TECHNIQUE AND PRACTICE

Shell-working in the Western Pacific and Island Southeast Asia

Katherine Anne Szabó

VOLUME 1

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Except where otherwise stated in the text, this thesis is based entirely on my own research.

Katherine Anne Szabó

Department of Archaeology and Natural History
Research School of Pacific and Asian Studies
The Australian National University
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ABSTRACT

The Lapita cultural complex has been a focal point of Pacific archaeology for many years. Not only is it materially distinctive, but it is also cast as signalling the first colonisation the western Pacific beyond the main Solomon Islands chain, the introduction of a neolithic way of life to this area, and providing the cultural base from which later Polynesian cultures emerge. The 'origins' of the Lapita cultural complex have also been a major area of interest, and there has been much debate as to how much Lapita owes to the Island Southeast Asian neolithic, and how much of the culture represents a continuation of Near Oceanic cultural trajectories. Despite all this debate, archaeological material from Island Southeast Asia, pre-Lapita Near Oceania and the Lapita cultural complex itself, has never been physically compared in any systematic way. This task forms the basis of the research presented here.

Artefacts produced in shell have been central to arguments for both Lapita representing an 'extension' of the Island Southeast Asian neolithic and a local trajectory encompassing the neolithic transition in Near Oceania. It was thus felt that a controlled comparison of worked shell material across Island Southeast Asia and the western Pacific, deriving from different temporal contexts, would be fruitful.

The issue of social and ancestral relationships, both through time and across space, is a challenging one to address. Necessarily, it broaches on longstanding disagreements within archaeology as a whole, such as the status of diffusion as a mechanism for social change and the issue of 'homology' versus 'analogy'. Thus, as well as presenting the results of the conducted analysis, this thesis details new theoretical and methodological perspectives that have both structured the overall approach and facilitated interpretation.

Through the application of a rigorous methodology, situated within a transparent theoretical framework, clear patterns have emerged. The results do not agree with either 'intrusionist' or 'indigenist' arguments for the genesis of the Lapita cultural complex. Rather, they suggest widespread relationships in shell-working practices across the Island Southeast Asia/western Pacific area that have a considerable time-depth.
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Chapter 1: Introduction to the topic and Scope of research

'A comparison of [the Bismarck Archipelago] with island southeast Asia will necessitate more work in the latter region to weigh up the nature of similarities and differences throughout these archipelagos…' (Gosden 1991a:261)

1.1 Introduction

The research and results presented in this thesis were intended originally to get inside the question of 'Lapita origins' in the western Pacific c.3300 years ago through a comparative analysis of shell artefacts and associated production techniques from Lapita, pre-Lapita Island Melanesian and Island Southeast Asia sites. While this matter still forms the core of the thesis, the issues encountered in addressing that topic have resulted in theoretical and methodological work that has implications well beyond investigation of the Lapita archaeological culture. In developing ways to compare and test relationships between artefacts located at different points in space and time, the long-standing archaeological issue of 'homology versus analogy' or, how to separate evidence for migration from stimulus diffusion, technological transfer/acculturation and independent innovation, has had to be addressed. What results then, is a thesis that revolves around two separate but interlocking issues; (1) testing a new theory-driven methodology aimed at delineating the presence and nature of relationships between artefacts, and (2) testing relationships between formal
shell artefacts recovered from Lapita, Island Southeast Asian and pre-Lapita Near Oceanic sites.

A brief discussion of the evolving concept of ‘Lapita’, and debates surrounding its derivation and hypothesised relationships with other regions and cultures, is followed by an overview of the way evidence from shell artefacts has been incorporated into these hypotheses. The case involving shell artefacts serves to highlight the methodological complexities of detecting and delineating relationships between artefacts through space and time. This chapter closes with an outline of the structure of the thesis.

1.2 Introduction to ‘Lapita’

1.2.1 The Foundations of Lapita

‘Lapita’ has seen many definitions and understandings over the course of the last half-century as knowledge of the archaeological record and diverse theoretical stances have developed and combined. After initial discoveries of a distinctive ‘dentate-stamped’ pottery on Watom Island, New Britain by Father Otto Meyer in the early twentieth century (see Specht 1967:29), and Lenormand (1948) and Avias (1950) in the Isle of Pines, New Caledonia, excavations by Gifford in Fiji (Gifford 1951) and Gifford and Shutler in New Caledonia (Gifford and Shutler 1956) began to clarify the spatial and temporal positioning of the earliest ceramic horizon in the western Pacific. A survey of the evidence up to 1960 by Golson (1961) proposed an ‘early community of culture’ that could be

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1 As formulated by Pawley and Green (1973), Near Oceania comprises the islands of New Guinea, the Bismarck Archipelago and the main Solomon Island chain, and Remote Oceania refers to all islands east of this boundary. The islands of Near Oceania provide evidence of Pleistocene human occupation, while the first colonisation of Remote Oceania is signalled by the Lapita horizon.
seen as preceding the ‘Melanesian’ culture of New Caledonia, and as ancestral to West Polynesian culture. Material evidence from the sites of Sigatoka in Fiji and, more tentatively, Watom in New Britain was also included (Golson 1961:176). Continuing research and synthesis soon produced an understanding of ‘Lapita’ as more than distinctive pottery, but as an archaeological ‘cultural complex' with both spatial and temporal dimensions (Golson 1971). This definition, as well as discussion of constituent elements, has been further detailed by Green (e.g. 1979; 1992)

1.2.2 Views on Lapita ‘Origins’

While the Lapita cultural complex was generally accepted as having been ancestral to Polynesian cultures at the eastern end of its range (Green 1979:49), the origins of Lapita in the west became an increasingly discussed question. It was at this point that hypotheses regarding the origins and affiliations of the Lapita Cultural Complex became entwined with long-established theories relating to the spread of Austronesian languages and concomitant culture spread out of Asia.

The relatedness of the languages of Polynesia, Micronesia, much of Melanesia, and Island Southeast Asia had been recognized as far back as the early 18th century and formalized by Dempwolff in a series of papers from 1934 to 1938 (Suggs 1960:39-42). The remarkable distribution of these languages, labelled Austronesian, laid the foundations for myriad migrationist interpretations for the peopling of Island Southeast Asia and the Pacific. Early attempts at outlining the prehistory of Island Southeast Asia, and by extension much of the Pacific, drew upon material culture as much as linguistic categories (e.g. Heine-Geldern 1932). Historical linguistics, however, has increasingly
dominated pan-regional syntheses of the neolithic transition, which is thought to
be represented by the expansion of Austronesian language speakers (e.g.
Chang 1970; Shutler and Marck 1975; Bellwood 1995; Bellwood 2002a).

In recent expressions of this view, the Lapita polythetic assemblage is
seen as a marker and representative of the expansion of Austronesian
language-speakers who originally spread from a homeland in Taiwan, travelled
through the Philippines and eastern Indonesia, and emerged on the other side
of Lapita as the present-day Polynesians (Bellwood 1983; Bellwood 1997). The
route of this migration is said to be signified archaeologically through the
presence of assemblages containing either plain or red-slipped pottery of simple
morphology, sometimes bearing incised, impressed or stamped decoration
(Bellwood 1997:219), polished stone adzes, a variety of shell artefacts including
bracelets and beads, tattooing chisels, fishhooks, barkcloth beaters and stone
net-sinkers (Bellwood 1997:219-230; Bellwood 2002b:26). Furthermore, the
Austronesian-speaking migrants are argued to be farmers of rice and millet with
an agricultural suite also containing pig and dog (Bellwood 1995:99) and as
such, introduced a neolithic way of life to an area previously occupied by
hunter-gatherers.

Such linguistically-based hypotheses have been generally treated with a
degree of caution within Lapita-focused scholarship (e.g. Green 1979; Allen and
Gosden 1996; Terrell 1988), and concerns have been raised as to whether the
Childean notion of ‘people’, employed most prominently by Bellwood (e.g.
2002a:22), was being applied appropriately to what was understood as an
archaeological culture (Green 1992:9). Despite this, the ‘Austronesian
expansion hypothesis’, variously interpreted and understood, had become the
broad orthodoxy by the late 1970s (Spriggs 1985:185-186). It was not however,
accepted across the board. There were many lingering questions and pieces of evidence that did not appear to fit the orthodox view. For example, evidence of pre-Lapita occupation and transport of obsidian in the Bismarck Archipelago and non-Lapita ceramic traditions in New Caledonia and Vanuatu were not accommodated in the orthodox hypothesis, and these prompted the initiation of the ‘Lapita Homeland Project’ in the 1980s (Spriggs 1985; Allen 1984). The results of this project disclosed a long pre-Lapita sequence for the Bismarck Archipelago with attendant pre-Lapita shell-working traditions, watercraft and voyaging, and trading systems (Allen and White 1989:141). The position of domesticated plants and animals remained ambiguous, and the Lapita pottery tradition itself was seen as the only potentially sustainable ‘cultural intrusion’ (Allen and White 1989:142).

The main effect of the results of the Lapita Homeland Project was that doubt was cast upon a Lapita incursion in the Bismarck sequence, and that other possibilities needed to be considered and new evidence addressed. The conceptual possibilities offered took a series of independently-expressed, but often mutually compatible, forms. Two of these possibilities aimed at understanding Lapita in Near Oceania will be addressed briefly here. The first focuses on ideas presented by Gosden and colleagues (Gosden 1991b; Gosden and Specht 1991; Gosden 1991a; Allen and Gosden 1996), and the second is the ‘Triple-I’ framework offered by Green (1991; 2000; 2003).

1.2.3 ‘Learning about Lapita’ within a broader context

After the presentation of a large body of results from the Lapita Homeland Project (Allen and Gosden 1991), Gosden (1991a) concluded with comments on future directions for investigations of Lapita, and more generally, Near
Oceania, and recommended a series of conceptual shifts. In a discussion of ways of conceptualising Lapita, Gosden (1991a:261-3) contrasts the ‘Lapita as people’ perspective with a view which sees Lapita as an archaeological construct situated within broader social and geographical structures in space and time. Gosden (1991a:262-3; see also Allen and Gosden 1996:183-4) favours the latter, seeing Lapita as a ‘mosaic of social landscapes’ set within a wider ‘social geography’. From this standpoint, cultural expressions visible in the archaeological record do not necessarily relate to ethnographic or ‘ethnic’ categories, and cannot be so easily attached to groups of a particular membership with a specific collective ancestry and historical trajectory. This conceptualisation, with its focus upon situated social relationships and networks, works toward establishing connections through analysis of the archaeological record rather than assuming the social cohesiveness of an already-conceived category. Furthermore, it avoids epistemic reliance on the reified category assignations of Austronesian/non-Austronesian, Mongoloid/Australo-Melanesoid, Lapita/pre-Lapita, and Island Southeast Asia/Island Melanesia. That conceptual stance is taken as a starting point within this thesis.

Of further research interest is a distinction that can be drawn between ‘Lapita’ or, even more so ‘Austronesians’, as a ‘people’ versus shifting patterns of social geography. In the most fervent expressions of ‘Lapita as people’ (e.g. Bellwood 1997:234-36), the Lapita cultural complex is seen as the ‘result’ of the rapid spread of Austronesian-speaking migrants. The emphasis here is clearly on delineating the history of a people, as opposed to an attempt to clarify the shifting nature of human cultural behaviour through time within a region. While
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focusing on a perceived main line can be revealing, it also tends to limit
peripheral vision, and with it our ability to detect complexity and diversity.

Coming from the more regional-contextual stance, Gosden stresses the
need to develop a framework that allows us to compare ‘sites of the same
period on different parts of the landscape, as well as between landscapes of
different periods’ (Gosden 1991a:265). From here, we can work toward fitting
‘individual sites into the context of a local landscapes [sic] and to look at how
these local regions were knit together into larger groupings at various periods’
(Gosden 1991a:266). Although Gosden suggests some specific areas for
attention – notably the roles of obsidian and pottery through time and space –
he offers no methodological framework for defining how relationships can be
assessed. What is more, opening the locked box of ‘broad similarities between
the assemblages found in Island Southeast Asia and Melanesia’ (Allen and
Gosden 1996:193) tends to be confounded by a lack of research, analysis and
firm chronology in the former region. Chapters 3 and 4 address this issue, and
offer possible solutions, from theoretical and methodological perspectives
respectively.

1.2.4 Diverse threads – the ‘Triple-I’ framework

The Triple-I (Integration/Intrusion/Innovation) framework put forward by Green
was also offered in response to the interpretative quandaries presented by the
results of the Lapita Homeland Project. More explicitly focused on the Lapita
cultural complex itself rather than the Near Oceanic region, the Triple-I model
sought to untangle the diverse threads that constituted this archaeological
expression. The Triple-I model (Green 1991:298-99):
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‘requires us to establish archaeologically which elements present in
the Lapita cultural complex already existed in Near Oceania and
either have their source there or constitute no new addition to the
existing cultural milieu, which elements constitute new additions from
sources outside that long settled region, and finally which elements
are in fact innovations of Lapita itself’.

The Triple-I approach was further modified after a dual-pronged comment
made by Spriggs (1996) relating to the ‘integration’ element. Firstly, he pointed
out that a Lapita element could not be considered ‘integrated’ if it occurred in
pre-Lapita (or pre-Lapita age) assemblages in the Bismarcks and Island
Southeast Asia on the basis that it was unclear where the element was
integrated from (Spriggs 1996:327). Secondly, he pointed to the ambiguity of
‘local’, and whether this included the island of New Guinea (Spriggs 1996:327).
Green considered and incorporated these comments into his revised and
extended expression of the Triple-I framework, which resulted in distinguishing
between Near Oceanic intrusions, deriving from mainland New Guinea, and
Island Southeast Asian intrusions (Green 2000:373-4). The problem of
assigning widespread pre-Lapita traits to either ‘intrusive’ or ‘integrated’
categories remains problematic, though surely the answer must lie in detailed
analysis and chronological control.

The Triple-I framework has opened interpretative doors by requiring us to
assess the evidence for each constituent element of the cultural complex rather
than advocating continuity or rupture across the board. Most importantly,
however, it takes us past the assumption that items within a recognized
polythetic cultural ‘package’ necessarily have ancestral relationships to one
another. This recognition reinforces the insightful comments made by those
such as Kroeber (1948:286) who pointed out that, although a culture may appear as an integrated and homogeneous totality when viewed synchronously, 'dissective analysis and knowledge of history ... reveal the compositeness of any culture'. This is a fundamental and analytically-useful observation, and will constitute one of the founding assumptions within this thesis.

