeau principal, sont de type indéterminé (INDET). Bien souvent c'est la taille du fragment qui n'a pas permis de déterminer sa position. La petitesse de certains tessons a également rendu difficile la reconaissance des caractères du décor. On retrouve à peu près le même pourcentage de tessons non identifiables dans le type pointillé du bandeau principal, pour les trois caractères linéaires, courbes et composites : 38%, 39% et 40%. Nous pouvons donc nous permettre d'ignorer ces décors non positionnés.

20% des tessons décorés sont des carènes. Le caractère dominant est le linéaire (33%). 13% des bords sont décorés. Le caractère le plus fréquemment associé au bord est le caractère composite, suivi de près par le linéaire. Le nombre de tessons de caractère courbe (4 cas) est trop faible pour que le pourcentage de 18% qui lui est associé soit pertinent. L'encolure est la position la plus fréquemment utilisée pour le pointillé du bandeau principal (39%). Le caractère du décor le plus fréquent est le caractère composite (48%), puis le linéaire (28%). 21,9% des poteries ont un pointillé de bandeau principal sur l'épaulement, le plus souvent de caractère composite (24,9%) ou linéaire, plus rarement courbe. Il faut tenir compte de la forme de la poterie, les pots ronds ou convexes ne présentant pas d'encolure concave mais seulement un épaulement. Il est peu probable de trouver un décor principal à la fois sur l'encolure et sur l'épaulement d'une même poterie.

La position Coupe n'est associée qu'au caractère linéaire ; les seize tessons appartenant à cet ensemble ont été décrits et numérotés après le remontage de la poterie qui se trouve être une coupe.

Les autres positions trop peu représentées ne seront pas prises en compte. Les hauts de carène (HTCAR), les bas de carène (BSCAR) et autre (AUTRE) ne seront pas discutées.

Le décor des trois caractères linéaire (LINE), courbe (COUR) et composite (COMP) se subdivise en thèmes. Il en existe quatre pour les linéaires, trois pour les courbes et quatre pour les composites. (SIORAT, J.P. 1990 : 73-76) auxquels nous avons ajouté un courbe (papillon). D'autre part, nous avons transformé le caractère sinueux (SINU) en thème.

Le caractère linéaire : fig 5. peut être de thème vertical (VERT), damiers (DAME), diagonaux (DIAG) et obliques (OBLI). Le caractère courbe : fig 6. présente les thèmes, ailes,

zigzag, trèfles et papillons regroupés dans le thème de même nom : courbe (COUR) Les composites : fig 7. se divisent en deux thèmes, verticaux et obliques, auxquels nous avons ajouté médaillons (MEDA), languettes (LANG) et sinueux (SINU) La fréquence de représentation des thèmes des 3 caractères du pointillé du bandeau principal est donnée dans la table 5.

(Nous sommes obligés dans les tableaux suivants, de ne considérer que les pourcentages dans les caractères. En ce qui concerne les thèmes, on ne peut les additionner car ils sont spécifiques à chaque caractère, même s'ils portent le même nom).

Table 5 - Thèmes associés aux caractères

	VERT	DAME	DIAG	OBLI	MEDA	LANG	SINU	COUR	
CARAC									Total
LINE	168	42	48	91	0	0	0	0	349
	19,4	4,9	5,6	10,5	0	0	0	0	40,4
COUR	0	0	0	0	0	0	0	36	36
	0	0	0	0	0	0	0	4,2	4,2
COMP	242	0	0	142	56	24	15	0	479
	28,0	0	0	16,4	6,5	2,8	1,7	0	55,4
									864
Total %									100,0

Parmi tous les thèmes, les verticaux sont les plus représentés. Ils sont abondants avec le caractère composite (242 cas) et très fréquents avec le caractère linéaire (168 cas). Les thèmes obliques sont associés au caractère composite (142 cas) ou linéaire (91 cas). Le thème du médaillon est associé uniquement au caractère composite, alors que les thèmes diagonale et damier ne sont associés qu'au caractère linéaire (respectivement 48 et 42 cas). Les thèmes courbes n'apparaissent que dans le caractère courbe (36 cas). Chaque variation du thème courbe représente à peu près 1/4 des occurences. Les thèmes languettes et sinueux sont peu représentés et uniquement dans le caractère composite (24 et 15 cas)

Une fois les associations thèmes caractère connus, il est intéressant de les situer sur la poterie, en les mettant en correspondance avec chacune des quatre positions les plus importantes : les carènes, les bords, les encolures et les épaulements. (table 6 à 9)

a/ les carènes

Le caractère linéaire est le mieux représenté avec 68%. Le thème oblique domine (44%) suivi du thème vertical (15%). Le caractère composite, moins abondant est principalement représenté par le thème vertical ou oblique. Le caractère courbe, peu fréquent, n'est représenté que par le thème courbe.

b/ les bords

Sur les bords le caractère composite est le plus fréquent (58,6%). Les thèmes sont verticaux (27%) ou obliques (22%), plus rarement en médaillons (7%). Le caractère linéaire (37,5%) est également oblique (15,7%) ou vertical (10%), plus rarement diagonal ou damier.

Table 6 - Carènes

THEM	LINE	COUR	COMP
VERT	16	0	13
	15,2	0	12,4
DAME	6	0	0
	5,7	0	0
DIAG	3	0	0
	2,9	0	0
OBLI	47	0	10
	44,8	0	9,5
MEDA	0	0	3
	0	0	2,9
LANG	0	0	2
	0	0	1,9
SINU	0	0	1
	0	0	1,0
COUR	0	4	0
	0	3,8	0
	72	4	29
Total %	68,6	3,8	27,6

Table 7 - Bords

THEM	LINE	COUR	COMP
VERT	7	0	19
	10,0	0	27,1
DAME	3	0	0
	4,3	0	0
DIAG	4	0	0
	5,7	0	0
OBLI	11	0	16
	15,7	0	22,9
MEDA	0	0	5
	0	0	7,1
LANG	0	0	0
	0	0	0
SINU	0	0	1
	0	0	1,4
COUR	0	4	0
	0	5,7	0
	25	4	41
Total %	35,7	5,7	58,6

Table 8 - ENCOLURES

THEM	LINE	COUR	COMP
VERT	27	0	72
	13,1	0	35,0
DAME	16	0	0
	7,8	0	0
DIAG	12	0	0
	5,8	0	0
OBLI	7	0	50
	3,4	0	24,3
MEDA	0	0	13
	0	0	6,3
LANG	0	0	1
	0	0	,5
SINU	0	0	1
	0	0	,5
COUR	0	7	0
	0	3,4	0
	63	7	137
Total %	30,1	3,4	66,5

Table 9 - EPAULEMENTS

THEM	LINE	COUR	COMP
VERT	13	0	38
	11,5	0	33,6
DAME	9	0	0
	8,0	0	0
DIAG	4	0	0
	3,5	0	0
OBLI	9	0	14
	8,0	0	12,4
MEDA	0	0	8
	0	0	7,1
LANG	0	0	4
	0	0	3,5
SINU	0	0	7
	0	0	6,2
COUR	0	7	0
	0	6,2	0
	35	7	71
Total %	31	6,2	62,8

c/ les encolures

Cette position est celle qui rassemble le plus de tessons décorés. Le caractère composite (66,5%) est le mieux représenté ; les thèmes sont verticaux (35%) ou obliques (24,3%), beaucoup plus rarement en médaillon (6,3%). Le caractère linéaire (30,1%) est vertical (13,1%) ou damier (7,8%), plus rarement diagonal (5,6%) ou oblique (3,4%). Le caractère courbe n'est représenté que par 7 tessons (3,4% des cas).

d/ les épaulements

Le caractère composite est ici encore le plus fréquent (62,8%). Les thèmes les plus représentés sont verticaux (33,6%) et obliques (12,4%), plus rarement en médaillons (7,1%) en languettes (3,5%) ou sinueux (6,2%).

31% des tessons ont un caractère linéaire. Les thèmes les plus fréquents sont le vertical (11%), le damier (8%) et l'oblique (8%). Les courbes sont toujours peu représentés (6%).

V. DISCUSSIONS

Malgré l'importante incertitude, au niveau des tessons décorés, sur la détermination de leurs décors et de leur position sur la poterie, nous pouvons établir un tableau pertinent des différents pourcentages qu'occupe l' association CARACTERE-THEME dans leurs différentes positions sur la poterie.

	CAREN	BORDS	ENCOL	EPAUL
linéaire-vertical	**15**	10	13	11
linéaire-damier	6	4	8	8
linéaire-diagonal	3	6	6	4
linéaire-oblique	**45**	16	3	8
composite-vertical	12	**27**	**35**	**34**
composite-oblique	10	**23**	**24**	**12**
composite-médaillon	3	7	6	7
composite-languette	2	0	1	3
composite-sinueux	1	1	1	6
courbes-courbes	4	6	3	6
TOTAUX en %	100	100	100	100

Afin de mieux visualiser les associations nous avons mis en évidence **(caractères gras)** les deux plus importants pourcentages dans chacune des quatre positions. Une première analyse de ce tableau, nous permet de ranger la répartition des décors par rapport à leur position sur la poterie, en deux groupes

A.- Ceux, dont l'écart entre les % maximum et minimum ne dépassent pas 5%. Ils présentent deux sous-groupes. L'un de faible représentativité, moins de 10%, composé par : les linéaires DAMIERS et DIAGONAUX les composites MEDAILLES, LANGUETTES et SINUEUX les courbes COURBES. L'autre, de moyenne représentativité, moins de 15%, représenté par les linéaires VERTICAUX.