While the Triple-I framework provides a general structure or starting point for analysis, it has become evident that there are methodological complexities in both establishing relationships, and in delineating the nature of those relationships from assemblage to assemblage, artefact to artefact. Foremost among these complications is whether evidence of a particular element at a number of sites represents a true familial relationship, or whether this is evidence of diffusion, acculturation or indeed, represents another tradition/introduction entirely. This is perhaps part of the dilemma that underlies Spriggs' (1997:91) contention that if an element is found in pre-Lapita age deposits in both Island Southeast Asia and Near Oceania, it could be cast as either 'intrusive' or 'integrated'. This is of course, reliant on the pre-Lapita element representing a related tradition in different locations. Often, we do not appear to have a detailed enough understanding of the elements themselves to make this sort of judgement. Shell artefacts provide a tidy example of this sort of problem, and a discussion below will draw out aspects of this predicament and introduce a potential way forward that constitutes the body of this thesis.
1.3 The status of shell artefacts within the Lapita origins debate

1.3.1 Introduction

It is intended here to give a brief overview of shell artefact evidence and associated interpretation through time in relation to assemblages derived from Lapita, Island Southeast Asian and pre-Lapita Bismarck/Solomon Islands sites. Fuller coverage of sites and contents, as well as assemblages studied, will be presented in Chapters 5 (Lapita), 6 (Island Southeast Asia) and 7 (pre-Lapita Near Oceania).

1.3.2 The ‘traditional suite of Lapita shell artefacts’

Formal shell artefacts are a prominent and distinctive part of Lapita assemblages. Major artefact categories include adzes manufactured from the giant clam Tridacna spp., rings\(^2\) in Trochus niloticus, Tridacna spp. and various species of Conus, perforated plaques of Conus, pendants, beads (generally in Conus spp.), and fishhooks. These formal types are supplemented by a range of largely-unmodified expedient tools, such as scrapers and knives, which are considered only peripherally in this thesis.

Tridacna spp. adzes fall into two distinct categories; those made from the thick hinge portion of the shell, which generally have a plano-convex cross-section, and those made from the body of the shell, which are generally triangular in outline and have a broader, flatter cross-section. Rings manufactured from various species of Conus are ubiquitous within Lapita deposits and are represented by a range of morphological categories. These include ‘broad rings’, where the anterior section of the body as well as the

\(^2\) 'Ring' here is a morphological referent rather than designating a particular usage such as 'finger-ring' or 'arm-ring'. This term is preferred here over the more common 'armband' of the Lapita literature and 'bracelet' of much of the Island Southeast Asian literature.
shoulder of the shell form the substance of the ring, and a range of 'narrow rings', utilising only the shoulder of the shell and abraded to produce a number of common cross-sections including plano-convex, quadrangular, lenticular and triangular. Beads are typically manufactured from small species of Conus, though other types are occasionally reported, and 'pendants' generally cover a spectrum of forms and raw materials displaying perforations. Rings of Trochus niloticus and Tridacna spp. are less common than specimens in Conus and have yet to be adequately defined within Lapita. Fishhooks in both Trochus niloticus and Turbo marmoratus are associated with the western and southern reaches of Lapita, and forms tend to be restricted and consistent.

While these sorts of observations and generalisations can be made, the 'traditional suite of Lapita shell artefacts' has never been fully outlined. Publications relating to shell artefacts have generally been site- or region-specific (e.g. Kirch 1988; Bedford and Spriggs 2002; Szabó and Summerhayes 2002), and as such have not been able to draw out pan-Lapita patterns in shell-working. Thus, the analysis of Lapita shell artefacts and shell-working techniques within this thesis will work toward establishing intra-Lapita patterns so that a more profitable comparison with Island Southeast Asia and pre-Lapita Near Oceania can ensue.

1.3.3 'Ancestral' Austronesian and Island Southeast Asian shell-working

Prior to the archaeological work associated with the Lapita Homeland Project, early shell-working – with an apparent special emphasis on shell adzes and artefacts in Tridacna spp. and Conus spp. - was considered to be uniquely associated with Austronesian populations within the Island Southeast Asian and
Island Melanesian regions (Bellwood 1978:208). As such, it was considered to be a marker of migrating Austronesian-speaking groups. Indeed, Austronesian-migration interpretations continue to treat shell artefacts (most often as a generic category) found in association with red-slipped pottery, as an indication of Austronesian presence (e.g. Bellwood 1992:passim; Bellwood 2002a:26).

While shell artefacts and shell-working are evidenced at some early neolithic sites in Taiwan (e.g. Chang 1969; Li 1983; Tsang 1992), the *Tridacna* spp. adzes and *Conus* spp. artefacts so characteristic of Lapita have closer parallels in the Philippines. The discovery of early neolithic *Tridacna* spp. adzes and *Conus* spp. ornaments in sites on Palawan and Sanga Sanga islands in the Philippines was believed to be ‘of considerable consequence to the historical reconstruction of movements of people from Island Southeast Asia into the Pacific world’ (Fox 1970; see also Ronquillo 1998:73-4). The importance of early evidence for shell-working from the Philippines has also been incorporated into Solheim’s ‘Nusantao’ hypothesis for neolithic culture genesis in central Island Southeast and the spread of that culture through maritime trading networks into the Pacific\(^3\) (e.g. Solheim 1984-5; see also Solheim, Legaspi and Neri 1979:126).

### 1.3.4 Evidence for early shell-working from the Bismarcks and Solomons

One of the significant findings of the Lapita Homeland Project was evidence for shell-working traditions of considerable antiquity in both the islands of the Bismarck Archipelago and the main Solomon Islands chain. A number of sites

\(^3\) Given the results of the Lapita Homeland Project and continuing work in Near Oceania, Solheim (personal communication, April 2004) now believes that shell-working may have its roots in the Bismarck/Solomon Islands area, and spread back from there into Island, and then mainland, Southeast Asia.
in this region revealed pre-Lapita evidence for the production of shell artefacts; most notably in *Tridacna* spp., and *Trochus* spp. While much of the evidence consisted of expedient tools such as whole valves of venerid clams with evidence of edge-wear (see Barton and White 1993), a good deal either firmly represented, or was argued to represent the production of formal tools and artefacts. Unequivocal evidence for the pre-Lapita production of *Tridacna* spp. adzes was produced at the site of Pamwak, while sites across the region provided similarly unequivocal evidence for the production of *Trochus niloticus* rings. That there was a complex shell-working technology within the pre-Lapita Bismarck Archipelago and Solomon Island region is beyond debate (Kirch 2000:82). A degree of doubt surrounds claims for pre-Lapita fishhooks manufactured from *Trochus niloticus* (Green 2000:381-2).

1.3.4 *So what is Southeast Asian about Lapita shell-working?*

As discussed above in more general terms, the results of the Lapita Homeland Project prompted a rethink regarding the origins of specific traits comprising the Lapita cultural complex. The case, as it pertained to shell artefacts, was explicitly taken up by Spriggs (1996) and Green (2000:380-82). With regard to the Island Southeast Asian evidence, Spriggs pointed pertinently to the major chronological problems that beset much of the regional sequence (Spriggs 1996:328; see also Spriggs 1989; Spriggs 2003). This unfortunate reality makes a detailed discussion of shell artefact associations and chronologies difficult. Indeed, all the sites containing evidence for early *Tridacna* spp. adze, shell bead and fishhook manufacture in the Philippines, Timor and elsewhere in Island Southeast Asia are associated with questionable dates or stratigraphic contexts (Spriggs 1996:328). The Bismarck/Solomon Island dates are more
reliable, although evidence for shell artefact manufacture is scattered with a
good deal of attributions being open to interpretation. Spriggs' (1997:91) and
Gosden’s (1991a:261) caution regarding possible widespread common pre-
Austronesian traditions also make difficult the linking of ‘ancestral traditions’
with Lapita assemblages.

While some of these dilemmas (e.g. that of chronology) represent true
impasses for the time being at least, other problems can perhaps be
surmounted with a different methodological tack. The categories typically used
for comparison, such as ‘shell beads’ ‘pierced shell pendants’ and ‘hinge-region
Tridacna adzes’, are rather gross descriptions. Given the general lack of
rigorous analysis of much of this material, and the near total lack of controlled
comparative analysis, it is entirely possible that these high-level categories are
masking diversity in shell-working practices, if not in fact aggregating totally
unrelated traditions.

The broad task of the research presented here is to undertake a
comparative analysis of worked shell across the region to establish whether, for
example, shell beads represented in the Island Southeast Asian neolithic are
‘related’ to shell beads from Lapita contexts. To carry out such a comparison
effectively, a number of conceptual hurdles need to be cleared at the outset.
These include issues such as what constitutes a ‘relationship’ between items of
material culture separated by space and/or time, how we would recognise such
relationships in the archaeological record, what appropriate units for
comparison might be, and what material relationships mean in terms of broader
social relationships.
1.4 Approach and structure of the thesis

1.4.1 *Units and associations*

It is taken as a starting point that the formulation of broad interpretative categories – whether they be ‘ethno-linguistic’ as in the case of pre-Austronesian/Austronesian, or material as in the case of ‘shell beads’ – may be premature, and as such may have hindered more than helped our understanding of the regional archaeological record. While these types of categories may well represent some sort of reality, it is contended here that this needs to be established through a careful analysis of evidence rather an *a priori* assumption of cohesiveness. Given this, all assemblages analysed as part of this research have been treated as independent units. In the case of multi-layer sites, each stratigraphically/temporally distinct assemblage has been treated as an independent unit. This means that a ‘Lapita’ or ‘Austronesian’ association has been ignored at the outset with the view that these attributions need to be arrived at through analysis of the material.

On a finer scale, artefact types and working techniques represented within and across assemblages have also been treated as independent entities. This follows from the recognition that different artefacts and working techniques may have different trajectories through space and time, and a polythetic association may only give a snapshot of historical relationships. Indeed this recognition applies to the application of linguistic and biological evidence to the issue; all may follow different and complex pathways.
14.2 The nature of ‘relationships’ between artefacts over space and time

It is a truism that ‘similar’ can mean many things in terms of material and social relationships. ‘Similar’ artefacts within archaeological deposits can signal an ancestral relationship, diffusion of an idea, technological transfer, trade, or acculturation, to name but a few. Moreover, ‘similar’ may well not represent a real relationship at all, but rather independent innovations or convergent solutions. How to interpret similarity has been a constant concern of archaeology since its formalisation as a discipline, and different paradigms have favoured different explanations for material likeness.

The approach constructed here builds upon recent theoretical work within the anthropology of technology (e.g. Lemonnier 1993) and social constructivist approaches within the sociology of technological systems (e.g. Bijker, Hughes and Pinch 1989). These approaches work from a founding assertion that the production of material culture, and the systems which embrace this production, are human constructs grounded in a specific social ontology. This social ontology, as well as the patterning that derives from it, is structured by both historical and contingent processes. While materials provide constraints and human needs prompt technological solutions, these points of view stress that there are always choices. These technological choices can be isolated in the archaeological record through the construction of chaîne opératoire, or production sequences. Within this research, production sequences are defined in their widest scope, thereby including choices in raw material for working at one end of the sequence, and utilisation, curation, and discard of artefacts at the other. The production sequence thus encompasses the ‘life history’ of the artefact.
Given the close relationship between ontology and technology, patterning in technological choices can provide markers of the ontology that drives them. If close synchronic relationships between technological practices are established, we can define ‘communities of practice’. While such communities may signal a shared ancestry, they may also represent close contact through ongoing interaction. To separate these two possibilities, a temporal/diachronic dimension is required to draw out convergence or adoption of cultural practices. If similarities in technological choices are restricted to a few artefacts or techniques, relationships between communities are likely to be more distant temporally (e.g. a shared ancestral tradition of some antiquity) or socially (e.g. trade relationships or occasional contact). If artefact forms are similar but production sequences are not, this implies a more distant social relationship where ideas rather than technologies are diffusing. Equally, similarity of form may not represent any ‘real’ relationship at all, but rather independent innovation. The diffusion of ideas and independent innovation are difficult to distinguish from one another, although spatial and temporal patterning of artefact forms can be suggestive.

1.4.3 Structure of the thesis

Chapter 2 consists of an overview of the way ‘similarity’ and ‘difference’ have been approached and reconciled historically within archaeology. Important threads of thinking that have conditioned views include the perceived limits of human creativity, the status of the natural and social environments in structuring outcomes, and assumed reasons/catalysts for social change. These threads will be followed throughout the review. A further thread followed is the status of ‘technology’ in these formulations through time – whether as driving social
force, an interface between ‘natural’ and ‘cultural’, or as a marker of social achievement or ‘progress’.

The overview presented in Chapter 2 provides a theoretical backdrop to Chapter 3, which presents the way in which technology and change are understood within this research. The theoretical foundations and assumptions are described, and contrasted with opposing views — both within archaeology and theory of technology more generally.

The chaîne opératoire, as a theoretically-situated methodology, is introduced in Chapter 4. Chapter 4 further summarizes the methodology that connects the theoretical framework and the data, and establishes how chaîne opératoire can be established within archaeological deposits given the fractured reality of the archaeological record. Issues surrounding the construction of units for analysis, as well as the technicalities of shell analysis are broached with protocols followed during analysis outlined.

Chapter 5 gives the results of analysis of six Lapita sites, including the early site of Kamgot on Babase Island, New Ireland Province, Papua New Guinea; the middle Lapita sites of RF-2 in the southeast Solomons, 13A and St Maurice/Vatcha in New Caledonia, and Vao in Vanuatu; and the late eastern site of Naigani in Fiji. Chapter 6 presents results from the analysis of material from ten sites in Island Southeast Asia; Arku Cave, Leta Leta Cave, Parades Shelter, Bato Puti, Sa’gung Shelter, Duyong Cave, Ille Cave and Kamuanan Shelter from the Philippines, and Golo Cave and Uattamdi from the northern Moluccas, eastern Indonesia. Chapter 7 presents results of analysis of material from the pre-Lapita site of Pamwak on Manus Island, Bismarck Archipelago, as well as the two pre-Lapita sites of Kili Cave and Palandraku Cave on the island
of Buka, North Solomons Province, Papua New Guinea. The location of all of these sites is shown in Figure 1.1.

Chapter 8 draws together the results from Chapters 5, 6, and 7 and presents a comparative analysis set within the theoretical framework outlined in Chapter 3. Results from individual artefact types and production techniques are compared to ascertain discrete trajectories and relationships. The results from sites are then considered as aggregates in order to test for broader patterns, such as the movement of polythetic suites. These results are then set within the broader picture of social and historical relationships through the Early and Mid-Holocene of Island Southeast Asia and Island Melanesia. An important caveat in this final section is that while a study of shell-working may draw out particular relationships and trajectories, a similar study of other cultural items such as pottery, domesticates, or lithic artefact production may expose different patterns. This is indeed expected given the composite nature of culture and shifting fields of social relationships, both of which are taken as theoretical givens within this thesis.
Chapter 2: Approaches to culture and culture change in archaeological theory

2.1 Introduction

The concepts of culture and culture change have had colourful histories in archaeological theory. Prevailing attitudes though time regarding issues such as innate human creativeness, the stability and conservativeness of culture, factors promoting social change, and views on the structure of societies have all favoured particular explanations. This chapter seeks to sketch these changing attitudes. The aim here is not to give a comprehensive account of attitudes toward culture transformation in archaeology over the last century, but rather to draw out trajectories and shifts in thinking that have shaped archaeological practice and interpretation. Some of the issues introduced as part of this discussion will be picked up in Chapter 3, which will lay the theoretical groundwork for how various processes of cultural change are isolated, defined and interpreted within this thesis.