B.- ceux dont l'écart est supérieur à 13%. Ils possèdent une forte représentativité, de 23% à 45% : les linéaires OBLIQUES ; les composites VERTICAUX et OBLIQUES. Si les écarts importants entre maximum et minimum concrétisent la notion d'association, il est souhaitable d'expliquer certains d'entre eux, par exemple :

1.- Si l'on peut déjà assurer que pour les composites VERTICAUX et OBLIQUES la position la mieux représentée se trouve être l'ENCOLURE, les deux autres positions BORDS et EPAULEMENT restent malgré tout très peu différenciées. Cela peut s'expliquer, par le fait que ces fragments de poterie provenant de fosses à détritus, ont conservé une surface importante qui leur permet de présenter des ensembles décorés associant les positions BORDS et ENCOLURES ; il en est de même pour les positions ENCOLURES et EPAULEMENTS. Parfois le tesson possède l'ensemble des quatre positions. Nous retrouvons ici le problème de l'association des deux systèmes de décoration sur un même tesson et de son analyse. Nous pouvons apporter la remarque suivante : il est plus facile de reconnaître un chevauchement, dans le cas de l'analyse d'un épaulement, avec la partie basse d'un composite VERTICAL, qu'avec un composite OBLIQUE, (les arcs de cercle simples ou doubles d'un VERTICAL restent caractéristiques, alors que les terminaisons anguleuses des OBLIQUES peuvent être confondues avec des parties d'autres décors), d'où cette différence : ENCOL-EPAUL 1% pour l'un, et ENCOL-EPAUL 12% pour l'autre ; il est plus facile également de déterminer un haut de composite OBLIQUE que celui d'un composite VERTICAL, (l'OBLIQUE commence toujours par une série de 3 à 7 outils courbes opposés, alors que le VERTICAL présente à son sommet des croisements de lignes droites pas forcément reconnaissables) d'où la différence BORDS-ENCOL 1% pour l'un, BORDS-ENCOL 8% pour l'autre.

2.- Les résultats présentés par le LINEAIRE OBLIQUE amènent aux réflexions suivantes :

A.- Pour quelles raisons ce décor apparaît-il avec un aussi fort % sur CAREN (45%) alors qu'il ne donne que 3% sur ENCOL, position qui par définition est l'emplacement du décor principal. Cette association avec CAREN apporte la preuve qu'il existe une autre forme de bandeau principal attaché au haut de la carène (1) qui développe une forme bien souvent intermédiaire entre le grand bandeau principal et le décor d'accompagnement.

B.-Lorsqu'il se présente en ENCOL, son développement n'est guère plus large que sur une carène, (voir le fragment de poterie WBR001/E-1684, Siorat, J.P., 1990 : 72) ; on est obligé de remettre en question l'association des décors avec la taille de la poterie.

C.- Lorsqu'il se présente en BORD, il conserve le même dessin mais il n'a pas la même taille ; nous le retrouvons bien souvent sur la lèvre supérieure d'un bord composite, et il devrait s'analyser là, comme un décor de bandeau d'accompagnement.

Cette analyse test nous permet de tirer les conclusions suivantes -

1.- Améliorer la reconnaissance des INDET. Ils nous privent de près de la moitié des tessons comportant des décors principaux.

2.- Reprendre les définitions des positions sur la poterie afin d'éviter les chevauchements de décor : la prise en compte des décors de BORDS devraient s'arrêter à la première ligne pointillée du PNTB. L'EPAUL devrait débuter à la base de ENCOL et aller jusqu'à l'angle de carène. CAREN ne devrait pas définir une position de décor mais uniquement la ligne de séparation de deux plans de la poterie et être suivie par un nombre en degré. Cela nous permettrait de reconsidérer la position BSCAR (bas de carène ou bien le haut de la panse) qui apparaît bien souvent dans l'analyse de CAREN, et de supprimer HTCAR (haut de carène) qui lorsque la carène est cassée sur sa ligne d'angle devient EPAUL.

3.- Qu'il existe des positions privilégiées pour certaines formes de décors : les COMP affectionnent plus particulièrement la partie la plus visible de la poterie c'est à dire l'encolure, alors que les LINE se rencontrent plus facilement sur un deuxième bandeau, plus petit, situé sur l'épaulement. Il est donc possible de réaliser une poterie type de la fouille du site de Nessadiou (fig 8).

4.- Qu'il est souhaitable de continuer cette étude. Elle aura pour aboutissement, d'aider à la publication des données scientifiques du site de Nessadiou WBR001, par D. Frimigacci.

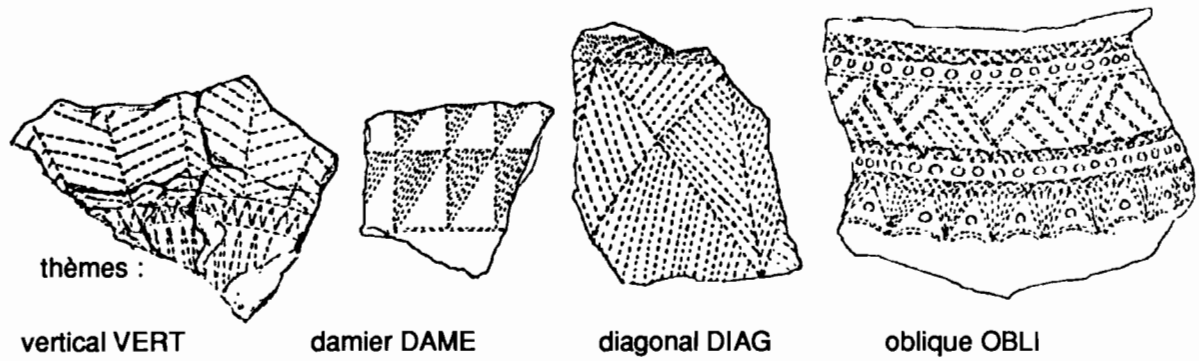

Figure 5. Caractères linéaires (LINE)

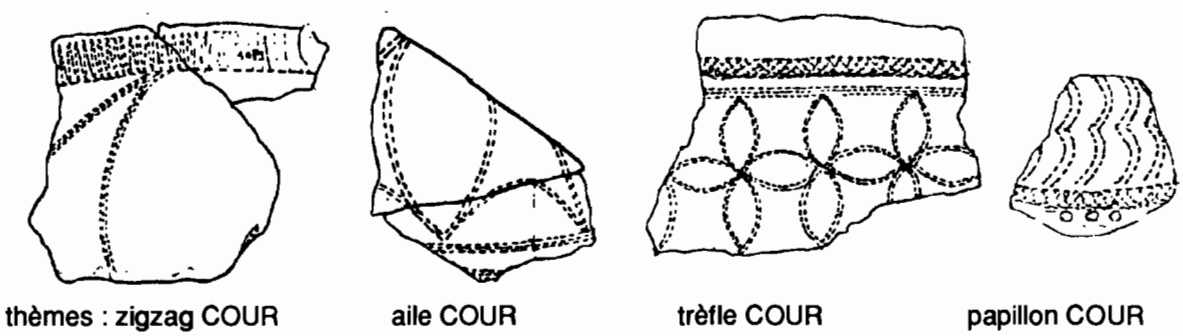

Figure 6. Caractères courbes (COUR)