2.2 Culture and culture change in early approaches to the human past

Much early interpretation of prehistory was tied directly to ideas associated with the Enlightenment. Primary amongst these Enlightenment principles was a belief in 'psychic unity', or, the belief that all humans had the same cognitive structure and therefore problem-solved in a similar manner, and the idea of progress culminating in a dispassionate rationality (Trigger 1989:57-8). The
focus on ‘progress’ was underpinned by a belief in social evolution that was common to the vast majority of early anthropological approaches. It is crucial to note, however, that humanity as a whole was seen to progress through evolutionary stages rather than individual cultures. Thus, mechanisms seen as promoting culture change, such as diffusion and population migration, were not seen as antithetical to evolutionary ideas – indeed they were considered essential to social progress in that they spread progressive ideas outward (White 1945:343; Harris 1968:343). Individual cultures could thus ‘skip phases’ (White 1945:343) and a belief in psychic unity meant that there were no ‘mental impediments’ to diffusing ideas. Independent invention was also considered likely.

The rise of nationalism following the Napoleonic wars represented a challenge to belief in the doctrine of psychic unity and stimulated the growth of viewpoints supporting differential biological and cognitive endowment amongst ethnic and national groups (Trigger 1989:111). These ideas were often tied explicitly to Darwinian principles of natural selection (for example Lubbock in Trigger 1989:117). The invocation of diffusion and migration in these schemes was underpinned by a belief that only some ethnic groups were capable of a creative process such as invention. This belief was formalised in Friedrich Ratzel’s ‘active’ and ‘passive’ cultures, and his belief in the unlikelihood of even the simplest of inventions being made more than once. That view was adopted by Gustav Kossinna and formalised within archaeological interpretative schemes (Trigger 1989:163). In Britain, similar beliefs were to form the basis of work by ‘hyperdiffusionists’ such as Grafton Elliot Smith and W. J. Perry who believed Egypt to be the home of all invention, from which items and ideas diffused to other centres around the globe. Smith’s belief in the capricious
nature of both human beings and diffusion as a process meant that he did not view diffusion as a “mere mechanical process”, but one in which items and ideas could be accepted, rejected or modified by recipient groups (Smith 1933:10).

While hyperdiffusionism enjoyed brief favour among most professional archaeologists of the time, most viewed innovation as rare, and relied heavily on diffusionist or migrationist explanations. Typically, those who advanced diffusionist explanations had a greater sense of optimism regarding human cognitive capacity than those who invoked waves of migration to explain all cultural change (Trigger 1989:154). However, even diffusionist explanations often rested on core/periphery assumptions in which ideas were held to spread out from more ‘innovative’ areas to the more culturally conservative peripheries (Trigger 1989:160). In any case, this growing focus on cultural variation over space shifted the focus from ‘periods’ to ‘cultures’ (Trigger 1989:154), and it was this shift that paved the way for a formal archaeological approach to the past in the form of Culture History.

2.3 Culture History in Europe – approaches to culture and culture change

2.3.1 Gustav Kossinna and the foundations of European Culture

History

The ‘archaeological culture’ was first formalised and employed by the German archaeologist Gustav Kossinna in Die Herkunft der Germanen (The Origin of the Germans) in 1911. Based on the widely-held assumption that cultural continuity indicated ethnic continuity, he proposed that particular artefact types
considered distinctive to certain ethnic groups could be mapped onto the
gEOGRAPHY OF Europe through time, thus clearly indicating prior areas of
occupation and the pathways of migration. He termed this approach
Siedlungsarchäologie, or 'settlement archaeology'. These principles of
interpretation are those of Culture History in general. This is defined by Jones
(Jones 1997:5) as

...the empiricist extraction, description and classification of material
remains within a spatial and temporal framework made up of units which
are usually referred to as 'cultures' and often regarded as the product of
discrete social entities in the past.

This approach was to form the basis for decades of culture-history in Europe,
and indeed throughout the world (Jones 1997:5).

Kossinna's belief in racially-defined ethnic units that were most often
directly linked to modern and/or historical European populations led to a
definition of archaeological culture that went well beyond reliance on material
aspects. This point is often overlooked in the literature, so it is worth
emphasizing that Kossinna's kultur-gruppe (or generic 'culture group') was
considered to be biologically and linguistically homogeneous, as well as sharing
a common material culture. Consequently, material culture could inform on the
movement and spread of language groups as well as physical type (which for
Kossinna was linked to innate cognitive capacities and racial qualities). Since
archaeological cultures were conceived as discrete but total ethnic packages
that could be traced back in time, changes within such units were ascribed to a
branching process of differentiation driven by increasing isolation from the
source. Needless to say, it was believed that linguistic, cultural and physical
differences were the result of the same process of differentiation (Trigger
1968:7-8). In this way, the various Germanic tribes known in Roman times, such as Vandals and Lombards, could be traced back to a single earlier Germanic race, and Indo-European (or for Kossinna ‘Indo-German’) languages could be traced back to an origin in space and time (Trigger 1989:165). Changing spatial patterns of material culture were explicitly linked to the migration of groups, while innovative capacities were linked to ‘active’ superior cultures rather than ‘passive’ inferior ones (Trigger 1989:165).

2.3.2 V. Gordon Childe and classic British Culture History

While V. Gordon Childe adopted many of Kossinna’s ideas, he explicitly rejected Kossinna’s formulation of ‘race’ as well as his association of physical type with material culture (Childe 1935:3-4). Childe saw ‘peoples’ as united by a social heritage; “by community of language, institutions, artistic and industrial traditions” (Childe 1935:4) and the archaeological record as “the concrete expressions of the common social traditions that bind together a people” (Childe 1956:2). Childe (1935:9-10) emphasized that it was not the task of archaeology to simply trace origins and migrations:

    And so it would be an old-fashioned prehistory that regarded it as its sole function to trace migrations and to locate the cradles of people. History has recently become much less political – less a record of intrigues, battles and revolutions – and more cultural.

As well as distancing himself from the racism and political motives of Kossinna, Childe set a new agenda for archaeology. He considered cultures as being adapted to their environment, and thus called for more attention to be paid to the nature of palaeoenvironments and the various adaptations of human groups
to these. This he viewed as the “functional conception of a culture” (Childe 1935:10).

While rejecting unquestioning migrationist views of prehistory and culture change, he emphatically defended diffusionism as a concept. While stating that the untested and undefined invocation of migration to explain all culture change was highly unsatisfactory, he stressed the need to understand what learning a new idea is constituted by and the various situations in which this could occur. In addition, proof of relatedness needed to go well beyond superficial similarities and the comparison of vaguely-defined or overly-inclusive categories of material culture (Childe 1935:12-13).

2.3.3 Diffusion versus invention – the proposals of Graebner and Trigger

Disagreements between diffusionists and those who supported the idea of psychic unity (and thus a high frequency of parallel invention) resulted in a series of attempts to outline methods by which archaeologists could distinguish between the two processes. The most prominent attempt was made by Fritz Graebner of the ‘Vienna’ or ‘Kulturkreis School’ in Die Methode der Ethnologie (1911). Despite its early publication date in relation to culture-historical practice, his methods remained heavily utilized and debated for decades. Graebner proposed a dual-pronged method to test for relationships between similar but geographically disjunct items of material culture based around two general criteria: form and quantity. The ‘criterion of form’ states that similarities in items of material culture or culture traits that do not arise from its essential nature or intended function should be deemed evidence of diffusion – regardless of the geographical distance that separates them. The ‘criterion of
quantity’ states that the greater the number of common traits, the greater the chance of an historical relationship (Harris 1968:384).

A cursory analysis of these propositions draws out a number of problems. As regards the criterion of quality, ‘similarity’ and ‘difference’ always have subjective components, and thus criteria for judging similarity and difference need to be explicit (Trigger 1968:32). Harris (1968:384) wonders how we are to decide what is an ‘arbitrary’ feature as opposed to one that arises from the function of the artefact or the nature of the material. One possible solution is to work out the nomothetic conditions under which the trait occurs. However, recourse to nomothetic explanation (i.e. the construction of general laws) was the very thing the Kulturkreis School sought to avoid (Harris 1968:384). With regards to the criterion of quantity, Trigger (1968:34) points out that lists can be inflated if traits are not independent of one another. For example, a mortar and pestle should be treated as a single category, not ‘mortar’ and ‘pestle’. Issues inherent in determining function often make this very difficult to judge (Trigger 1968:36).

Following his critique of Graebner, Trigger (1968:38) offers his own criteria for separating diffusion from independent invention. Firstly, Trigger suggests similarity in style is likely to be more informative than similarity of functional traits, given the adaptive and cross-cultural nature of function. Secondly, if a relationship seems likely, it must be determined whether this is the product of diffusion or convergent evolution. To answer this, Trigger recommends searching in both areas for antecedents of the trait in question. Thirdly, if the present distribution of what is thought to be a diffused trait is discontinuous, one must look further back in time along the proposed route of diffusion to check for a former continuous distribution.
Chapter 2 – Culture and culture change

While certainly being a step forward from Graebner’s criteria, these recommendations fall into many of the same traps. How does one ‘objectively’ establish an antecedent? Do we expect all diffusion to occur in a ‘down-the-line’ fashion leaving a clear trail of evidence? How does one separate the ‘functional’ from the ‘stylistic’? Is this even a realistic or valid distinction? These ideas, and potential ways into the problem, will be addressed in greater detail in Chapter 3.

Scholars within the later processual tradition pointed out that culture-historians never addressed the issue of what properties of a cultural system made internal innovation possible, or led to the acceptance of ideas from outside (Trigger 1989:206). This is perhaps debatable. Firstly, the major interest of culture-historical archaeologists lay in explaining particular cultural configurations rather than expounding general laws. Where there was an interest in pan-human process it was believed that the vagaries and contingencies of history and circumstance required general laws to be built up inductively though cultural comparison (Boas 1940:257-8). Each cultural situation or trait had to be understood in its own context before comparison of like with like could be assured. Secondly, considerable effort was put into studying the process of innovation by particular culture-historians such as Alfred Kroeber. The case of Kroeber will be discussed in the next section.
2.4 Culture History in the United States – approaches to culture and culture change

2.4.1 The foundations of American Culture History

Culture History in the United States arose independently from the European tradition and was based on inherently different interests and questions. While Culture History in Europe had been tied to questions about racial histories, language groups and tracking nationalities/ethnicities, the culture historians of the United States were focused on understanding of the ‘Other’ (namely the American Indian) rather than themselves. This alterity (or ‘otherness’) of the subject promoted the link between anthropology and prehistory in the United States, as opposed to the more traditional alliance of archaeology and history in Britain (Johnson 1999:29).

Culture-history appears to follow two distinct strands in the United States, which, although they overlapped in particular ways, were set toward different ends. The first strand was confined largely to archaeology and comprised the establishment of taxonomies and trait-lists set in chronological frameworks to outline history in its narrowest ‘time-line’ sense. This will be referred to here as the ‘taxonomic tradition’. The second was associated with the broader purview of four-field anthropology, whose focus was ‘history’ in the broader contextual and explanatory sense. This line of scholarship was represented by Franz Boas and his students.

2.4.2 The early ‘taxonomic’ tradition

As in early Culture History in Europe, those within the taxonomic tradition considered archaeological cultures to be total ethnic packages that represented
ethnographic/historical ‘tribes’. These units were thought to be largely unchanging through time because of negative assumptions regarding American Indians’ ability to change (Trigger 1989:173). For these reasons, early American archaeology had sought to explain change through either the replacement of groups, or through the branching tree of differentiation model. Reliance on this second interpretation often gave regional taxonomic schemes a dendritic appearance (Trigger 1989:191).

The most prominent and influential of the taxonomic schemes was McKern’s ‘Midwestern Taxonomic Method’ (McKern 1937). Based largely on formal classifications of artefacts, different types were implicitly thought to represent temporal difference, while similarity over space was thought to reinforce contemporaneity. This was based on an assumption that culture represented an adaptation to environment and that adaptive solutions at any given time would be similar (Trigger 1989:190). McKern (1937) first introduced the terms ‘component’, ‘foci’ and ‘pattern’; with component being an artefact assemblage from a site representing a single occupation, foci being a series of components that shared a preponderant majority of traits, and pattern being the larger reflection of adaptation by cultural groups to the regional environments.

This approach had several major effects. It allowed archaeological data to be assigned to levels associated with different scales of operation, and its implicit basis in the ‘ethnographic group’ and the ‘site’ promoted a synchronous outlook in which change was necessarily punctuated. Furthermore, the attention given to ‘similarity’ over ‘difference’ within a statically-conceived unit promoted archaeological thinking in ‘packages’, rather than in traits on their own terms. The focus on location in time and space also resulted in the production
of 'laundry lists' of traits without an attendant interest in what these traits represented in terms of human behaviour.

2.4.3 'The Boasians' – Franz Boas and his students

From very early on, the view of culture as an ethnic totality with language, physical type and culture differentiating together came in for strong criticism from Boas and his students. Edward Sapir was one of the most vehement critics, devoting a chapter of Language: An Introduction to the Study of Speech (Sapir 1921:chapter 10) to refuting the 'parallel differentiation' approach to cultural change and evolution. He stated that:

\begin{quote}
Historians and anthropologists find that races\(^4\), languages, and cultures are not distributed in parallel fashion, and that their areas of distribution intercross in the most bewildering fashion, and that the history of each is apt to follow a distinctive course. Races intermingle in a way that languages do not. On the other hand, languages may spread far beyond their original home, invading the territory of new races and of new culture spheres. (Sapir 1921:222)
\end{quote}

Franz Boas (1940) also spoke out strongly against the representation of cultural groups as essentialised racial totalities. Of the relationship between language, biology and culture he says:

\begin{quote}
In our investigations on the early history of mankind three methods are available, each directed to a certain series of phenomena – physical type, language, customs. These are not transmitted and do not develop in the
\end{quote}

\(^4\) When Sapir and Boas refer to 'race' they mean it in terms of a 'physical' or 'biological' types. This bioanthropological thrust is rather different from Kossina's 'race', which also incorporates innate psychological and cognitive aspects.
same manner. The one persists when the other changes, but all may be made to contribute to the solution of the general problem. (Boas 1940:153)

Boas took a very different approach to the task of understanding culture and culture change. He viewed cultures as complex and history-laden, and reminded his peers to be cognizant of this and not reduce explanation to single or determinist variables (Boas 1940:266). It was this recognition, as well as his rejection of unproven migrationist or simple dendritic explanation, that led him to adopt an explicitly inductive approach. This, he felt, allowed him to isolate incidences of diffusion, migration and parallel innovation rather than assuming them out of hand (Harris 1968:260). Rather than being against the formation of general laws, he believed that we need to understand individual instances of culture process and culture change, before we can be certain we are comparing like with like (Boas 1940:273-5; Harris 1968:316).

Boas seems to have gone further than any of his contemporaries in the drive to explain, rather than map, culture change. Unlike the majority of social scientists of the time, he saw the nature of an individual's interaction with the culture in which he/she was embedded as critical to understanding human behaviour (Boas 1940:258). Balancing the freedom of the individual with the constraints of cultural norms and practices was, he considered, the key to understanding sources of social transmission, acculturation and change (Boas 1940:285). Recognition of the importance of this level of analysis has re-emerged in new forms recently (e.g. Bourdieu 1977; Giddens 1984).

Alfred Kroeber was one of the first, and most influential, of Boas' students. Although he followed Boas in many respects, both his redirection of Boas' concerns and his interests in the social foundations of the production and use of material culture, make his work particularly pertinent to archaeologists. Like
Boas and Sapir, he spoke out strongly against viewing cultures as ethnic totalities where biology, language and material culture were not only congruent, but also coeval. He argued this, however, in a slightly different way. He viewed ethnicities as emic constructions, built on shared feelings of identity and often set up in opposition to an ‘other’. As such, they could not be expected to be harmonious in language, material culture, or indeed geography (Kroeber 1948:226). Assumptions to the contrary were regarded as being politically dangerous:

*It is …logically inadmissible and risky in practice to infer from nationality to language or culture, or vice versa. It is unsound much as it is unsound to assume an identity of race, language, and culture for a given area, or to argue from the prevalence of one to the other.* (Kroeber 1948:226)

In explicit opposition to the British social anthropology of Malinowski and Radcliffe-Brown, Kroeber (Kroeber 1948:287) viewed cultures as both open and composite. He stressed that although cultures may appear homogeneous and functionally-integrated to both members of the culture and those who view it synchronically from outside, a diachronic investigation will reveal a number of traits of different antiquity and source (Kroeber 1948:286-7). This recognition led him to in-depth studies of the nature and workings of diffusion and invention (Kroeber 1948:344-571). Throughout these discussions, Kroeber stressed the importance of the cultural milieu to both the acceptance and contextualisation of new traits – in regard to both independent innovation and diffusion. On the topic of innovation, he argued strongly against both ‘great man’ theories of invention and the maxim ‘necessity is the mother of invention’. Instead, he highlighted the importance of cultural context, historical process, and extant frameworks of (emic) knowledge in the genesis of independent innovations.
Even the 'happy accident' was only 'happy' if one was in a position to recognise its significance (Kroeber 1948:355).

Kroeber's work -- particularly that on invention -- has been labelled by some as a display of 'cultural determinism' due to the focus he places on milieu and cultural contingency. This is perhaps unfair as he does stress both individual agency and the power of factions within a cultural group to promote, resist or reformulate innovations within his larger explanatory framework (Kroeber 1948:361, 363). His central point, however, was to illuminate context and debunk the 'hero story' explanations attached to inventions. Indeed, it is interesting to note that the majority of Kroeber's assertions regarding invention and its context are very much the same as those prominent in social-constructivist approaches to technological invention presently in sociology.

Before leaving Kroeber and the Boasians, it is well to point out their explicit stance on the invocation of migration as an explanation of culture. Again, Kroeber appears to handle this subject most forthrightly and explicitly. His major objection is that invoking a migration to explain culture change in fact explains nothing. Rather, it is more likely to mask more important, subtle and gradual processes such as innovation and diffusion (Kroeber 1948:473-4). He dismisses as simplistic, notions of cultures "marching" out of their homelands "with their future culture packed away in little bundles on their backs" (Kroeber 1948:474).
2.4.4 Beyond the taxonomic tradition – the new synthesis of American Culture History

The late 1940s and 1950s represented a change of focus and, in some respects, a coming together of the two lines of thought and practice. This is best embodied in Walter Taylor’s watershed critique of Americanist archaeology as represented by the taxonomic school, A Study of Archeology (1948). Taylor felt that the goals of Americanist archaeology were too limited – being focused nearly exclusively on the establishment of chronologies – and argued for a greater effort on behalf of the nature of past cultural groupings (Taylor 1967 [orig. 1948]:60-1, 93). Taylor proposed a way forward in the ‘conjunctive approach’, which drew on many domains of Boasian thought. Firstly, he utilised Boas’ idealist conception of culture, which asserted that ‘culture’ was an intangible mental construct while the tangible visual and material products were expressions of culture and not culture itself (Taylor 1967 [orig. 1948]:99, 108). Secondly, he drew on Boas’ inductive method and the justifications behind it (outlined above) arguing that the context of artefacts and cultural ‘manifestations’ must be factored into interpretations ensuring comparability and adding to our corpus of cultural knowledge (Taylor 1967 [orig. 1948]:167-8).

What Taylor is probably most remembered for now, however, is his dual definition of the ‘culture concept’. He realised that the word ‘culture’ is frequently used in two very different ways; firstly as a holistic concept in opposition to the ‘natural’, and secondly as a partitive definition referring to particular cultures (Taylor 1967 [orig. 1948]:95-99).

With regards to units of study and interpretation, Taylor believed that the situation for archaeologists dealing with undocumented cultures was much more difficult than for archaeologists working on the recent past using the direct
historical approach. He found biological units too gross and therefore misleading, and warned about the assumptions entailed in giving cultural remains linguistic labels (Taylor 1967 [orig. 1948]:143-4). This, he believed, left socio-cultural units – such as 'clan', 'village' or 'tribe' - as the most acceptable units for archaeology (Taylor 1967 [orig. 1948]). Although unstated in any specific way, this would appear to mean that Taylor treats these groupings as bounded, definable, and most of all, real. Also of interest, is the fact that Taylor, despite his intensive treatment of many other aspects of archaeological practice and interpretation, does not broach the subject of culture change and ways through which this could be assessed.

A decade later, Gordon Willey and Philip Phillips again attempted to steer archaeology toward a focus on understanding culture in Method and Theory in American Archaeology (1958). Rather than building on Taylor (1948), Willey and Phillips engaged again with the traditional Americanist taxonomic school – particularly in the form of McKern and his Midwestern Taxonomic Method. Indeed, the framework offered by Willey and Phillips is based heavily on McKern's formulations. Willey and Phillips retain McKern's component, meaning a group of formal types associated within a layer or site, but replace 'foci' with phase (Willey and Phillips 1962 [orig. 1958]:21-2). They consider the phase to be the most practical and intelligible unit of archaeological study, and draw on Kidder, Jennings and Shook's (1946) definition:

A cultural complex possessing traits sufficiently characteristic to distinguish it for purposes of preliminary archaeological classification, from earlier and later manifestations of the cultural development of which it formed a part, and from other contemporaneous
complexes (Kidder, Jennings and Shook, 1946 in Willey and Phillips 1962 [1958]:22).

They proceed to define phase themselves in the following manner:

an archaeological unit possessing traits sufficiently characteristic to
distinguish it from all other units similarly conceived, whether of the same
or of other cultures or civilizations, spatially limited to the order of
magnitude of a locality or region and chronologically limited to a relatively

Willey and Phillips’ definition gets away explicitly from the notion of continuity
between one phase and another inherent in Kidder, Jennings and Shooks’
definition and explicitly allows for ‘intrusion’ (Willey and Phillips 1962 [orig.
1958]:23). As with Taylor however, mechanisms for change are not discussed.

Willey and Phillips viewed phases as being anchored on both spatial and
temporal dimensions, or, to use their terminology, phases were represented
spatially by horizon styles and temporally by traditions. The horizon style was
defined 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. (Willey and Phillips 1962 [orig.
1958]:33).

A tradition, on the other hand, was defined as:

A (primarily) temporal continuity represented by persistent
configurations in single technologies or other systems of related forms.

(Willey and Phillips 1962 [orig. 1958])

The overall focus appears to be on how to draw a circle around units in time
and space so that units may be viewed and described singly and synchronically.
Without attention to cultural change, or indeed 'process' of any sort, it is easy to see how these sorts of formulations were criticized of 'describing' rather than 'explaining' cultural manifestations in the archaeological record. It was to these sorts of approaches that processual and 'New' archaeologists reacted from the 1960s onwards.

2.5 The processual critique and the rise of the New Archaeology

2.5.1 New ways of viewing culture

While Culture History in Europe and the United States had been moving along parallel paths for decades, the processual critique and the emergence of the New Archaeology represented a greater degree of cross-fertilization and common purpose. A belief in societies as discrete, functionally-integrated systems infused with a neo-evolutionary focus on such units primarily representing adaptive strategies toward the environment, shifted archaeological questions and explanations well away from the prior concerns of Culture History. In Britain, the development of this new approach owed much to the 'New Geography' focus on general systems – taken up in archaeology most notably in the work of David Clarke (e.g. Clarke 1968). In the United States, systems thinking within archaeology owed its intellectual debt to the emergent British social anthropology associated with E. R. Radcliffe-Brown and Bronislaw Malinowski.

Scholars within the British tradition of social anthropology had been propounding formulations of social systems as functionally-integrated and bounded units for some time. Based on the earlier work of Emile Durkheim,
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Radcliffe-Brown (Radcliffe-Brown 1986) believed social structure to underpin and co-ordinate a functioning social whole, and it was the job of anthropology to map regularities in the morphologies of these structures. His concern with regularity and the general unimportance of history and contingency, led him to a trenchantly ahistorical and synchronic outlook (Radcliffe-Brown 1986:192), in stark contrast to Boas and his students.

It is easy to see how the structural-functionalist school of British social anthropology, and the larger trend of which it was a part, was attractive to archaeologists. High-level inferences could be drawn about the nature of society from small, synchronic units that were seen to be generally in a state of homeostasis founded on adaptation to the environment (Radcliffe-Brown 1986). This must have seemed both more manageable and rewarding than traditional culture-historical approaches. In any event, the adoption of a structural-functionalist model of society within archaeology, in both Britain and the United States, signalled a major epistemological and methodological shift expressed most strongly in the ‘New Archaeology’.

2.5.2 Economics, environment and ecology – the new basis

The exponents of the New Archaeology focused scholarship onto detecting regularities in human behaviour, recognizing the physical environment as one of, if not the, primary variable. The stage had been set for this focus by the work of Graham Clark in Britain and Julian Steward and Leslie White in the United States. Clark (Clark 1974 [1952]:7-9), drawing on new ideas in geography but also in line with British structural-functionalist anthropology, viewed cultures as being in a state of equilibrium both internally and with the surrounding environment. He viewed culture change in terms of ‘progress’ –
specifically related to the human ability to control and manipulate the natural environment:

_The relationship between man and external nature is ... a dynamic one and the development of culture in its economic aspect is indeed one of man’s growing knowledge of and control over forces external to himself._

_The history of man differs from that of any other species precisely in that it has been one of progressive emancipation from the thraldom of instinctive conformity with a pattern imposed by external forces: by every advance in his culture man has enlarged the sphere for the exercise of choice for good or for evil._ (Clark 1974 [1952]:7)

Economics stood at the interface between the natural environment and social systems, and was thus seen to be of fundamental importance. Set within an explicitly social-evolutionary framework reminiscent of those of Victorian anthropologists Morgan and Tylor, societies were seen to progress through stages with change being prompted by economic or technological innovations (Clark 1974 [1952]:15). The explanation for how these changes arose seems to be implicit in both the evolutionary and environmentally-determinist base. In line with earlier social evolutionary schemes in Europe, only some societies were seen to invent. These innovative ideas were spread either through migration/appropriation of land, or a process of acculturation in which:

_**higher groups obtained certain economic advantages without the necessity of force and simpler ones assuaged their feelings of inferiority be emulating their more advanced neighbours and adopting in a devolved form their mode of life**” (Clark 1974 [1952]:16-17).

Julian Steward, being a student of Kroeber, took environmental explanation in another direction based on different founding assumptions.
Steward explicitly distanced himself from the social evolutionary schemata of Victorian anthropologists – including the “revamped” use of them in contemporary works (Steward 1955:11, 14), and instead promoted the idea of ‘multilinear evolution’. Like earlier unilinear approaches to evolution, multilinear evolution dealt with developmental sequences. Rather than seeking (or assuming) universals however, it aimed to detect “parallels of limited occurrence” (Steward 1955:15). In this sense, it can be seen as an extension of Boas’ inductivist contextual approach.

While Steward’s work was an important contribution to the later ‘New Archaeology’, it was the writings of Leslie White that were to have the greatest influence in the following decades. White represented the new breed of scientific cultural anthropologist focused on delineating general laws of human behaviour within an explicitly evolutionary framework. He had little interest in investigating the workings of particular societies, and rather sought to outline patterns of ‘general evolution’ common to humanity as a whole. As such, he signifies the antithesis of particularist and historicist Boasian anthropology.

White conceived of cultural systems as tripartite, having techno-economic, social and ideological facets, with the techno-economic component determining the overall systemic structure. Viewing cultures as thermodynamic systems, he believed that culture evolved as the harnessing of energy and the efficient use of this energy increased. This was laid out in the formula ‘Culture = Energy x Technology’ (C = E x T). Given White’s interest in ‘general’ evolution only, invocations of migration or diffusion to explain change were ipso facto irrelevant. The problem of how technology itself is supposed to change within technologically-determinist theories will be addressed in the next chapter.
2.5.3 Binford, the New Archaeology, and systems approaches

The influence of White's thinking on the most vocal of the New Archaeologists, Lewis Binford, is explicit. Binford adopted White's tripartite conception of culture, labelling the constituent segments technomic, socio-technic and ideotechnic (Binford 1962). Like White, he also saw the 'technomic' as the defining characteristic of the overall social structure, however his rationale was somewhat different. While White saw environmental variation as being of little relevance as contingent or historical particulars in understanding general patterns of evolution (Trigger 1989:290), Binford saw environmental variation as being the primary key to understanding human adaptive solutions (Binford 1962:218). If the technomic component of a culture was to be understood as having its 'primary functional context in coping directly with the physical environment' (Binford 1962:219), then this segment was the cultural linchpin.

Binford believed it was the task of archaeology, among other things, to understand how the technomic, socio-technic and ideo-technic articulated with one another, and to establish general laws relating both to intra-system dynamics and extra-systemic relationships (e.g. see Binford 1962; Binford 1965). In short, the goal was to reveal general patterns of cultural process that had validity at the level of human behaviour. In this sense the approach was geared to Taylor's 'holistic' rather than 'partitive' culture (Taylor 1967 [orig. 1948]:95-9).