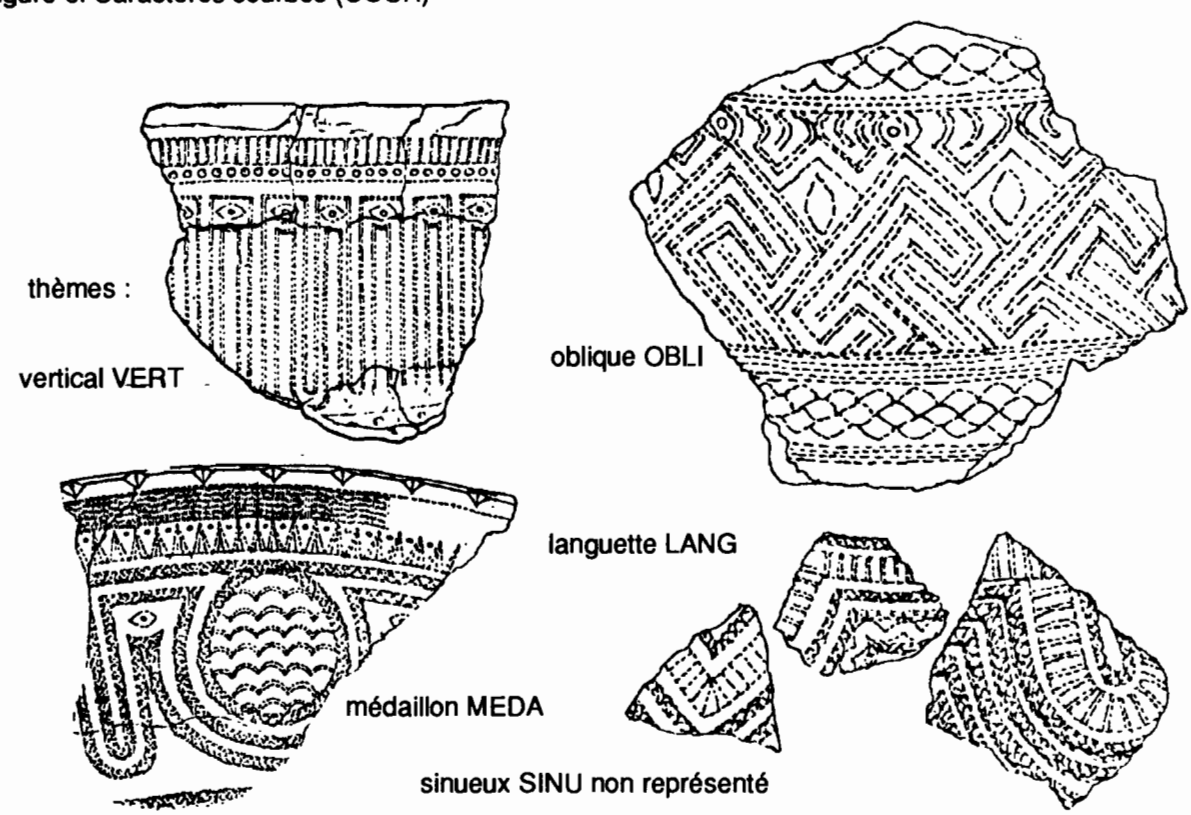

Figure 7. Caractères composites (COMP)

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LA DIFFERENCIATION DES CHRONOLOGIES CERAMIQUES DE POLYNESIE OCCIDENTALE A PARTIR D'UNE TRADITION CULTURELLE COMMUNE ISSUE DU COMPLEXE CULTUREL LAPITA

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RÉSUMÉ

Cet article tente de faire une analyse critique de l'évolution des typologies céramiques, des îles de la Polynésie occidentale. En partant de la chronologie céramique régionale proposée en 1974 par R.C Green, il intègre les données archéologiques publiées aussi bien sur les grandes îles comme Tongatapu ou les Samoa Occidentales, que sur les îles plus petites comme Niuatoputapu ou Futuna depuis cette première synthèse.

Les nouvelles données font apparaître que les évolutions divergentes des typologies, d'un archipel à l'autre, ont été plus marquées que ce qui avait été conclu à partir du matériel de Samoa et Tongatapu. Chaque archipel semble avoir une chronologie céramique propre, à partir d'un fond ancestral commun issu du Complexe Culturel Lapita.

Sans proposer une nouvelle chronologie, cette courte étude fait apparaître trois traits régionaux :

(1) la disparition rapide des poteries pointillées, caractéristiques du Lapita, sauf à Tongatapu,

(2) la présence, dès les niveaux archéologiques les plus anciens à la fin du deuxième millénaire avant J.C., de la majorité des formes céramiques caractéristiques de la période céramique récente,

(3) la disparition à quelques siècles d'intervalle durant le milieu du premier millénaire après J.C. dans l'ensemble des îles de la Polynésie occidentale, d'après les données actuelles, de la fabrication de la poterie.

ABSTRACT

The definition of the West Polynesian ceramics chronologies deriving from a common culture originating in the Lapita Cultural Complex.

This paper is an attempt at a critical analysis of the evolution of the ceramic typologies in the islands of western Polynesia. Using as a starting point the regional ceramic chronology proposed in 1974 by Green , the presentation brings together the archaeological data published since then, for the large islands such as Tongatapu and Western Samoa, as well as for the smaller islands such as Niuatoputapu and Futuna.

The new data tend to show that the evolution of the typologies between the different island groups was more diverging than had been thought earlier based on the material excavated in Samoa and Tongatapu. Each island group appears to have its own ceramic chronology, all issuing from the common ancestral background of the Lapita Cultural Complex.

Without proposing a whole new chronology, this brief presentation brings to light three regional characteristics :

(1) The rapid disappearance, except in Tongatapu, of the dentate stamped pottery, specific to Lapita,

(2) The presence, in the earliest archaeological levels at the end of the second millennium B.C., of the majority of the ceramic forms characteristic of the later ceramic period ;

and (3) According to currently available data, the total disappearance of pottery manufacture within the span of a few centuries around the middle of the first millennium A.D., throughout the whole of Western Polynesia.

INTRODUCTION

Les recherches archéologiques menées depuis plus de trente ans en Polynésie occidentale ont permis de faire remonter le premier peuplement de cette partie du Pacifique sud-ouest à l'arrivée de locuteurs austronésiens dans des archipels inhabités de Tonga, Samoa, Wallis et Futuna (Figure 1). Ceux-ci apportèrent avec eux la technique de fabrication de la poterie et du décor géométrique qui caractérisent le Lapita (Davidson 1989 ; Kirch 1984 ; Sand 1987).

Je souhaiterais analyser dans cet article comment ces potiers austronésiens de l'ensemble culturel Lapita ont fait évoluer leur art et combien, à partir d'un fond technique commun, chaque archipel a su créer des ensembles céramiques diversifiés. Cette analyse est basée sur des données publiées sur Tonga (ex. Groube 1971 ; Dye 1987 ; Poulsen 1964, 1968,1987 ; Kirch 1978, 1988 ; Spennemann 1989) et Samoa (Green 1979 ; Green et al. 1969, 1974, 1975, Jennings et al. 1976, 1980 ; Hunt et al. 1988 ; Kirch et al. 1989, 1990) ainsi que sur du matériel céramique de Wallis et de Futuna provenant de recherches menées par P.V. Kirch (1975, 1976, 1981) et par l'ORSTOM et le CNRS sous la direction de D. Frimigacci et B. Vienne (Frimigacci 1990 ; Frimigacci et al. 1984, 1987 ; Sand 1986, 1987, 1988, 1990a et b, 1992). Néanmoins, les conclusions présentées ici n'engagent que moi-même. Les modalités de transformation de la chronologie céramique de Fidji étant encore débattues entre les tenants d'une transformation principalement interne (Hunt 1980, 1987) et les tenants d'une transformation due à des éléments extérieurs (Best 1984), j'ai préféré, dans le cadre de cet article, ne pas intégrer ces données. Il ne sera donc que rarement question de Fidji.

La chronologie générale

Dans un essai de synthèse sur la poterie de Polynésie occidentale publiée en 1974 (p. 240-253), R.C. Green proposa de diviser la chronologie céramique en trois périodes. La période de premier peuplement au cours de la deuxième moitié du second millénaire avant J.C., nommée Early Eastern Lapita, aurait été suivie vers 1000 avant J.C. par le Late Eastern Lapita. Cet ensemble céramique aurait périclité vers le milieu du premier millénaire avant J.C. et aurait lentement été remplacé par de la céramique différente nommée Polynesian Plain Ware. Celle-ci, caractérisée par une abondance de bols, disparaît au début de l'ère chrétienne et marque la fin de la production de la poterie en Polynésie occidentale.

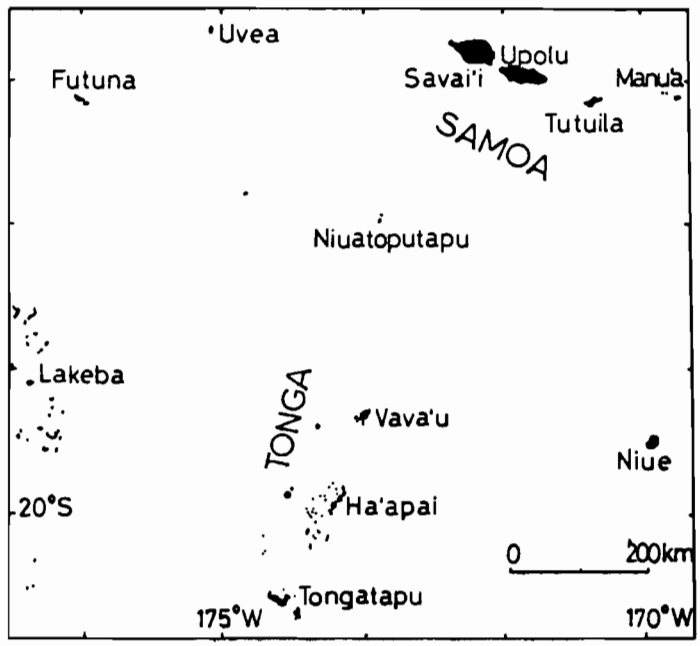

Figure 1 : Carte des archipels de la Polynésie occidentale, ainsi que des îles Lau (Fidji) et Niué.

La définition des relations entre le Lapita et le Polynesian Plain Ware est controversée. Ne trouvant que peu de relations entre le Plain Ware et les formes caractéristiques du Lapita, Green a choisi de ne plus utiliser un terme associé à "Lapita" pour la dernière partie de la chronologie. D'autres, comme Kirch, ont préféré dénommer l'ensemble de la tradition céramique sous le terme de Lapitoïd.

Le "Early Eastern" Lapita

D'après les datations C14 les plus anciennes disponibles sur la Polynésie occidentale, il apparaît que la première colonisation des différents archipels de la région a été rapide. Actuellement la datation la plus ancienne se trouve de façon étonnante dans l'archipel le plus oriental, sur l'île d'Ofu, avec une datation autour du milieu du deuxième millénaire avant J.C. (Kirch et Hunt 1989). Mais le contexte stratigraphique particulier de cette datation et le peu de matériel céramique publié en relation avec le niveau daté n'en permettent pas une utilisation pour notre propos.

Un second ensemble de dates se situe entre la fin du deuxième millénaire avant J.C. et le début du premier millénaire avant J.C. et correspond à des niveaux d'occupation archéologique caractérisés en premier lieu par la présence de poteries Lapita. Il s'agit du site NT-90 de Lolokoka à Niuatoputapu, avec une date initiale calibrée de 1410-1230 avant J.C. et 1255-1085 avant J.C. (Kirch 1988), TON-2 de Tongatapu avec 1045-745 avant J.C. (Poulsen 1987), Mulifanua à Samoa avec 1035-555 avant J.C. (Leach et Green 1989) et la base du site MU21B d'Utuleve à Wallis avec 1150-800 avant J.C. (Sand 1992).

La division chronologique un peu brutale de 1000 avant J.C. proposée par R.C. Green pour le passage entre la période de Early et Late Eastern Lapita semble, d'après les résultats d'un certain nombre de sites, devoir être modulée et assouplie. Ainsi, il me semble souhaitable d'intégrer dans cette période, en plus des sites de Fakatafenga et Tongoleleka à Ha'apai (Dye 1987) qui n'ont pas été datés, la base du site MU46a d'Utuleve à Wallis (Frimigacci et al. 1984 ; Sand 1992) et la base du site SI-01 d'Asipani à Futuna, avec une datation estimée à 800-700 avant J.C. (Sand 1988, 1990, n.d.).

Le matériel céramique de l'ensemble de ces sites se caractérise en premier lieu par des formes de poteries complexes, avec des carènes, des épaulements, des bords sortants et des décors pointillés de tradition Lapita (Green 1974, 1979). Kirch a tenté de montrer, à partir de l'analyse des décors pointillés, la présence d'un groupe stylistique interprété comme plus récent comprenant Samoa, Niuatoputapu, Wallis, ainsi que Futuna d'après nos données (Kirch 1988, p.188). Malheureusement, il semble que ce groupe soit surtout formé par des sites ayant été peu fouillés, comme Wallis et Futuna, ou par des sites ayant des conditions stratigraphiques particulières comme Niuatoputapu ou Mulifanua.

Ce qui est surtout évident dans le matériel céramique de ces sites de Polynésie occidentale c'est que, dès cette première période, les différences avec les sites Lapita de l'arc mélanésien sont importantes. En premier lieu au niveau du pourcentage des tessons décorés : à l'exception du site TO-2 de Tongatapu qui totalise environ 33 % de tessons décorés (Poulsen 1987, p.113), tous les autres sites ont des fréquences qui débutent entre 8% et 5%, comme par exemple Mulifanua (Green et al. 1975) ou Tongoleleka (Dye 1987), parfois 3% comme à Asipani et qui, dès la couche stratigraphique plus récente, passent à 2% ou 1%.

Cette faible représentativité des poteries composites qui caractérise le Lapita décoré se retrouve également en toute logique dans les diminutions très rapides de pourcentages des formes avec carène dans certains sites, comme à Tongoleleka (Dye 1987), où l'on passe de 10% de carènes dans la couche III, la plus ancienne, à 3,5% dès la couche IIb.

Afin d'essayer de cerner plus précisément ce que pouvaient signifier ces données, j'ai tenté pour le site SI-01 d'Asipani de faire une estimation du nombre de pots décorés susceptibles d'être présent dans ma collection céramique. Dans mon horizon ancien situé à la base de la stratigraphie, environ 20% des poteries devaient être décorées, en comptant les poteries simplement incisées ou estampées sur le bord. Cette proportion tombe à 5% dans l'horizon suivant puis à 1%, avec la disparition des carènes.

Ces données semblent signifier que, très rapidement après l'installation de la plupart de ces premières colonies, les potiers cessent de réaliser des poteries à décor pointillé ainsi que tous les types de vaisselle qui leur servent de support. Ils cessent également très rapidement d'utiliser comme dégraissant du sable corallien, qui est surtout présent dans les poteries Lapita (Kirch 1988). Préciser temporellement la vitesse de cette disparition reste aléatoire, mais je serais tenté de penser que cela n'a souvent pas dû excéder quelques générations.

Dès ce passage entre le Early Eastern Lapita et le Late Eastern Lapita, soit d'après les datations des divers sites entre 900 avant J.C. et 700 avant J.C., un peu plus tard que la date de 1000 avant J.C. proposée par Green, les typologies céramiques entre les archipels divergent. A Tongatapu, la tradition du décor pointillé, bien que simplifiée, reste présent. De façon intéressante, les sites classés par Poulsen dans sa middle-period comportente des décors pointillés qui ont totalement disparu des sites céramiques de la même époque dans d'autres archipels de Polynésie occidentale. A Futuna, les décors incisés sur le bord qui caractérisent traditionnellement le Late Eastern Lapita, disparaissent en même temps que les décors pointillés. De même, les formes de bols disparaissent en même temps que la majorité des formes carénées, alors qu'à Samoa, par exemple, celles-ci durent et caractérisent la fin de la chronologie céramique.

La place de la poterie imprimée au battoir dans la chronologie céramique de Polynésie occidentale

La question de la relation entre la poterie Lapita et la poterie imprimée au battoir dans les sites de Polynésie occidentale se pose depuis longtemps, principalement à cause de l'importance de cette technique décorative dans la seconde moitié de la chronologie céramique fidjienne. Pour Fidji, le débat reste ouvert, entre les tenants d'une tradition associée au Lapita, comme Hunt (1980) et partiellement Davidson et al. (1990), et les tenants d'une innovation probablement extérieure, comme Best (1984).

L'étude du matériel céramique de Polynésie occidentale peut venir en complément de ces données. Tous les chercheurs travaillant sur la région ont noté la présence plus ou moins importante de tessons imprimés au battoir. Dans la majorité des cas, les publications indiquent qu'environ 1% à 3% des tessons ont ce type de décor. Dans le site MU21 d'Utuleve à Wallis, ce type de décor est présent dès la couche la plus ancienne, en association avec les décors pointillés. Il semble néanmoins, comme par exemple sur le matériel de Tongatapu, que des traces de marques sur les tessons qui auraient été enregistrées par certains archéologues, dont moi, comme des traces de battoir, ont été enregistrées par Poulsen comme des traces de lissage.

Dans le site SI-01 d'Asipani, la proportion de poterie imprimée au battoir est dans certains niveaux plus importante (Figure 2)(Sand 1988). Dans le niveau ancien A, qui comporte 3% de poterie pointillée ou incisée, la proportion de poterie imprimée au battoir est de 1,6%. Ce chiffre passe à environ 24% dans le niveau B, alors que les décors pointillés ne représentent plus en moyenne que 1,5% du total. Dans le niveau C qui marque la fin de la poterie pointillée, le pourcentage de battoir est de plus de 30%, puis repasse à 8% dans le niveau D, dont, dans la couche la plus récente datée de la fin du premier millénaire avant J.C., seulement 3% de battoir. La stratigraphie du site d'Asipani est très simple et les déplacements de matériel ont dû être minimes. Il semble donc, d'après ces données, qu'il y ait, pour Futuna, une évolution du battoir en parallèle à la disparition des décors pointillés et incisés. Ces décors au battoir vont de pair, d'après les mesures d'épaisseur des tessons, avec une évolution de la technique de fabrication des pots, souvent plus fins, mieux cuits et plus solides que les premières séries de poteries du site d'Asipani.

De façon révélatrice, cette chronologie du battoir à Futuna est semblable à celle présentée par Davidson et al. dans un article de synthèse sur Natunuku (1990) avec, entre autres, une augmentation des impressions au battoir en parallèle à une diminution du décor pointillé, et des poteries au battoir plus fines que les poteries décorées de pointillés. Il semble donc, d'après ces quelques résultats, que la tradition de l'imprimé au battoir soit présent dès la première période de colonisation en Polynésie occidentale, ainsi qu'à Fidji. Mais là encore, la variabilité entre les sites est grande et semble indiquer un développement des traditions à un niveau local.