If the focus of the New Archaeology was to be on functioning systems and adaptive solutions, then Culture Historical concepts of culture change such as diffusion had little currency. That processes like diffusion or migration happened was not contentious. That they had any explanatory value in delineating the nature of culture evolutionary process was much less certain.
Although Binford charged culture historical archaeology with not offering explanations of human cultural behaviour, the difference between the ‘old’ and ‘new’ archaeology relates more fairly to where explanatory goalposts were set (for further discussion see Johnson 1999:27-8). One way of sketching this fundamental difference between the two approaches would be to say that Culture History wished to explain the historical processes that had built up the archaeological record in particular instances, while the New Archaeology wished to utilise the archaeological record to reveal more basic ‘truths’ about human behaviour. The former focused on diversity, while the latter focused on commonality. From this standpoint, neither is right or wrong – they simply seek to answer different questions.

For the purposes of this thesis, there is another important distinction to draw out between Culture History and the New Archaeology. This relates to the structure of socio-cultural units. The systems approach adopted by the New Archaeology necessarily required a system to model. The focus on adaptation coupled with contemporaneous understandings in cultural anthropology, led to the assumption that this system was geared toward homeostasis. This assumption presents a series of problems when trying to model social change, because a ‘well-adapted system’ has no need to change unless prompted to do so by external variables (Johnson 1999:77). Environmental determinism thus looms large, despite special pleading to the contrary (Binford 1962:218). In contrast, Culture History – particularly the Boasian strand – viewed culture as accretionary and eclectic. Characterised most colourfully by Lowie, presumably after Gilbert and Sullivan⁵, as a ‘thing of shreds and patches’ (Lowie in Kroeber 1948:286), cultures were seen as open and receptive. This is not to say that

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⁵ The Mikado
they did not function in a systemic sense, but rather that internal configurations were understood to be always shifting as cultural items and practices were accepted, displaced or reinterpreted (see Kroeber 1948:256-8, 286-7). It is this appreciation of culture that led Kroeber (as mentioned above in section 2.4.3) to state that only a dissective analysis and knowledge of history of a given culture will reveal its composite character. This composite character belies an outward impression of functioning homogeneity when viewed synchronously (Kroeber 1948:286).

2.6 Post-processual critiques and approaches

2.6.1 Introduction to post-processual thought

It is difficult to draw a box around the ideas that arose within the ‘post-processual’ movement that started to gain momentum in the 1980s. Certainly, there was a widely-held sentiment that the New Archaeology had been too narrow in its concerns, thereby closing the door to interesting and important questions about culture and culture change (Trigger 1989:329-30). Following directly from this, there was a renewed focus on diversity as well as continuity in culture. Johnson (1999:102-8) usefully draws out eight major strands in post-processual thought. Archaeologists working under the rubric of post-processualism may not utilise or give equal credence to all of these points, however they are all recurring themes.

The first theme is a rejection of the positivist conception of science. This stance, and the concomitant rise of ‘social constructivism’ is dealt with in the next section (2.6.2). Secondly, there is a general post-processual recognition that interpretation is a hermeneutic exercise. By this it is meant that we assume
meanings onto archaeological material and ancient people. These meanings are always grounded in present-day understandings and our own cultural ontology and, whether explicit or not, represent analogical thinking.

Thirdly, there is a rejection of the distinction between the ‘material’ and the ‘ideal’. This point is in reference to disagreements between Culture History and the New Archaeology regarding ‘where culture exists’. Culture History, and the Boasian strand in particular, had maintained that culture was a set of ideas and beliefs that then structured the tangible and observable aspects of culture. Culture itself was not believed to be observable – simply its products. New Archaeologists such as Binford took exception to this ‘ideal’ or ‘mentalistic’ view of culture. Binford did not see culture as an individual human possession but rather conceptualised it as a system that one ‘participated in’ (e.g. Binford 1965). Utilising White’s (White 1959:8) definition of culture as ‘man’s extrasomatic means of adaptation’, Binford saw culture as a way of adapting to a specific ecological setting. The resultant focus on the importance of cultural facets such as tools, subsistence techniques and general ‘adaptive solutions’ made it an explicitly materialist approach. Post-processual stances tend to reject the dichotomising of material and ideal, or work them in together to present a multifaceted interpretation (see Johnson 1999:103 for further discussion and examples).

Fourthly, post-processual approaches often acknowledge that when offering interpretations, we try and place our minds in the heads of ancient people to understand their motives and decisions. In post-processual approaches, this tactic is frequently made explicit, rather than being cast as ‘logic’ or ‘rationality’. Fifthly, agency is of concern within post-processualist approaches. By agency is meant the way in which individuals as thoughtful
actors creatively challenge and manipulate social rules. This represents a
critique of both the all-encompassing normativism associated with Culture
History, and the equally all-encompassing adaptive systems in which ‘people’
often disappear. Efforts to assess the actions of historical agents frequently
draw on the works of Bourdieu (1977) or Giddens (e.g. 1984), both of which will
be considered further in the next chapter.

Sixthly, there is a recurring ‘text’ analogy in post-processualist
approaches. This analogy is a complex one but, at the risk of oversimplifying, it
works on the premise that texts can be read in different ways and can be
manipulated to different ends. A final or authoritative reading of text is not
possible. So too the archaeological record. Seventhly, the importance of
archaeological ‘context’ is widely stressed in post-processual perspectives.
Context is considered to be of the utmost importance in our efforts to give
meaning to the archaeological record. Lastly, it is recognised that the past is
always interpreted in the political present. Our interpretations therefore have a
political quality.

The merit of all of these post-processual critiques are accepted in this
thesis, however some are more pertinent to the questions posed here than
others. The next two sections elaborate on two aspects of the post-processual
critique that are central to this research. The first is the emergence and basis of
social constructivist thought, and the second is the way in which we are thinking
about culture and cultural change.

2.6.2 The shift toward social constructivism

From the 1980s, archaeology was part of a universal unrest across the social
sciences relating to the claims of positivism and the ‘reality’ of science. Driven
in a large part by the work of philosophers of science such as Kuhn and Feyerabend (e.g. Kuhn 1962; Feyerabend 1988) the positivist stance that had characterised the science of the 1960s and 1970s was coming under increasing attack.

Positivism maintained that science could produce objective and ‘real’ knowledge about the world through the employment of a hypothetico-deductive-nomological approach to test between rival interpretations. This view had been championed in archaeology most prominently by Binford (e.g. 1968) and Watson, LeBlanc and Redman (Watson, LeBlanc and Redman 1971). The gist of Kuhn’s (1962) critique is that scientific method, and positivism in particular, are not statements about what scientists really do, rather they are manifestos of what science aims to do (see Johnson 1999:43-4). At any given time, a particular ‘paradigm’ will be dominant within scientific method and explanation. This paradigm is a series of assumptions about the way the world works that underlies the structuring of questions, methods and interpretations. In times of ‘normal science’, the paradigm will form the foundation of practice and be called rarely into question. Periodically however, paradigms replace one another with ‘paradigm shifts’ being characterised by heated theoretical debate.

These initial observations of Kuhn have been expanded upon by both philosophers of science and social scientists. One of the bodies of theory to emerge from this consideration was what has become known broadly as ‘social constructivism’. Taking Kuhn’s observation that paradigms are based on a series of (often unstated) assumptions, social constructivists have argued that science cannot be regarded as anything more than a social construct situated as much in culturally-specific ontologies as any other form of knowledge. Thus,
‘science’ is merely one form of knowledge among many and, as such, cannot be privileged.

If ‘science’ as a privileged body of knowledge is to be regarded as mythical, then where does this leave archaeology? Certainly the New Archaeological aims of revealing general laws of human behaviour, utilising categories with assumed cross-cultural validity, and set within prefigured functioning systems, begin to appear questionably valid if not downright ethnocentric. Under the auspices of social constructivism science has its own social context, and thus we can only construct ways of understanding things rather than uncovering essential universal truths. This is a recurrent understanding within post-processual thinking of whatever stripe.

The rejection of positivism and ‘objective truth’ by adherents of post-processual approaches brings explanation full circle back to ‘the best explanation based on the current evidence’ that was a feature of Culture History. Rather than seeing this as epistemological defeat, it presents a stimulating challenge to us regarding the way in which we structure our questions, arguments and explanations. Certainly, now more than ever, theory should not operate ‘under the radar’ as in Kuhn’s normal science. The onus is on us to present theoretically explicit and epistemologically convincing arguments, whatever form they should take. Ways in which this can be done is a topic for fruitful debate (e.g. see Wylie 2002b; Wylie 2002a).

2.6.3 Cultural units and culture change

Discontent with the New Archaeology’s conception of culture and the ensuing programme to ‘explain’ it was not the sole intellectual property of those adhering to post-processual approaches. Even the prominent New Archaeologist Kent
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Flannery stated that utilisation of the principles of unilinear evolution was not sufficient to explain cultural diversity as well as similarity (Flannery 1983 in Trigger 1989:329). Culture was coming to be thought of as more than ‘adaptive solution’, though what it was to be understood as was an open question.

At the forefront of the post-processual critique, Ian Hodder (e.g. Hodder 1985; Hodder and Hutson 2003) drew on ideas of Bourdieu and Giddens to conceptualise culture as a series of structuring principles that are actively constituted and renegotiated by human actors. From this standpoint, culture is not considered bounded or passive. Rather, it is seen as being continually negotiated, manipulated, and thoughtfully constituted. There is no pre-conceived notion of how a cultural system should look as it is structured through the active interplay of history, interaction, and contingent processes. As with Culture History, a focus on cultural diversity is the outcome.

Diversity also seems to be the key word when it comes to explanations of culture change. Given that history matters, material culture is actively manipulated, and results of human interaction are both variable and unpredictable, there can be no ‘just add water’ formula for understanding cultural change. It would seem that each identified case in the archaeological record has to be judged on its own merits. If the assumption of homeostasis associated with the New Archaeology is also rejected, this further means that comprehending stability is as much an issue as understanding change.

2.7 Summary and state of play

This chapter has endeavoured to highlight shifting perceptions in archaeology about what culture is and how it comes to change. What is clear is that ideas
about prevalent and important types of change process are firmly linked to the conception of culture. Thus, when culture is viewed as an emic though contingent association (as with Kroeber), processes of culture change are frequently linked to social interaction. This is characterised by the movement of goods and ideas creating and reinforcing various degrees of social distance. On the other hand, if culture is to be viewed as an etic adaptive system (*sensu* White and Binford), culture change is necessarily linked to adaptive solutions and evolutionary success. In the end, much of this disagreement comes down to opinions about what archaeology and anthropology could and should be investigating. Explicating shifting patterns of inheritance and interaction through time is a very different goal to that of mapping the socio-cultural evolution of human beings as a collective entity.

Within most post-processual archaeology, human action, history, interaction and resultant relations are all recognized to be contingent and unpredictable. From the archaeologist’s point of view, data are theory-laden and our interpretations are culturally-situated and subjective. While there is now, perhaps, more scope than ever for asking a wide variety of questions and accessing knowledge in a range of ways, there is no longer any sort of prescribed formula for what we do and how we do it. The theory-laden quality of the data further means that there is no dichotomous existence between ‘those who do excavation and analysis’ and ‘those who engage in matters of theory’.

In the next chapter I outline my specific premises, assumptions and starting points in relation to the research questions. Here however, I will outline the broad stance that will underpin the rest of this thesis. The first important point to make is in regard to units and systems. Following Kroeber (e.g.
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Kroeber 1948:286-7) and others working in a Boasian tradition, material culture expressions are seen as particular constellations of elements of differing source and antiquity configured into a contingent functioning whole. As such, co-associations between various elements (or ‘packages’ of material culture) are seen as contingent rather than necessary. This further means that ideas and artefacts can move independently of both one another and the culture in which they are situated at any given time.

This acknowledgement of the independence of cultural traits and ideas is further extended to the triad of language, biology and cultural expression. Once more in line with the Boasians, the co-variation of these is not assumed. Following from this, constellations of material culture will not be associated with historically or ethnographically-known peoples or given linguistic labels.

The recognition of the independence of items of material culture and cultural traits reinforces an open, rather than bounded conception of culture. ‘Systems’ can be observed to exist – but only contingently. My interest within this thesis is in isolating these contingent associations and ‘systems’ both in space and time. Accepting the openness of culture and the contingent association of its components, dendritic models are taken to be inadequate in expressing cultural form and change. The interest here is in isolating trajectories and associations of ideas and material products through time and space.

For enculturated human beings situated within socially-perceived physical landscapes, both history and the physical environment are seen to matter. Both the social and environmental milieu provide constraints to practice. Both however also offer a range of possibilities for renegotiation where different choices can be made. Determinist stances are therefore rejected in this thesis.
It is framed instead in terms of *possibilities* and *constraints*. Cultural 'meaning' is likewise treated in the same manner. Meanings are imposed on components of the natural and cultural world and are neither constant in that meaning nor essential in nature. Meaning is contextual and can be manipulated by human actors to a variety of ends.

The next chapter will work from these basic premises, shifting the focus to the specific nexus of technology and its relationship with society.
Chapter 3: Technology, Ontology and Culture - Ways of doing and Communities of practice

“As individuals express their life, so they are. What they are, therefore, coincides with their production, both with what they produce and with how they produce.”
(Marx and Engels 1970 in Dobres and Robb 2000:5)

“Especially in technical matters, there is always more than one way to get a job done. Why technicians work their materials in some ways and not others, therefore, becomes an important question” (Dobres 2000:135)

3.1 Introduction

‘Technology’ is a concept that means many things to many people in the post-industrial ‘information age’ world. Certainly, the term has become loaded with meanings and connotations, both positive and pejorative, since the Enlightenment and as part and parcel of Modernism. From visions of technology as an abstract ‘it’ at the vanguard of the march of human progress, to a weapon in the fight against our ever-encroaching nemesis ‘nature’, to a mechanized fiend set up in opposition to humanity, we have managed to set up technology as an autonomous ‘other’ that controls, thwarts or deterministically facilitates our destiny. Somewhere along the track, we have lost sight of the fact that technology is a product of human culture(s).

All of these themes have loomed large within archaeological interpretation at various points over the last century. The pervasiveness of these attitudes toward technology – which are a part of our own Western and capitalist history (see Ingold 2000g:313-4) – have meant that technology within archaeology has been “overlooked, under-theorized, and over-determined” (Dobres 2000:12).
Furthermore, there are those that argue that we have retrofitted our own explicitly contextual attitudes toward technology – such as the dichotomous treatment of technology/art or function/style - onto the past, thereby creating a technological teleology (Ingold 1999:viii-ix). This state of affairs surely merits some deconstruction.