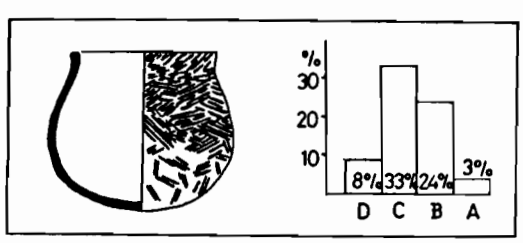

Figure 2 : Forme de poterie imprimée au battoir et représentativité de cette tradition céramique dans les quatre niveaux du site SI-01 d'Asipani (Futuna)

Que peut-on nommer Late Eastern Lapita?

Le Early Eastern Lapita et la période nommée Late Eastern Lapita comportent donc déjà, d'après les données de plusieurs sites, la majorité des éléments qui caractérisent le millénaire suivant de la chronologie céramique de la Polynésie occidentale (Figure 3). Ceci amène dans certains cas des difficultés pour définir clairement un Late Eastern Lapita. Les données publiées sur cette période, comme celles présentées à l'instant, semblent en effet indiquer que les transformations ne se sont pas faites au même moment dans tous les archipels. Pour Samoa, les données sont limitées au site de Jane's Camp, avec des datations principalement entre environ 700 avant J.C. et 200 avant J.C. (Jennings et al. 1976, p.9 ; Poulsen 1987(II), p.64), et au riche site de To'aga aux Samoas américaines (Kirch et al. 1990). Dans les deux cas, l'étude du matériel, et tout particulièrement des bords, montre la présence de formes de jarres à bords droits ainsi que l'augmentation des formes de bols à parois épaisses. A Wallis, cette période est caractérisée par des formes de jarres à bords droits, un changement dans les dégraissants ainsi que par l'apparition de formes de bols épais avec, parfois, une carène et un bord sortant avec méplat (Sand 1992). La même situation est présente à Niuatoputapu (Kirch 1988). A Futuna, on note la présence unique de jarres à bords droits (Sand 1990). Dans les sites de Ha'apai au contraire, comme dans la couche III du site de Tongoleleka daté 400-122 avant J.C., Dye (1987) note, en parallèle à la diminution des bords apparentés aux bols, l'augmentation des jarres avec un col rétréci.

	Niua		Tongatapu		Ha'apai		W. Samoa		E. Samoa		Uvea		Futuna	
	Lap	Pw	Lap	Pw	Lap	Pw	Lap	Pw	Lap	Pw	Lap	Pw	Lap	Pw
	Xd	X	X	X	X	?	X	X		?	X	X	Xd	
	X		X	?	X	?	X	X		X	X	X	Xd	
	X		X	X	X	?	X	X		X	X	X	X	
	X	X	X	X	?	X	?	?	X		X	X	X	X
	X		X	X	X	X	X		?		X	X	X	X
	X		X		X		?				X			
	X	X	?	?	X	X					X	X	X	X
	X	X	X		X		X		Xd		Xd		Xd	
	X	?	X	X	X		X				X		X	
			X					X				X	X	
	Xd		Xd		X	X	X				Xd		X	
			X		Xd		Xd				Xd			
			Xd											
	Xd		Xd		Xd		Xd						Xd	
	Xd		Xd				Xd				Xd			
	Xd		Xd		X?		Xd				Xd		Xd	

Figure 3 : Essai de répartition des formes de poteries fabriquées dans les différents archipels de Polynésie occidentale.

Lap = Eastern Lapita ;
Pw = Plain ware (post-Lapita) ;
d = Décoré.

D'après les différents ensembles de datations, il semblerait plus profitable, plutôt que de placer le Late Eastern Lapita entre 1000 avant J.C. et 500 avant J.C. comme proposé par Green, de reculer les dates d'environ 300 ans, soit entre 700 avant J.C. et 200 avant J.C..

Dans certains archipels, pour des raisons tenant entre autres à la nature des dépôts comme à Niuatoputapu ou Ha'apai, ou à la chronologie céramique connue à ce jour, comme à Futuna, la différenciation entre le Late Eastern Lapita et le Polynesian Plain Ware est difficile à fixer ou inexistante. Ailleurs, comme à Tongatapu ou Wallis, cette différenciation est plus évidente, due à une évolution plus claire des décors ou à des transformations plus évolutives des poteries. Ceci pose le problème d'une définition régionale du Late Eastern Lapita. En effet, celui-ci est principalement caractérisé par la disparition de la grande majorité des formes composites et la limitation des décors principalement aux bords (Green 1974, 1979). Mais, si ce schéma semble fonctionner pour Fidji, il est plus difficile à appliquer à la Polynésie occidentale. En effet, la majorité des formes composites disparaissent avec les décors pointillés, mais certaines formes de jarres carénées ou de bols à fond plat sont présentes dans des archipels comme Wallis durant la plus grande partie de la chronologie céramique. De même, les décors incisés sur le bord sont présents dans plusieurs archipels au-delà de 300 avant J.C.. Ces quelques exemples montrent que, dès la fin du Early Eastern Lapita, la diversification des traditions céramiques à un niveau local est telle que la standardisation des chronologies en un schéma régional est difficile.

Variabilité des chronologies locales et traditions régionales

Au tournant de l'ère chrétienne, les différents archipels semblent donc développer, chacun, des formes de poteries particulières (Figure 4). Néanmoins, des ensembles géographiques de traditions sont clairement visibles : ainsi, les formes de jarres avec une ou deux anses verticales, qui ont leur origine dans le Early Eastern Lapita, sont réalisées dans les petits archipels comme Niuatoputapu, Wallis, Futuna ou Ha'apai, ainsi qu'à Fidji mais n'ont encore jamais été signalés à Samoa ou Tongatapu. De même, il semble, d'après les études de formes de bords et de dégraissants, que l'archipel samoan qui ne produit plus que des formes de bols de plus en plus épais et grossiers, ait une typologie proche de celle de Wallis aussi bien au niveau de la technique de fabrication des poteries, des choix des dégraissants que des formes. Par contre, la poterie de Futuna est techniquement et typologiquement proche des poteries de Tongatapu.

Ces quelques données comparatives restent à être explorées plus avant, aussi bien au niveau de la céramique que du reste du matériel archéologique. Ils sont, en effet, susceptibles de donner des informations de premier ordre sur les relations privilégiées de certains groupes d'archipels de Polynésie occidentale à partir de la fin du premier millénaire avant J.C., relations qui ont pu être totalement modifiées durant la préhistoire récente comme, par exemple, entre Samoa et Wallis.

La disparition de la fabrication de poterie en Polynésie occidentale

Les derniers siècles de fabrication de la poterie en Polynésie occidentale sont mal connus. A Tongatapu, la difficulté de trouver des sites en place a incité Groube dans son article de 1971 à proposer une date autour du début de l'ère chrétienne pour la fin de la chronologie céramique. Cette estimation a récemment été portée à environ 400 après J.C. par Poulsen (1987) et 500 après J.C. par Spennemann (1989, p.204). A Niuatoputapu, Kirch a présenté une chronologie céramique jusqu'à 800 après J.C. (1988) mais la complexité de la stratigraphie rend l'utilisation de cette donnée problématique et plusieurs archéologues

ont mis en cause une date aussi récente (ex. Kennedy 1990). A Samoa, la date la plus récente tourne autour de 300 après J.C. (Jennings et al. 1980). A Wallis, l'unique datation semble indiquer la fin de la fabrication de la poterie dans le courant du milieu du premier millénaire (Sand 1990). Enfin à Futuna, les avis sont partagés. J'ai proposé dans un autre article (1990) de placer la fin de la chronologie céramique autour de 500-600 après J.C. D.Frimigacci (1990) pense que son utilisation a duré jusqu'au XVe siècle.

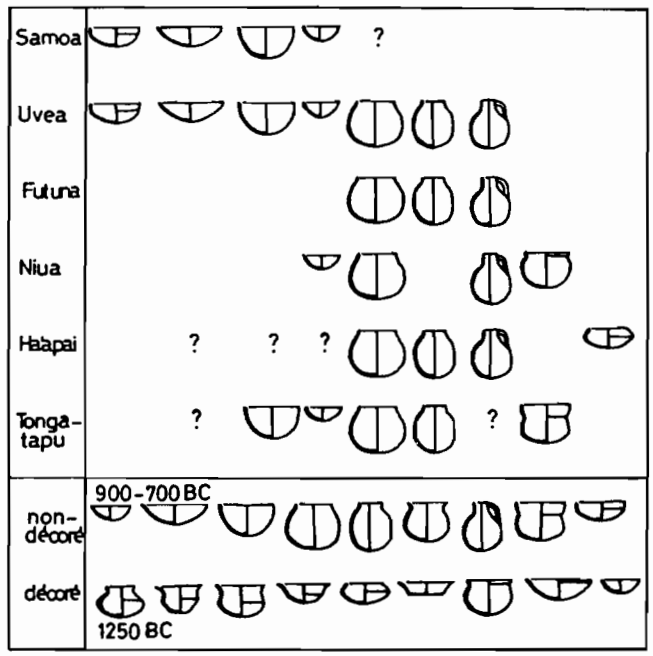

Figure 4 : Essai de synthèse de la diversification des typologies céramiques de Polynésie occidentale à partir du Lapita.

De toute évidence, la fin de la chronologie céramique dans les différents archipels est rapprochée dans le temps, peut-être exception faite de Futuna. Ceci est un paradoxe alors que, typologiquement, chaque archipel semblait avoir adapté des types de poteries particuliers. Actuellement, seuls les travaux de Green sur Samoa (1974) ont donné des éléments de réponse satisfaisants, en montrant que les dernières collections de poteries étaient de très mauvaise qualité et que, probablement, les récipients en argile avaient simplement été remplacés par des récipients en bois de même forme. Il est probable que la disparition de la poterie ait de multiples raisons. Ce n'est pas le but de cet article d'en faire la liste (ex. Le Moine 1989). Néanmoins, il me parait important de noter que les datations semblent refléter un phénomène régional de cessation de la fabrication de la poterie à la même période, à 200-300 ans près. Chaque archipel ayant depuis presque un millénaire développé une typologie locale, cette disparition simultanée doit refléter un bouleversement social important marquant, peut-être, la première tentative d'un groupe ou d'un archipel de contrôler politiquement d'autres îles, dans le cadre d'une expansion régionale. Il aurait pu imposer ses traditions, dont l'absence de fabrication des poteries aurait été un composante. Seules des recherches plus poussées sur ce passage entre la fin de la période céramique et ce que Janet Davidson a appelé le West Polynesian Dark Age (1979) permettraient de préciser cette proposition.

CONCLUSION

J'ai tenté dans cet article de relever un certain nombre de points de la chronologie céramique des différents archipels de Polynésie occidentale afin de montrer la difficulté de pouvoir synthétiser des chronologies locales à un niveau régional. A partir d'une tradition culturelle commune issue de l'Early Eastern Lapita, les potiers de Polynésie occidentale ont développé des formes céramiques particulières dans chaque archipel, après avoir très rapidement, probablement en quelques générations à part à Tongatapu, abandonné la fabrication de poteries complexes qui caractérisent le Lapita de l'arc mélanésien, en conservant simplement la vaisselle utilitaire.

La chronologie tripartite régionale de Green est très utile à un niveau général mais elle doit être utilisée en gardant en mémoire la grande variabilité des typologies céramiques à un niveau local.

Enfin, la relation typologique entre le Lapita et la Plain Ware, telle qu'elle fut établie par Green en 1974, semble être plus complexe que ne l'indique le matériel de Samoa. De toute évidence, la majorité des poteries qui sont présentes à la fin de la chronologie céramique sont issues du Lapita. Ainsi se pose le problème de définir à partir de quel moment on peut, théoriquement, parler de Polynesian Plain Ware, avec toutes les implications culturelles que cela comporte. Le débat reste ouvert.

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WHAT HAPPENS TO LAPITA IN MELANESIA ?

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RÉSUMÉ

Quel est le sort du Lapita en Mélanésie?

Le sort du Lapita en Mélanésie dépend de ce que l'on entend par Lapita. Bien que les anciennes théories simplistes qui affirmaient que le Lapita était soit totalement le fruit d'apports externes, soit totalement indigène, aient été abandonnées récemment, il existe toujours un manque d'enthousiasme pour l'étude de ce que représentent cette poterie et les objets qui lui sont associés en termes historiques. On rencontre dans les diverses publications au moins cinq possibilités :

1. Lapita considéré comme un réseau d'échanges de produits issus de centres spécialisés ;
2. Liens affectifs à une terre d'origine conservés par des migrants qui continuent d'importer des objets et marchandises longtemps après que ces fournitures soient devenues disponibles sur place ;
3. Un nouveau système économique comprenant un agriculture de subsistance améliorée, des animaux domestiqués, et de nouvelles techniques de préparation des aliments utilisant la poterie ;
4. Une idéologie religieuse et un système social partagés ;
5. Un langage et une fraternité ethnique partagés par un groupe de langue austronésienne, initialement endogame et ethniquement différent, s'introduisant sur des territoires déjà peuplés.

Compte tenu de ces possibilités, cinq modèles supplémentaires sont proposés pour expliquer l'évolution que l'on peut constater vers la fin de la période Lapita. Ils ne sont pas forcément contradictoires et peuvent se chevaucher à travers diverses combinaisons que l'on pourra considérer :

A. Contraction/spécialisation du système d'échanges commerciaux ;
B. Adaptation aux conditions locales ;
C. Transformation socio-politique
D. Absorbtion
E. Migration secondaire

De l'examen de ces modèles pourra ressortir le problème suivant : la possibilité que l'interprétation par des processus différents conduise à des résultats identiques du point de vue de l'évidence archéologique. Dans l'état actuel des recherches, cependant, le problème risque plutôt d'être lié à un manque de données et aux contraintes imposées par les méthodes traditionnelles de la recherche archéologique.

ABSTRACT

What happens to Lapita in Melanesia depends on what Lapita is. While earlier simplistic views of Lapita being a totally intrusive culture or a totally indigenous one have recently been abandoned, there is still a reluctance to address what the pottery and associated artifacts represent in historical terms. At least five possiblities have been considered in the literature :

1. Lapita as an exchange network of goods produced by specialist centres, 2. affective links to a homeland by settlers continuing to import goods long after local supplies were availble, 3. a new economic system involving improved subsistence gardening, domesticated animals, and new cooking and food preparation technologies utilising pottery containers, 4. a shared religious ideology and social system, and 5. language and ethnicity shared by an initially endogamous, genetically distinct group intrusive into an already settled area and speaking an Austronesian language.

Given these possibilities, a further five models are put forward to explain the changes which can be detected towards the end of the Lapita culture. They are :

A. trade system contration/specialization, B. local adaptation, C. sociopolitical transformation, D. absorption, and E. secondary migration.

In examining these models it might appear that there is a serious equifinality problem, different processes leading to the same archaeological outcome. The problem, however, is more likely a simple lack of information at the current stage of research, and the limitations of traditional archaeological research procedures.

What happens to Lapita in Melanesia depends on what Lapita is. While earlier simplistic views of Lapita being a totally intrusive culture or a totally indigenous one have recently been abandoned, there seems still to be a reluctance to address what the pottery and associated artifacts represent in historical terms. If it is indeed a history of the region we are after, rather than simply a narrow archaeology, then we cannot ignore important sister disciplines such as historical linguistics and physical anthropology which also have a bearing on the period in question.

A few "facts" simply cannot be ignored. The Lapita culture distribution crosses the traditional divide between Polynesia and Melanesia. Western Polynesian culture is descended from Lapita. Polynesian populations cannot, according to nearly all physical anthropologists, be derived from the genetic diversity found today in Melanesia but show clear signs of being of Southeast Asian ancestry. All Austronesian languages are ultimately of Island Southeast Asian origin. All Polynesian and many Island Melanesian languages are Austronesian. Some aspects of Lapita culture occur earlier in Southeast Asia. "Local" or indigenous aspects of Lapita are not specific to the area where the earliest Lapita sites are located in the Bismarcks, but can be expected to have been found also in a large area to the west in New Guinea and possibly in island groups such as Maluku even further west.

It seems to me quite critical to a consideration of Lapita to know whether the bearers of this culture were in large part an intrusive group moving into the Bismarcks from the west, or were resident groups which adopted some Southeast Asian material culture items and with this newly-acquired technology were able quickly to settle a region from the Solomons toSamoa in a few hundred years. Two quite different kinds of human behaviours are represented by these possibilities. While the former provides a mechanism for the spread of Austronesian languages through Island Melanesia and on to Polynesia, it is hard to imagine how the latter could provide a mechanism for language transfer of this type. It is harder still to explain the Southeast Asian features of modern and recent Polynesians if they were derived from bearers of the Lapita culture who were long resident in the Bismarcks, perhaps for upwards of 30,000 years.

These considerations affect the kinds of models usefully considered for the end of Lapita : as Green (1982 : 1617) pointed out in response to Clark and Terrell's (1978) models of the Lapita phenomenon, prior plausibility is an important means of cutting down the infinite number of models which one can devise for any situation. Accepting for the purposes of this paper that there was something called a Lapita culture, the interrelationship of whose elements was evident to its bearers, we can ask what held it together during the 500-1000 years of its existence.