In this chapter, I will firstly assess the sorts of assumptions regarding technology that have coloured archaeological interpretation. These trajectories in thinking will be examined both at the broad level of social theory and in their more explicit expressions within archaeology. Encompassed in this discussion will be consideration of ideas such as technological determinism, ‘progress’, evolutionary imperatives, essentialism, and normativism. Secondly, I will introduce practice theory – most often associated with Bourdieu (e.g. 1977) – as a way of understanding the situated and changing nature of technology as a socially-produced and -embedded phenomenon. As well as examining how technologies are produced and reproduced within social groupings, I will also discuss issues of technological change, innovation, diffusion and transfer. Specific methodologies will be dealt with in the next chapter (Chapter 4 – methodology). Finally, I will outline how a practice-based approach to shell-working technology has the potential to shed light on issues of social group formation, maintenance and interaction in the Western Pacific and Island Southeast Asia.
3.2 Pervasive attitudes to technology

3.2.1 Introduction

Technology is a major part of all of our lives. We work with technological products and carry out technological routines as part of our everyday existence - much of the time without even thinking about it. The car we drive, the computer we work on, and the teaspoon we use to measure out coffee are all technological things that define and structure our society as we concurrently define and structure them. Why, then, do our sociological theories about technology so frequently treat technology as separate from society, moving under self-propulsion through the ages with humanity playing catch-up? In the following five sections, I will explore a number of interrelated ideas about technology, society, and the human condition. Through this, I hope to contextualise both historically and intellectually why certain attitudes toward technology have been so compelling and widespread. I will further discuss how these ideas have been operationalised (and institutionalised) within archaeology as a discipline. As well as deconstructing and clarifying ideas about technology, this section serves to draw out issues that have been instrumental in guiding the theoretical approach I have chosen to take. Details of this approach follow in section 3.3.

3.2.2 Determinism, progress, and the evolutionary imperative

In his book investigating and deconstructing ideas about technology, Feenberg (1999) isolates two premises which underlie the concept of technological determinism: unilinear progress and determination by the base (Feenberg 1999:77-8). Unilinear progress sees humanity moving toward ever-greater
complexity, sophistication, and dominion over nature. This 'unfolding' can (and has been) cast in either a positive or negative light. The idea of unilinear progress is borne of retrospective reasoning, where technological configurations of today appear as "inevitable and inescapable" outcomes (Pacey 1983:23) of an unfolding trajectory from simple to complex (Feenberg 1999:77). The end of the story is cast as being fated from the beginning, as:

It projects the abstract technical logic of the finished object back into its origins as a cause of development, confounding our understanding of the past and stifling the imagination of a different future. (Feenberg 1999:80)

In this, technological determinism is teleological, and rather than assisting our comprehension of the past, it promotes the production of "simulacra of the past" (Dobres 2000:11).

Prevailing attitudes toward the general notion of progress have had a substantial impact on archaeological questions, frameworks and interpretations over the course of the history of the discipline (Triger 1978a:54). Indeed, in one sense the archaeological record is seen to document progress, and thus it is unsurprising that transformations in archaeological theory can be correlated with key shifts in attitudes toward progress within the social sciences and society more generally (Triger 1978a:54). The approaches of De Mortillet, and in particular his laws of similar development, typify the early work framed within the principles of psychic unity, where cultural evolution was seen as inexorable and cross-culturally parallel. Only rates of evolution were seen to differ—largely due to differing environmental contexts (Triger 1978a:63). In the true spirit of the Enlightenment, progress was seen as natural and worthy.
In sharp contrast, the same pessimism of late nineteenth-century scholarship that gave rise to the racial theories associated with those such as Kossinna and Ratzel (discussed in Chapter 2) also cast a pall over attitudes towards the 'onward and upward' course of progress, as well as generating a general mistrust of technology (Trigger 1978a:65). As also outlined in Chapter 2, this period was further characterised by the playing down of human creativity in favour of diffusionism, while at the same time it stressed the capriciousness and unpredictability of culture (Trigger 1978a:65). Despite this radical shift in thinking regarding progress and general social evolution, there remained a constant assumption in the form of technological determinism. Whether one viewed technological change as a "cheerful doctrine of progress" (Feenberg 1999:3) or technology as "inherently biased toward domination" (Feenberg 1999:3), technology remained the 'it' that controlled human destiny. The archaeological record provided a convenient means of documenting these trajectories – whether on the road toward perfection or decimation.

Given the 'proxy' status of technology for pinpointing stages of development and the general evolutionary path of culture(s), markers of technological ability and complexity were used to order and define the archaeological record. Thus, we conceive of a stone age, a bronze age, and an industrial age that constitute particular nodes on a unilinear continuum (Pacey 1983:23). On a more fine-grained level, prominent early archaeologists, such as Montelius, Lartet and Petrie, all constructed evolutionary schemes based on progressive change in tool forms through time (Dobres 2000:16). As Dobres (2000:17) points out, this meant that 'difference' and 'distance' on both spatial and temporal scales were measured through perceived technological
complexity. Cultural histories and contexts were thus ‘flattened’ and the
toevality of groups was denied (Dobres 2000:17).

Determination by the base, as outlined by Feenberg (1999:77-8), refers to
the belief that society must regularly re-order itself to adapt to the changing
demands of the technological base. Society is seen as playing an ongoing
game of ‘catch-up’ with technology, sometimes termed ‘cultural lag’⁶ (Pacey
1983:23). In archaeology, certain strands of evolutionary and New
Archaeological thought worked on allied assumptions, however the catch-cries
tended to be ‘adaptation’ and ‘efficiency’. Prominent among these approaches
was the work of Leslie White (e.g. 1959b) whose influence cast a long shadow
over the New Archaeology. As outlined in the last chapter, White was
concerned neither with understanding the evolutionary pathways of particular
societies nor with the conditions imposed by various types of environment.
Rather, his approach to general evolution was directed toward assessing
panhuman evolutionary advance measured in terms of ability to harness
energy. This capacity was directly related to technological prowess and
extractive efficiency. Levels of technological ability, in turn, dictated the level of
social complexity or ‘evolutionary stage’. As put succinctly by Spier (1970:8) in
a discussion of White’s approach:

The social order is supportive of the exploitation scheme, and the
ideological order provides a rationale, after the fact, for the whole system
of behavior.

In this, White’s theories are a good example of determination by the base.

⁶ Although the idea of cultural lag has its roots with Marx, it was expanded into a general
sociological theory by William Ogburn (e.g. 1964).
One of the major problems with technologically-determinist arguments, such as that presented by White, is the question of how technology itself actually changes. The fact that the social and ideological aspects of society are seen to lag behind technological change rules out social agency as a contributing factor. Variable environments are likewise not seen to be of central importance. So how do technological innovations come about? While there have been a variety of solutions to this problem historically, including the popularist ‘great men, great deeds’ argument, explanations most frequently rely on essentialist arguments whereby technologies reveal themselves as a natural fact. A discussion of essentialism follows in section 3.2.4.

In the various forms of technological determinism discussed by Feenberg (1999) and Pacey (1983), technology itself is seen to be the ‘base’ that determines. There is, however, a similarly structured line of thinking that sees technology to be determined by the environment (which then constitutes the base). Technology has a more ambiguous position in these sorts of approaches, at once being the vehicle through which humans manage the environment and the outcome of demands placed by the environment on humanity. Technology is a conceptual fulcrum in this equation. Human ability to make informed choices is a tantalising spectre in these schools of thought – though a spectre it usually remains.

The techno-environmental rationale has had a persistent and pervasive presence in archaeological explanation – more so than White’s blunt technological determinism. While viewing the physical environment as the critical variable in determining technology that then acts as a proxy of evolutionary attainment is most notably associated with Lewis Binford, this sort
of thinking has a considerably longer history within archaeology. As mentioned above, De Mortillet saw environment to be the major conditioning variable affecting rates of change, which were measured in terms of technological sophistication. Likewise, Childe believed progress to be the increasingly successful adaptation of a culture to its environment, or in higher evolutionary phases, the more effective adaptation of the environment in the service of culture (Childe 1944 in Trigger 1978a:68).

Foreshadowing Binford, Childe (Childe 1956:137) argued for the importance of the physical environment as a structuring feature of technologies. It is worth quoting Childe (1956:137) on the clear expression of this point:

*Now in so far as a culture is an adaptation to a specific environment, it must be modified by transfer to a different environment, and the degree of modification is likely to be inversely proportional to the culture’s technological level. In no case can it be expected that one and the same culture should be represented by an identical assemblage of types in two contrasted environments. Conversely all cultures under identical environmental conditions are liable to exhibit quite a number of common traits – behaviour patterns and archaeological types expressing them that are imposed on men by external natural conditions such as raw materials, or are at least adaptations peculiarly well fitted to securing survival in a particular environment.*

Childe’s (Childe 1956:137) assertion that “the degree of modification is likely to be inversely proportional to the culture’s technological level’ is indicative of his belief that more technologically-advanced societies were more coherent, successful, and would eventually overcome less technologically-advanced
groups (Trigger 1978a:68). This belief can also be seen in the writings of Graham Clark quoted in Chapter 2 (section 2.5.2). In both cases, technology was strongly correlated with successful progress. Likewise, the formulations of Binford set up technology (or the 'technomic') as the critical adaptive interface between humanity and the environment (Binford 1962, see also discussion in Chapter 2, section 2.5.3).

While many of the approaches associated with the New Archaeology can be seen as techno-economic determinism (e.g. Harris 1968), there is perhaps a more fundamental assumption at work that has influenced both archaeological theory and method with regards to technology. This is the dichotomous treatment of a variety of central concepts such as mind/body, nature/culture, and theory/practice.

3.2.3 Dualism: culture/ nature, theory/practice, thinking/ doing

One of the major legacies of the Enlightenment to modern scientific thinking is the division of 'objective knowledge' and practical pursuits. The Baconian project of science was the observation of nature and, through rational and objective enquiry, the demystification of Her workings. The subject and the object were thus cleanly severed in a conscious effort to separate nature from the obfuscating empathy of the human observer (and especially the female observer (Dobres 2000:54)). Nature became the 'it' that humans desired to both unmask and dominate, and technology became the practical 'it' through which this was to be achieved (for an extended discussion of these ideas, refer to Dobres 2000:53-60). From this perspective it is easy to see how technology could become a neutral tool, and that the progress of technology was equated with the progress of humanity generally (Feenberg 1999:2).
Technology then, was endowed with the workmanlike aspect of assisting humanity to ‘make good’ in the world. Although it was the chief weapon of culture against nature, through its daily dealings it enjoyed a closer relationship to the latter than other aspects of culture (such as more humanistic pursuits). The impact of this sort of thinking on archaeological thought has been omnipresent, with technology acting as a neutral and largely (if not purely) functional tamer of nature (for further discussion of the effect of dualism on the concept of technology, see Ingold 2000g). It is this type of wisdom that constitutes the foundation of ‘Hawkes’ hierarchy’ and functionalist-adaptationalist approaches. It also lies at the heart of the enduring style-function controversy.

The heuristic cleaving of artefacts into ‘functional’ and ‘stylistic’ components contains within it the assumption of other dualisms; especially nature/culture, materialist/idealist, and practical/symbolic. This partitive thinking has been infused into the core of many, if not most, methodological approaches toward the study of tools, technology, and material culture more generally. The same vision that informed Hawkes’ hierarchy also implies that function is easier to infer than stylistic meaning (Graves-Brown 2000:7, footnote 6), which sits at loftier heights on the interpretational ladder. Likewise, social meaning is thought to be contained in style, rather than nature-driven function (Lemonnier 1993a:2). These combined assumptions have given rise to the methodological tactic of prioritising the study of functional and ‘adaptive’ traits of objects, and

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7 Hawkes (1954) outlined a ‘ladder of inference’ that worked on the premise that the archaeological record was likely to reveal more about the ‘natural’ aspects of human behaviour (such as technology and economy) than the more cultural aspect (i.e. religious and symbolic facets). Thus technology, due to its ‘not-so-cultural’ slant, is seen as being relatively straightforward to understand.
treating as social whatever residue cannot be explained through such measures (Dobres 2000:36-7; an excellent example of this sort of reasoning is Szabó 1999).

The analytical priority given to material aspects in archaeological approaches to technology has also served to privilege the constraints of the natural world over the constraints and possibilities of social context. This is often to the point where technology is perceived as having a "solely material character" (Skourtopoulou 1998:9). Thus, artefact forms are seen to be controlled by the nature of the raw material, and come about culturally through the demands placed upon society by nature. Human agents appear to be irrelevant to both the developing and functioning of artefacts (Graves-Brown 2000:3). This sort of thinking is codified in many replicative and experimental studies of artefacts, where actions performed on a raw material can be understood and reproduced solely through objective and rational calculation devoid of social context or understanding (Dobres 2000:89).

That technology is 'extra-cultural', to a greater or lesser degree, is an assumption common to all the viewpoints and rationalizations discussed in the last two sections. At the more extreme end, however, technology is seen as a force independent of culture "intruding upon our social life from a coldly rational beyond" – indeed, from the same "realm of reason in which science too finds its source" (Feenberg 1999:viii, vii). These stances are invariably associated with essentialist assumptions.

3.2.4 Essentialism: Technology in itself

The word 'invent' comes from the Latin *in-venire* meaning 'to come upon' or 'discover'. Its usage has a clear connection with Platonic thinking, where all
things were believed to have an immutable ‘essence’ representing an absolute truth through space and time (Hickman 1995:214; Gosden 1994:108). Any observable imperfection of a thing was contained within our perception of it, and not the thing itself. However, essences could ‘reveal themselves’ if perceived correctly. Indeed, within Aristotelian thought, matter was not seen as neutral, but rather incorporating a cosmic or sacred life force. Matter itself sought form, and was characterised by Aristotle as having ‘desires’ (Mitcham 1994:132-3).

In this classical sense then, the acts of making and inventing were a revealing of inner form rather than innately human creative processes.

While modern conceptions of essentialism carry in them the seed of Platonic and Aristotelian thought, specific meanings and applications within the social sciences are various. From the standpoint of social constructivist sociology, Feenberg (1999:viii) characterises essentialist attitudes toward technology as the reduction of technology to “essentially functional, and therefore as essentially oriented toward efficiency”. Being ‘essential’, this is true for all times and peoples. Thus, in Feenberg’s terms, functionalist approaches to the study of technology and technological products within archaeology (where social and symbolic facets are secondary or epiphenomenal) are indeed essentialist.

Within archaeology, Johnson (1999:190-1) has defined essentialism as the “belief that there are certain attitudes or emotions that are ‘natural’ or biologically endowed, either to humans in general or to a specific sex”.

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8 This point regarding the etymology of the word ‘invent’ and the linkage to Platonic thought was made by Jeanette Winterson in her literary work Art and Lies (1994:199) which I duly acknowledge here.

9 Mitcham (1994:132-3) makes the interesting point that this view of matter meant the act of working with it had a sacred dimension, hence the non-profane character of alchemy.
Essentialism is thus restricted to humans, rather than objects or, more generally, non-human matter. An example of essentialism in the sense meant by Johnson is the doctrine of psychic unity, where the essential human mind will reach the same conclusions when faced with the same situation.