Possibilities include :

1.an exchange network of goods produced by specialist centres (this would seem to be Terrell's 1989 viewpoint) ;

2.affective links to a homeland, witnessed by the long-distance distribution of obsidian from the Bismarcks to areas such as Santa Cruz in the Southeast Solomons, long after local sources of this and other items were available (Green 1987, in press) ;

3.a new economic system involving improved subsistence gardening, domesticated animals (pig, dog, chicken), fishing and shellfishing, hunting of previously unexploited faunal resources on pristine Islands, and new cooking and food preparation technologies utilising pottery containers ;

4.a shared religious ideology and social system, reflected in elaborate pottery decorations on ritual vessels, exchange valuables, "clan" emblems and an assumed social hierarchy necessary to mount organized expeditions for colonization (Friedman 1981 ; Hayden 1983 ; and others) ;

5.language and ethnicity, shared by an initially endogamous, genetically distinct group intrusive into an already settled area and speaking an Austronesian language (Bellwood 1989 ; Shutler and Marck 1975 ; and others).

It is easy to overdefine what is meant by the end of Lapita. One line of argument might suggest that the Lapita culture is still with us, pointing to continuities in various material culture items, domestic animals, subsistence techniques, and inter-island trade. An argument based solely on the defining characteristic of dentate-stamped pottery would have the benefit of exactitude ("heirloom" effects aside) but might not actually be telling us very much either. That is, unless the social glue of Lapita was a shared decorative system on pots and/or the social labour invested in producing the pots and their initially elaborate designs.

If Lapita were only a set of related pottery styles there would be no problem, the process of stylistic change might be random and unrelated to other aspects of culture. If there was a Lapita culture, however, in terms of pottery and other associated items of material culture, settlement pattern and subsistence practices, then a historical explanation is required for evidence of important cultural (in the archaeological sense) changes. These might be cessation of long-distance exchange networks or major rearrangement of such networks, shift in settlement pattern or general abandonment of previously occupied sites, loss of pottery and/or other significant changes in the material culture inventory, and changed subsistence practices or use of the landscape. I would argue that evidence for such changes is widespread in Island Melanesia in the period c.2500-2000 BP, possibly earlier in some areas (Santa Cruz? Central Vanuatu?) and later in others (New Ireland? Nissan? New Caledonia?).

Several models could be put forward to explain the changes which can be detected towards the end of the Lapita culture. I will outline and further develop some of these below. They are not all mutually exclusive and various combinations of them might be considered, so in this sense they are all partial models.

The models are :

A. trade system contraction/specialization ;
B. local adaptation ;
C. sociopolitical transformation ;
D. absorption ;
E. secondary migration.

A.Trade System Contraction/specialisation

This model has been put forward in most detail by Allen (1984,1985) as a general model for the development of trading systems in the Lapita and post-Lapita periods in Melanesia.

It suggests periods of trading intensity initially escalating, then becoming unstable and eventually breaking down. In the long term there is overall growth in the complexity of systems, complemented by a reduction in their geographical extent. Despite this growth, the model presupposes some real ceiling to institutional growth which prevents transformation of the egalitarian social order into an hierarchical one (Allen 1985 : 51).

Thus if the Lapita culture was essentially a trade network (as in Clark and Terrell's [1978] trader model), its demise came about through a contraction of the exchange network, which eventually exceeded the ability of the social system to sustain it. Post-Lapita continuity of population and basic culture would occur, albeit with reduced cultural links to other areas and with local settlement pattern change in response to re-ordered and more locally oriented exchange networks. The end of Lapita in this model, while archaeologically very visible, may not have had necessarily dramatic effects on all the societies involved. As Allen (1984 : 439) notes, breakdowns of trade, "while affecting all subsystem groups, would have their most dramatic effects on the specialist trader groups. Food shortages and disputes over scarce local resources would rapidly result in dispersal and regrouping by these latter groups".

B. Local Adaptation

This has been expressed most elegantly not by an archaeologist but by the linguist Andrew Pawley in his (1981) theory of the "cycle of linguistic diversification", an attempt to explain the situation of many languages per archipelago in Melanesia in contrast to the norm of one language per archipelago in Polynesia (1981 : 294-295).

Initially, settlements on the larger islands of Melanesia were almost exclusively on the coast. Populations were small and scattered and the sailing technology permitted inter-island and coastal voyaging. Such voyaging between dispersed sister communities was encouraged by economic needs, kinship and marriage ties, the political ambition of leaders and, very likely, a love of adventure and exploration common to hardy pioneering colonials. For a time the sister communities continued to regard themselves as people of one stock, and for a longer period, as people of one language.

As the centuries passed, however, contact between scattered sister dialect communities tended to become relatively less important and less frequent. Adaptive changes in economic and social life led to such a weakening of the lines of communication. We suggest that in most of the large, high island groups of Melanesia the following

developments took place : population increase ; wider and more intensive exploitation of resources available locally and in nearby inland and coastal habitats ; the emergence of substantial, permanent inland populations speaking [Oceanic Austronesian] languages (at least in those large islands which did not have such populations before [Oceanic Austronesian] colonisation).

Expanding on this scenario Pawley suggests that Kin and marriage ties weakened between widely separated sister communities and dimunition of the social as well as the economic importance of trade exchanges with remote sister communities led in turn to an impairment of the traditional skills of canoe-building and sailing, even in coastal communities.

In many regions other cultural losses (or substitutions) went along with these changes, whether as cause or effect cannot be discovered : loss of pottery-making tradition, loss of hereditary chieftainship and the concomitant system of head of a group of dispersed descent groups(1981 : 296).

This model represents cultural and linguistic diversification in situ. Again it implies continuity in population but with a degree of turning inward, literally in terms of opening up the hinterlands and concentrating more on agriculture. Once more a breakdown or contraction of the exchange system is postulated but in this case not because the system is too socially costly to maintain, but because it is no longer functionally necessary for the economic and biological survival of individual communities. The affective ties to the homeland become attenuated and finally broken. Again, archaeological visibility is high but social consequences not immediately transformative.

C. Sociopolitical Transformation

This model was put forward by the anthropologist Jonathan Friedman (1981,1982) on the basis of a reconstruction of Lapita social structure from linguistics and comparative Austronesian social structure studies. More recently, Kirch's (1988) discussion of the possible role of shell ornaments as Lapita exchange valuables has enabled some archaeological flesh to be added to Friedman's sketch. Lapita culture would represent, in Friedman's model, a prestige-goods system which over time was transformed into the varieties of political system found in Melanesia today.

Prestige-good systems can be characterised in their most elementary form as a combination of the following elements :

1. generalized exchange 2. monopoly over prestige-good imports that are necessary for marriage and other crucial payments, i.e. for the social reproduction of local kin groups 3. a bilineal tendency in the kinship structure (asymmetrical) 4. a tendency to asymmetrical political dualism : religious vs. political chiefs, original people vs. invaders, female vs. male, inside vs. outside etc...

The control of prestige-goods implies an exchange situation in which wives move towards monopolistic centres and valuables (and men) move in the opposite direction (Friedman 1981 : 281).

In further developing this model, Kirch noted the value in linking back to homeland communities in early stages of colonization of previously uninhabited islands "in the event of

unpredictable environmental hazards (droughts or cyclone), or to augment demographically small and unstable groups with suitable marriage partners" (1988 : 113). A formal exchange system involving acquisition of status enhancing prestige-goods such as shell valuables, high grade obsidian, and stone adzes provided the social mechanism which was required.

That such a system persisted for several hundred years after colonisation is due to other social forces, of which Kirch stresses "competition for control over long-distance exchange reinforcing a hierarchical structure" (1988 : 114). His explanation for the end of this system is a version of the local adaptation model, that the risks of long-distance canoe travel came to outweigh the advantages (social and political).

Friedman's original model, however, suggests other possibilities of the social structure, mechanisms for its transformation into forms as diverse as the "Big Man" systems of parts of Melanesia and the "theocratic feudalism" of Eastern Polynesia. Monopoly over external trade as a basis for political hierarchisation can only be maintained under conditions of trade scarcity. Where there is a long term increase in trade network density such hierarchies break down, such as in the short distance but intensive and specialized trading systems characteristic of parts of Melanesia, linked to the development of so called big-man societies. Hierarchically organized prestige-goods systems in the recent past were characteristic of the Trobriands, Admiralties and New Caledonia, although it would be unwise to assume direct continuity from Lapita in any particular case (Friedman 1981 : 284).

Friedman also discusses a situation such as in Eastern Polynesia where the prestige-good system broke down early, characterized by endogamy, warfare and where chiefs combined religious and political status as opposed to a previous dualism of political vs. religious office.

There is apparently an enormous intensification of agricultural production wherever possible and it might be argued that the loss of external monopoly leads to increasing competition within the aristocracy which in turn puts pressure on local production which... becomes a crucial factor in the accumulation of power and status (Friedman 1981 : 288).

He labels this system as theocratic feudalism, because the power structure becomes increasingly dependent upon the material force of supernatural dictates. In Eastern Polynesia he sees it as a result of the extremely long distances between island groups severely limiting prestige-goods exchange and leading to an increase in competitive feasting and warfare, underwritten by agricultural intensification (although see Thomas [1989 : 92-4] for a critique of Friedman's arguments on this). Elsewhere (Spriggs 1986) I have argued that Aneityum in Southern Vanuatu had such a system at European contact, there having been an important diminution in exchange when the New Caledonia to Vanuatu exchange system contracted and Aneityum was left at a cul de sac in the Southern Vanuatu system.