Lyman, O'Brien and Dunnell's (1997:4) conception of essentialism is closer to classical thought than either the definitions of Feenberg (1999:viii) or Johnson (1999:190-1). Drawn from ideas about essentialism within the biological sciences, Lyman et al. (Lyman et al. 1997:4) provide the following explanation:

*An essentialist metaphysic presumes the existence of discoverable, discrete kinds of things. Things are of the same kind because of shared essential properties— their 'essences'— and these essential properties dictate whether a specimen is of kind A or kind B. The essential properties define an ideal, or archetype, 'to which actual objects [are] imperfect approximations'; nonessential variation between specimens is 'annoying distraction' (Lewontin 1974:5).*

Thus, material may contain a variety of properties of which only some are considered essential and/or used as categorizing markers. This version of essentialism is the cornerstone of typological thinking in both archaeology and the biological sciences (Lyman et al. 1997:5)

There are a number of problems with essentialism of any breed, two of which I will discuss briefly here. The first problem relates to the timelessness of essentialism. In Lyman et al.'s description of essentialism as reified, immutable units, neither change nor internal variation can be dealt with (Lyman et al. 1997:5). As summed up by Mayr, "Genuine change, according to essentialism,
is possible only through the saltational origin of new essences" (Mayr 1982 in Lyman et al. 1997:5). However, true Platonic thought holds that new essences cannot be generated. Essences constitute an “external, self-sufficient, and fully formed reality that exists anterior to our knowledge of it” (Hickman 1995:214). Change can only be related to our perception of this essential reality. This leads directly to the second major problem inherent in essentialist thinking which relates to knowledge and learning. In essentialist doctrine, knowing is a passive experience, as it relates to taking in information rather than active engagement or creation (Hickman 1995:214). One can only discover what is already (and has always been) there.

While recognising that all matter has particular properties such as hard/soft or light/heavy, the point I wish to stress here is that it matters less what the physical properties of matter are than the way in which these properties are perceived and manipulated by human agents. A pearl oyster may be classified as being ‘hard’, ‘shiny’, and having a largely sheet nacreous microstructure; but these features neither call for its use as a raw material for artefact production, nor dictate how it should be worked. I certainly do not mean to deny the presence and importance of the innate properties of materials, nevertheless, materials do not fashion themselves and all technological procedures are patterned by human perceptions and ideas about the material being worked and the techniques applied in its working. Following from this, an analytic methodology driven by essentialist assumption appears as a large tail wagging a rather small dog, and indeed may obscure some of the most interesting questions regarding human cultural behaviour.
3.2.5 Normativism

Unlike those adhering to determinist or essentialist standpoints, normativists have long recognized that world views, history, and social experience structure technological endeavours along with other aspects of the social lifeworld. Along these lines, much sensitive analysis has been conducted to demonstrate how world views and understandings are reflected in technological practice (e.g. Lechtman 1977; van der Leeuw 1993). In the wake of the New Archaeology, many of those allied with ‘cognitive archaeology’ (e.g. contributors to Renfrew and Zubrow 1994) are likewise concerned with isolating such underlying, structuring perceptions. While these recognitions are important, such studies run the risk of returning full-circle to the mental templates and ‘black boxes’ of much Culture History (Schlanger 1994:148; Dobres 2000:173-7). Such studies assumed both the homogeneous and non-discursive nature of ‘doing’, thereby blinding us not only to conflict and diversity, but also to how norms came into being and how they could either be maintained or changed. Salient in this regard is the question posed by Dobres (2000:130):

...if they [prehistoric actors] are not to be thought of as mere cultural dupes blindly faithful to mental templates, then how are technical agents implicated in all this recursive making and reaffirmation of their world views?

This is exactly the issue I will take up in the next section. Not only do I wish to demonstrate the socially-embedded and –charged nature of technologies, but also how change can and does happen.
3.3 Re-thinking the technological object (or should that be subject?): Skill and practice

3.3.1 Introduction

Rather than regarding technology as being determined, either by the demands of nature, progress, or evolution, or as having an ‘meta-reality’ that may be revealed through human thought and action, I take technology to be a social production, grounded in culturally-experienced ontological perceptions of the world and its resources and possibilities, and guided by culturally-perceived needs and ideals. I see as unnecessary the dualisms that have enjoyed axiom status in general thought since the Enlightenment (e.g. nature/culture, mind/body, theory/practice) and within archaeology (e.g. style/function).

In the following sections, I will outline the proposition that the world, although ‘objective’ and ‘real’ is always perceived, understood and interacted with culturally. Through daily practice and experience within a cultural environment we acquire attitudes, dispositions and strategies to work in (rather than ‘on’) the world. Building on this perspective, I will then propose that technology does not lie outside this world of daily practice and is an intrinsically social phenomenon. Drawing on the ideas of Bourdieu (e.g. 1977) and Ingold (e.g. 2000a; 2000g) I will suggest how technological ideas emerge and are maintained within a social framework. Through a presentation of technology as ‘skilled practice’, I will push beyond normative conceptions in an effort to understand how technological ideas are communicated, interpreted and enacted across temporal, notably generational, as well as spatial dimensions that are encoded in terms such as diffusion and technological transfer. This is
then used as a baseline to develop a framework for both isolating and comprehending technological tradition, diffusion and change in prehistory. How this could be detected archaeologically will be considered at the end of this chapter, and further extended upon within Chapter 4 (methodology).

3.3.2 ‘The world’ as culturally-perceived/constructed

Imagine this: People from a variety of social and cultural backgrounds are asked ‘what a tree is good for’. The variety of responses might include timber, a place to hang a swing, a place to attract the birds, a place to catch the birds, to climb, to provide shade, to perform a ritual, to break up the concrete and asphalt monotony of the urban landscape and so on. Indeed, a tree might not be considered ‘good’, but perhaps an obstruction – say, to the view, sunlight, or a proposed road or building project. As summed up by Ingold (2000a:157):

*Take people from different backgrounds and place them in the same situation; they are likely to differ in what they make of it.*

These different ways of understanding the tree reflect different knowledge, experiences and context, both at the level of the individual and more inclusive levels of group. In short, social and situational context, experience/history and culturally-guided ascription of meaning coalesce to form ‘world-views’.

In this, philosophy has recently realised what anthropology has known for quite some time: perceptions and interpretations of the world are grounded in encultured experience. The philosopher of technology, Don Ihde, credits Merleau-Ponty with the apprehension that “there is an informing of perception by culture” (Merleau-Ponty in Ihde 1983b:109). Through an investigation of this point, Ihde (1983b:114) concludes that there is no “supracultural position from which to judge cultural perceptions” leading to the further suggestion that the
most basic question, in terms of phenomenology, is the question of “how the world is seen” (Ihde 1983b:116).

Within the social sciences, such thinking has a longer, if somewhat patchy, history. As early as 1935, Hallowell stated that “Man’s attitude toward [the elements of the natural environment] is a function of reality as culturally defined, not in terms of their mere physical existence (Hallowell 1935 in Taylor 1967 [orig. 1948]:21). These types of views have been both re-expressed and elaborated upon in recent years in the social sciences, and within archaeology have found a voice within post-processual discourse. We are seen to interact not with an ‘objective reality’, but rather occupy and act within a reality that is culturally constituted (Brück and Goodman 1999:9; Dobres 2000:74). While objects in the world necessarily have ‘objective’ physical properties, the logic of how these properties are understood, classified, worked with and manipulated is situated in the cultural rather than material realm\(^{10}\) (Dobres 2000:151-2). This argument lies at the heart of strong social constructivist stances (discussed in chapter 2, section 2.6.2), where even the ‘laws’ of physics and chemistry are viewed as socially-constituted ways of understanding that should not be privileged as more ‘true’ or ‘real’ than understandings informed by other ontologies, contexts or agendas\(^{11}\).

As mentioned previously, Culture-Historical approaches recognised the culturally-embedded nature of perception and action. However, different strands of Culture History dealt with the realisation in distinct ways.

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\(^{10}\) This stance is encapsulated in the social constructivist ‘principle of underdetermination’, where meanings are taken to be fluid and polysemous rather than essential. See Feenberg (1999:78) and Law (1987:111) for further discussion of this principle.

\(^{11}\) This is referred to as the ‘principle of symmetry’ within social constructivist arguments. See Feenberg (1999:10, 78) and Brey (1997:3-4) for further discussion.
Sociological stances following from the work of Durkheim saw cultural understandings as being embedded within the 'collective consciousness' of the society. This collective consciousness, or 'social mind', was thought to have emergent properties of its own, and was in no way reducible to the psychological dispositions of the individuals that composed it (Ingold 2000a:157). Human behaviour was informed (or indeed determined) by adherence to norms that were products of this self-generating superorganic structure (Rapport and Overing 2000:1).

Based on very different understandings, Franz Boas believed the nexus of social understanding, and socialisation processes in general, to lie in the interaction between the individual and society. While emphasizing the extent to which society shaped the character of the individual, he also stressed that the individual had the power to transform aspects of society (Boas 1940:285). Indeed, he believed that the relationship between the individual and the wider social group was the key to understanding human cultural behaviour (Boas 1940:285).

With these recognitions, Boas was beginning to push past normative conceptions of culture and, arguably, pre-empted later poststructuralist efforts to understand the generation, maintenance and change of cultural dispositions within the framework of the recursive relationship between the individual and his/her social context (e.g. Bourdieu 1977; Giddens 1984). The conceptual similarities between Boas' ideas about agency, and those expressed within poststructural and many post-processual theories are not often remarked upon (but see Trigger 1991:554; also Acciaioli 1981:31 for such a recognition within anthropology), however, in the spirit of 'credit where credit is due' there is
indeed much within the pages of Boasian anthropology that has particular relevance to post-processual archaeology.\footnote{For example, see Boas’ comments on prime movers (1940:256), systemic disequilibria (1940:256), issues with a nomological approach (1940:257-8), environmental determinism (1940:266), psychic unity/cognitive determinism (1940:273).}

The Boasian concept of culture as a contingent and historically-informed “ongoing creative process” (Rapport and Overing 2000:94) was overshadowed for the majority of the twentieth century by the meta-narratives of structural-functionalism, structuralism, and symbolism. All of these approaches saw culture as informing human behaviour from an immutable and pre-ordained metaphysical beyond. The last few decades have seen an increasing unease with such depopulated viewpoints, and as pithily stated by Rapport and Overing (2000:96):

*What is particularly being called into account is the understanding of cultural (collective) representations as a template for social action, with its related unfortunate effect – all those anthropological portrayals of cultural dopes who act unconsciously in accordance with underlying structures of shared symbolic meaning.*

Corrective therapy for an anthropology (and archaeology) that had apparently misplaced its subject matter has recently arisen in the form of investigations of agency, practice, and how people ‘live in’ yet concurrently ‘create’ culture. This project has necessarily meant the collapsing of the dualisms that were the inheritance of the Enlightenment. Thus, instead of following the existing opposition between (theoretical) knowledge and practice, we are now encouraged to think in terms of “practical knowledge and knowledgeable practice” (Ingold 2000g:316; see also Pauketat 2000:115).
dissolving of the theory/practice dualism goes a long way also to disestablishing the dichotomization of mind and body. In many current appraisals, knowledge is seen as being constituted through active and embodied practice and experience, rather than the receiving of normative cultural formulae for action or as a rational supra-cultural reaction to the objective world in functionalist-adaptationalist terms. Knowledge and practice will be considered further below in section 3.3.3. The nature/culture dualism is likewise collapsed, and instead of viewing cultural behaviour as human action 'on' the world, as in functionalist-adaptationalist approaches, it is suggested that we instead view human action takes place 'within' a world that is culturally-conceived and continually emergent. As succinctly stated by Ingold, "we work from within the world, not upon it" (Ingold in Graves-Brown 2000:3).

All of these reconsiderations result in a radically different conception of 'culture' and 'enculturation', as compared to the traditional transcendental conceptions, whether those are assessed in terms of rationality, essence or norms. Culture is not something that is inherited, bestowed upon, or taught. Culture is lived, and learned not through teaching, but through experience and intersubjective interaction. Thus "it might be more realistic ... to say that people live culturally rather than they live in cultures" (Ingold 1994 in Rapport and Overing 2000:97). From this perspective, norms are not batons being passed from generation to generation down the ages, but rather are learned (or "re-grown" in Ingold's terms) anew in each (Ingold 2000b:5; see also Sassaman 2000:149).

If this is accepted to be the case, the question becomes how individuals come to embody cultural dispositions, how these embodied dispositions cohere
intersubjectively to embrace social collectivities, and how they can be manipulated, challenged, transformed, or rejected in favour of novel practices or understandings. In addressing these issues, the social theorists most frequently alluded to within archaeological literature are Bourdieu (e.g. 1977) and Giddens (e.g. 1984), who are associated with practice theory and structuration respectively.

3.3.3 Structure, practice and agency

Bourdieu (1977) contended that shared social practices emerged and were maintained and reaffirmed through a recursive relationship between structure and practice. This recursiveness comes through the recognition that while people ‘create’ and reaffirm the structures they live in through everyday practice, people are also ‘created’ by these structures which, tacitly or explicitly, codify dispositions and establish social context. Thus, social structures and dispositions are not detachable from the agents that populate them, and are therefore not able to be studied as a separate ‘objective’ entity - as is the case with the Durkheimian superorganic. Rather, structures are continuously emergent through the practices of agents while at the same time guiding and providing a context and arena for practice (Gosden 1994:115). The internalised set of “durable but transposable dispositions” that articulates structure and practice is known as the *habitus* (Hodder and Hutson 2003:90). *Habitus* is acquired not through didactic processes as much as active participation and acquiring an appreciation of the boundaries of ‘right ways’ and ‘wrong ways’ through social interaction, trial and error, and experimentation. In this way, a “*practical* logic” is acquired (Hodder and Hutson 2003:92).
One of the central achievements of Bourdieu's conception of the *habitus* is that it neither resorts to the depopulated meta-structures characteristic of structural-functionalist, structuralist or symbolist positions nor the unrestrained individualism of those such as Sartre and the rational actor theorists (Gosden 1994:116; see also Last 1995:149). *Habitus* accounts for the persistence of cultural dispositions, yet allows actors latitude of action within its bounds. Thus, "*h*abitus produces practices which are unpredictable individually, but limited in their diversity" (Bourdieu 1990 in Gosden 1994:117). It must be noted, however, that 'practice' was cast non-discursively, presuming that actions mediated by the *habitus* are "instinctive and regulated" (Last 1995:149), thereby dealing much more effectively with the *maintenance* of structure than its transformation\(^\text{13}\).