Under such a system, intensification might fail because of increasing environmental degradation, in which case there would be a situation of declining hierarchy, or "devolution". There are examples of this in Polynesia (Easter Island and the Marquesas), and there may be examples too in Melanesia on some of the smaller islands, or at particular times in the historical sequences on particular islands. Hints of this are contained in the environmental histories of some areas of Melanesia. A corollary of this might be nutritional stress, determinable from palaeopathological analyses (cf. Allen 1985 : 55).

Friedman's model can be seen in part as a combination of the trade system contraction/specialization and local adaptation models, but it stresses the sociopolitical consequences of changes in a postulated early and widespread prestige-goods system. Such a system is different in its implications than a more generalized exchange system, the consequences of whose decline or maintenance would perhaps not be as momentous for the societies involved. It also implies an initially much more hierarchical social system than suggested by Allen's (1984, 1985) trade model, and different possibilities of social transformation.

The designs on Lapita pots may have been important in maintaining a shared symbolic and religious system which linked communities and provided a charter for the social system. The end of the specialized vessel forms and often-elaborate designs is symptomatic of the end of such a shared religious and social ideology. Following from my earlier speculations concerning Lapita design (Spriggs 1990), it might be suggested that Lapita pottery ceased to speak to its users when it became "faceless". In this variant of the model it is important when the Lapita design system breaks down or is transformed into a different style or more localized series of styles. Where this occurs early, in parts of Vanuatu (Mangaasi), New Caledonia and perhaps in Santa Cruz, communities had dropped out of the Lapita system and the ideology that underpinned it and became the pioneers of a new diversity of cultural and political forms in the region, in a world of Lapita and anti-Lapita.

D. Absorption

This model requires that Lapita originally represented an intrusive linguistic and cultural group moving into an already inhabited region. Technological superiority and a flexible social system allowing or even requiring continual expansion and colonization initially led the culture to establish itself at least on the edges of already-occupied islands. The need to establish relatively peaceful relations with autochthonous groups would over time have broken down an endogamous social structure, and technological transfer would have allowed other groups to "catch up" such that over time a process of homogenisation would occur and Lapita would lose its distinctive cultural and genetic make-up and a "creole" culture develop (cf. Bellwood 1975 : 14). The initial technological advantages, including new agricultural crops and techniques, and possession of valuable domestic animals, would ensure that in many cases it would be the higher-status Austronesian language that would be learned by the autochthones, with language-switch occurring after a relatively short period of bilingualism.

That in many cases in Island Melanesia there has been an important influence on Austronesian languages from Non-Austronesian ones would fit with this model. It might also suggest that as well as the Bismarcks and Solomons, Vanuatu and New Caledonia were also settled pre-Lapita, (cf. Lynch 1981 : 120). Archaeologically one would expect that contemporary but initially very different cultures, Lapita and non-Lapita, would over time become more and more similar until their cultural distinctiveness disappeared into the variety of post-Lapita cultures known from the area. Continued exchange, although perhaps more attenuated, could have ensured that change in pottery style (incised and applied relief or Mangaasi *sensu latu*) continued to occur "in sync" over a wide area of Island Melanesia (Spriggs 1984). Effects on social structure would be specific to each particular situation and perhaps not predictable in any general sense, although the possibility of reassertion or continuity of less hierarchical pre-Lapita social forms should be considered (Lilley 1985 : 64).

E. Secondary Migration

It is an old idea that post-Lapita cultures or those contemporary with Lapita but different, such as Mangaasi and Podtanéan, represent a secondary migration of people into the Island Melanesian region (Bellwood 1989 : 41 ; Keesing and Keesing 1971 : 111 ; Shutler and Marck 1975 : 105 ; and for Fiji, Bellwood 1975 and Frost 1979). On the surface it is a rather old-fashioned idea of different pottery styles representing different "peoples" in a rather simplistic sense, but as Anthony (1990) has recently warned, ignoring the possibility of migration in prehistory may be throwing the baby out with the bathwater if we are attempting to examine historical process.

Ross (1988,1989) has argued that the linguistic situation in the Bismarcks and the north-Western Solomons has been complicated by a secondary spread of Western Oceanic Austronesian languages of the Meso-Melanesian cluster from New Britain, which may have in part replaced Austronesian languages of probable Southeast Solomonic type in Bougainville and presumably also in New Ireland. It is tempting to link this hypothesized language spread to the replacement of recognizably Lapita pottery by the incised and applied relief styles (Mangaasi) which are found from the Bismarcks to Fiji. While the linguistic influence is argued by Ross to have stopped at the "Tryon-Hackman line" separating Western Oceanic and Southeast Solomonic languages, the suggested archaeological signature of this process continued further south, ultimately to Fiji. It should be noted that Ross' idea of a two-stage spread of Austronesian languages in the New Ireland-Solomons area is a controversial one and by no means universally accepted by linguists working in the region (Andrew Pawley, personal communication).

If there was a secondary movement of population from the Bismarcks to the south and east, it was a movement from the same general area as the original Lapita spread and so may not have been represented by a distinctive material culture apart from a new pottery style. The population would however be more mixed with the original Bismarcks' inhabitants than the previous Lapita spread, providing the more "Melanesian" phenotype that is found today in Vanuatu, New Caledonia and to a lesser extent in Fiji.

In his discussion of migration in archaeology, Anthony (1990) notes that migration streams often continue to flow in a given direction despite circumstances quite changed from those that prompted the initial (in this case Lapita) movement.

Kinship linkages, dependence, and the reduction of obstacles may attract a secondary flow that is quite different in goal orientation and composition from the initial migrant group. Such a chronological shift in group composition and organization might well have archaeological effects (1990 : 904).

The changes which occur at the end of Lapita may form an example of such a secondary stream (see Spriggs [in press] for further discussion of Anthony's ideas, in relation to Lapita). Keesing and Keesing (1971 : 111) and Green (1975) hypothesized that these later migrants may have been better-adapted for life in rainforests and/or malaria-endemic areas and so came to dominate, in terms of gene frequency, previous Lapita populations.

A mixture of the absorption and secondary migration models would see absorption in the Bismarcks with a subsequent migration through parts of the Solomons and into Vanuatu, New Caledonia and ultimately Fiji. If there was a pre-Lapita occupation of Vanuatu and New Caledonia, then secondary migration on any scale might only be relevant for Fiji.

Secondary migration might be expected to have had major social consequences, depending on the numbers involved, whether the social system of the migrants was substantially different than the previously settled communities, and whether the interaction was peaceful or hostile. I know of no archaeological information currently available in the region which would bear on these matters.

Investigating The Alternatives

From the above discussion of the different models it might appear that we have a serious equifinality problem, different processes leading to the same archaeological outcome or signature. The problem, however, is more likely a simple lack of information at the current stage of research, and the limitations of traditional archaeological research procedures.

Throughout Island Melanesia sites of immediately pre-Lapita age or contemporary with Lapita but not plausibly related to it are extremely scarce. While our surveys locate certain types of sites such as rockshelters or open, pottery bearing sites we are not finding or at least not recognising other site types by our usual survey methods. While the agricultural status of most Lapita sites seems clear, the nature of the pre-Lapita economic system or systems is not (Spriggs 1992). The kind of system that Lapita was intrusive into or developed from must surely have been critical for its history.

Archaeologists working in Melanesia have not been very successful in investigating sociopolitical organization in the absence of purported continuity to post-contact forms or exceptional oral history. The only way to get at Lapita and post-Lapita social and spatial organization is through area excavation and detailed spatial analysis of the kind undertaken by Sheppard and Green (1991). The relation between form, decoration and function of pottery vessels of Lapita and other styles can only be properly assessed by incorporating studies of the chemical residues remaining in the pots. Residue analysis of stone tools will also prove important, both for the economic information provided and also potentially for DNA analysis of human blood, commonly found on them as a result of cuts during tool manufacture or use.

Very little information is available on the human biology of the populations which used Lapita pottery or on their predecessors and contemporaries in the region. There is certainly more evidence around than is commonly believed, however. Even isolated teeth or very fragmentary cranial and post-cranial material are amenable to analysis using current methods. Ongoing research on extraction of DNA from prehistoric bone shows the promise of getting significant results from even small scraps of material.

The non-dentate stamped component of Lapita pottery and the incised and applied relief styles loosely called Mangaasi deserve attention on the same scale as "classic" Lapita. The first question is whether those styles are in fact related and/or whether various sub-styles of regional or chronological significance can be identified.

CONCLUSION

Information along the lines indicated above will certainly allow a better idea of what happened at the end of Lapita. It requires a larger scale of excavation than usually employed, innovative survey strategies, and a more sustained and coordinated analysis of excavated materials using standard techniques applied to larger bodies of material and continuing development and application of more recently formulated and often "high tech" approaches. A willingness to share data and ideas is a further prerequisite for elucidation of this and all other problems in Pacific prehistory.

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