Giddens (1984) develops the idea of 'reflexivity' between structure and agent to greater extent and takes it in a slightly different direction. Rather than seeing structure and action as separate but linked (i.e. through the *habitus*), Giddens focuses on the 'duality' of structure that is at the same time negotiating and negotiated. In this way, structure and agency are two halves of the same phenomenon rather than two levels being inextricably bound as in Bourdieu's conception. While Giddens' approach may appear advantageous if one wishes to distance oneself from any implication of transcendental structures, the lack of an intervening concept such as *habitus* is perhaps problematic. Bourdieu's *habitus* is the product of a particular cultural milieu and associated social contexts, whereas Giddens' actors have overtones of being 'essentially' rational

\(^{13}\text{It is because subjects do not, strictly speaking, know what they are doing that what they do has more meaning than they know. The habitus is the universalising mediation which causes an individual agent's practices, without either explicit reason or signifying intent, to be none the less 'sensible' and 'reasonable'. (Bourdieu 1977:79)\)}}
agents (Last 1995:152). It would seem from this perspective that Bourdieu’s habitus provides a better starting point for archaeologists to assess non-modern and non-western social groupings.

‘Agent’ and ‘agency’ have been mentioned several times so far in this section, and require further investigation here as they have been particularly fluid concepts within recent archaeology (Dobres and Robb 2000:3-4). The invocation of ‘agency’ has been one of the major ways in which archaeologists have tried to comprehend not just the way in which behaviour patterns the record, but why agents behaved in particular ways (which then pattern the record). This is not to say that processual or behavioural archaeologists are not interested in the why, but more the fact that reliance on notions of ‘efficiency’, ‘adaptation’, or simply (perceived) parsimony often function as an explanatory given (see also Hodder 2000:22). Through investigations focusing on agency, the archaeological project shifts from how humans are constituted by external factors and demands, to how they constitute themselves in the world through active practice and decision-making. This difference is more than semantic: we have moved from humans being ‘moved and shaken’ by the environment, technology or hypostatic autonomous structures, to humans doing the ‘moving and shaking’ in a culturally-encountered world. While it could be posited that this is simply an issue of scale, without a change in practice, there is no change (adaptive or otherwise) at any scale (see Pauketat 2001).

While this basic aspect of agency seems to be accepted across the theoretical board, there are a number of major sticking points where consensus is yet to be reached (summarized in Dobres and Robb 2000:8-13). I will deal with one of the most significant issues here, given its central significance to this
thesis. This involves whether agency is always a property of individuals, or whether it can be extended to collectives. A further problem, as regards structure and agency, relates to how change is generated and encompassed within structure. This I will investigate this addressing within the specific case of technology/technique for the remainder of section 3.3.

The question, as posed by Dobres and Robb (2000:11), as to whether agency is a feature only of individual behaviour or whether collectives too can exercise agency, is a fraught one that broaches on many other issues relating to power and action. Hodder (e.g. 2000) has been one of the most consistent and vocal advocates of viewing agency as a property of individuals. He sees the focus on long-term processes within archaeology as resulting in an homogenisation process where human action is seen as “trend + noise”, and points to a general lack of emphasis on how the small-scale of the ‘everyday’ (which indeed constitutes the bulk of the archaeological record) articulates with large-scale processes of cultural maintenance and change (Hodder 2000:26). Others, such as Barrett (2000) argue that to focus on the individual is to misconstrue what agency is. He sees agency not solely as a synonym for ‘action’, but rather as something that is “constituted through knowledgeability and action, operating in practices which occupy time/space” (Barrett 2000:62).

Barrett draws the conceptual distinction between structural conditions and structural principles (Barrett 2000:65). Structural conditions include material resources, technologies and symbolic order, which all have their own histories inextricably bound with past agency. Together, they are “the accumulated mass, the debris of history, which confronts the living”, and rather than acting, they constitute the arena for practice, knowledge and action (Barrett 2000:65).
Structuring principles "are the means of inhabiting certain structural conditions" and encompass the ways in which actors reproduce and transform both themselves and the conditions in which they exist (Barrett 2000:65). While this is effectively a restatement of Giddens (1984) theory of structuration, importantly for archaeology Barrett focuses upon the temporal/historical dimension of structure. This not only deflects any tendency to reify structure, it also serves to highlight the continual renegotiation of both structure and practice through reinforcing the diachronic dimension of structuration. Through emphasizing the importance of history and previous agency in the formation of structural conditions, Barrett also escapes the criticism levelled at Giddens' approach (mentioned above) where actors appear 'rational' with essential agential characteristics. Agency is thus spatially, temporally, contextually and structurally contingent.

Johnson (2000:213) maintains a position close to Barrett (2000) in arguing that agency "must be seen as historically particular, specific and changing: what constitutes 'agency' will vary from society to society, and from historical context to context". Thus, it is pointless to argue whether agency generally is the property of individuals or collectives: the parameters and performance space of agency, as well as who has more or less power to effectively act, are established by historically-constituted structures and cannot be considered in any way universal. There can be no cross-cultural model of agency (Johnson 2000:213). As regards this issue of scale and agency, I follow Barrett (2000) and Johnson (2000) as seeing both structure and agency as historically contextual and specific. I will further address the issue of scale below (section
3.4.3) as it pertains here to the issue of shell-working practices in Island Southeast Asia and the Western Pacific.

3.3.4 Technology as social, technique as skilled practice

As pointed out recently by Sinclair (2000:196), there have been a number of studies over the last decade which note that technology is not "simply a body of explicitly formulated and objectively described knowledge". While this is assuredly true, discussion about how we conceive of technology and how this affects our archaeological approaches/interpretations has not been a feature of Pacific archaeology. Therefore, I will briefly cover recent theoretical stances arguing for an explicitly social approach to the study of technology.

It was Marx who first presented a specific and historically-grounded argument as to why we, in the modern world, feel so alienated from technology. Through shifts in the mode and social relations of production associated historically with industrialisation, there has been a progressive distancing between us as humans and the tools/technologies that are part of our world (discussed in Ingold 2000h). Thus, technology, in the sense that we commonly think of it, is equated with 'the machine' – the logic and workings of which may or may not be fully understood by its operators. Indeed, Ingold (2000g:314) believes the modern conceptual link between 'technology' and 'machine' to be so close and distorting in modern thinking that he rejects the use of the word 'technology' altogether when discussing non-Western and/or pre-modern societies, preferring instead 'tools' and 'skills'.

Recent considerations of technology within branches of sociology such as the adherents of versions of the 'social construction of technology' (SCOT) school (e.g. Bijker et al. 1989; Bijker and Law 1992b; Feenberg 1999), and
'actor network theory' (e.g. Latour 1992; Law 1987; Callon 1987; Akrich 1992), as well as philosophy of technology (e.g. Hickman 1995; Ihde 1983a; Mitcham 1994) and anthropology (e.g. Lemonnier 1986; Lemonnier 1993a; Pfaffenberger 1992; Ingold 2000d), have all concluded that technology is an intrinsically social phenomenon. Archaeology has also contributed to the general 'rethink' of technology, with scholars such as Pétrequin (e.g. 1993), Schlanger (e.g. 1990; 1994), van der Leeuw (1993; 1994), Dobres (1994; 2000) and Sinclair (1995; 2000) being among those who have made notable contributions to both the way in which we think about technology, and how new questions could be asked of the archaeological record.\(^{14}\)

These disciplines have approached the issue of technology from different directions and at different analytical scales, variously introducing historical, ethnographic, and archaeological evidence. Sociological studies along the SCOT trajectory have drawn our attention to social aspects of technology; such as the importance of competing interests of consumer groups in the design process (e.g. Pinch and Bijker 1987), and the significance of antecedents and social conditions - both in innovation processes and in the social acceptance of those innovations (e.g. Bijker 1987; Cook 1995). The wider cultural purview of ethnographic and ethnoarchaeological studies, however, presents understandings that are on the whole more useful to archaeology.\(^{15}\)

Within anthropology and ethno-archaeology, studies of skill acquisition and technological decision-making have reinforced both the situated nature of

\(^{14}\) I am well aware of the basis of much of this work in the French approaches to gesture and technique – most notably those of Mauss and Leroi-Gourhan. This linkage, as well as the basis of chaîne opératoire as an analytical approach, will be discussed in Chapter 4.

\(^{15}\) Indeed, the lack of a 'macro' or cultural level to studies within the sociological SCOT approach has been one of the most pointed and salient criticisms (Brey 1997:5).
learning and the culturally-based logic of decision-making (e.g. van der Leeuw
1993; Dougherty and Keller 1982; MacKenzie 1991; extended upon by Ingold
2000c). What has become clear is that, physical properties of materials and
constraints of the natural environment notwithstanding, there are always several
ways to 'get the job done'. I see this as applicable not only to the production of
particular artefacts or working specific types of material, but indeed extending to
the choice of making a particular artefact or using a particular material at all. In
the same way that a pot does "not need to be made in a certain way" (Dobres
2000:93), a pot does not, in fact, need to be made at all.

In this thesis, I frame technology as a part of the structures of everyday
life, negotiated and continually re-emergent through skilled practice guided by
habitus. What is 'good' to make or re-fashion and how it should be 'rightly'
made and used are taken to be the outcome of the on-going recursive
relationship between structure and practice/habitus (or structural conditions and
structural principles in Barrett's (2000) approach). Following from this view,
'tradition' is understood here as the continual re-emergence of practical
dispositions that are structured to both express and negotiate relationships and
understandings in and of 'the world'. Thus tradition is not conceived of as some
sort of cultural inertia or stasis, but rather as a process of equal significance to
change.

Following Ingold (2000a:162) I further accept that "the habitus is not
expressed in practice, but rather subsists in it". I interpret this as being a
rejection of the view that material culture, or indeed technological practice, is a
reflection of culture (e.g. Lechtman 1977:4; Lechtman and Steinberg 1979:139;
Lemonnier 1993a:58). In this view, culture is contained somewhere other than
daily life – whether, for example, as a superorganic, overarching/underlying symbolic system, or set of mentalist norms. In the view taken here, material culture and the techniques and social settings through which it emerges, are an intrinsic part of culture, *habitus*, and the structures of everyday life.

Technical skill is more than simply a knowledge of ‘how-to’. Being a process of practical thinking/doing, technical skill is embodied; routinized in gestures and motor skills acquired through practice and experience (Ingold 2000a:162; also Bourdieu 1977:87; 1990:69-74 on ‘body hexis’). Thus, while there is an abstract level of technical choice as to raw materials, approaches to manufacture and tool use where norms may be discursively deviated from, motor skills often present rather more intractable habits. In the learning of technical skills, we attune our bodies to performing particular motions and actions, and with attention and practice these movements become second nature. This is more than simple force on matter, but involves at once judgement, dexterity and care (Ingold 2000f:291). Once a particular motion is inculcated in non-discursive gesture, however, it becomes difficult to ‘unlearn’ (Kroeber 1948:348). The skill effectively has to be re-learned if we wish to retrain our body’s motor habits. Imagine how long it would take to achieve proficiency to the level of automatic gesture if from tomorrow we were all to write with our non-favoured hand. It is this recognition of both the embeddedness and cultural basis of gesture and technical motor skills that prompts Kroeber (1948:350) to state:

*A particular congenital motor habit rarely suffices to explain the whole method of operation: this always remains partly or mostly cultural in origin.*
Motor habits have the limits of their range set by the human organic equipment, but their specific determination is overwhelmingly by culture.

Both Kroeber (1948:349) and Bourdieu (1990:chapter 4) also note that bodily comportment and gesture need not (and are probably not) homogeneous across communities. There may be differences between 'categories' of people, whether based on gender, age, status, or any other socially-prescribed division. Given this, I will now consider the concept of the 'community of practice': both what we may conceive this to be, and how we might distinguish communities of practice in the archaeological record.

3.3.5 The concept of 'communities of practice'

Within archaeology, ideas about 'community' have often been borrowed from anthropological/ethnographic understandings. Thus, we typically conceive of the community as:

...a co-residential collection of individuals or households characterized by day-to-day interaction, shared experiences, and common culture (Murdock 1949 in Yaeger and Canuto 2000:2).

While I do not necessarily want to challenge this definition of 'community' here, both its synchronicity and the broader connotations of boundedness, integration, and homogeneity present certain challenges to archaeologists. It requires us to look for configurations of the ethnographic present in the past – a task for which the archaeological record is questionably suited. I wish instead to view 'community' in an inherently different way – as 'communities of practice' that have both strong spatial and diachronic dimensions.

So far within section 3.3 I have discussed culture as skilled practice that exists not as a reified transcendental structure or set of cues directing human
behaviour, but intrinsically within everyday social practice. I have also expressed agreement with views that see the 'world' as culturally-perceived, as mediated by *habitus*. I have further discussed how techniques and motor skills are embodied in cultural agents. Here, then, I will attempt to roll these concepts together to outline my conception of spatial and temporal communities of practice.

By 'community', I mean here a group of people who have a shared outlook and set of practical encultured dispositions regarding particular technological practices, whether this be through time or across space. Whether the members of these communities are genetically or linguistically related is of little consequence to this view. It matters not who people are in an ethno-linguistic sense, but rather what they do. At the end of the day, it is indeed human action that patterns the archaeological record, rather than intention, emic perceptions of self, language, or 'racial' type. That these latter classificatory groups may have an impact on archaeological patterning is not disputed – but that any of these categories should be expected *a priori* to pattern the record in a way perceptible to archaeologists is. Whether these analytical units will in any way structure the archaeological record depends, as with the parameters of agency, on the *structure* of the community that patterned the record.

Given that I am following the view that sees humans as *living culturally* rather than *living in cultures*, there is thus no reason to believe that techniques should be contained within bounded units. Ideas and knowledge can surely travel across biological, linguistic or various sorts of social boundaries. Ideas are not only re-emergent in discrete social units through time, but flow between groups of people through space. Furthermore, there is no reason to expect that
ideas will travel as part of a ‘package’. Following Kroeber’s view, outlined in Chapter 2 section 2.4.3 and discussed further in section 2.7, ‘cultures’ are seen to be contingent associations of practices. Based on these understandings, there is no a priori reason to expect that spatial or temporal patterns observed in the distribution of a particular ceramic type will match, say, those of a particular lithic industry. Likewise, there is no good a priori reason to expect that ‘red-slipped pottery’ traditions associated with Austronesian speaking peoples will track exactly with ‘traditional suite of shell artefacts’. Following from these premises, material culture cannot necessarily be expected to indicate ethno-linguistic affiliation.

In isolating communities of practice, both through time and across space, I will define groups of people who are either (1) linked historically to (an) antecedent group(s) and have continued to reproduce a particular practice mediated by a similar habitus as the historical group(s) or (2) groups of people that are in close enough social contact to share aspects of perception, habitus, and bodily gesture. I wish to stress that these ‘communities of practice’ have no strict equivalent within ethnographic terminology.

Of course, not everyone who is perceived to be ‘doing the same sort of thing’ is linked by shared perception or encultured in a similar manner. Ideas can travel through space or time with varying amounts of contextual information, thereby being interpreted and actioned quite differently by different groups of people. Material culture and cultural practices can also be manipulated either to accentuate or to down-play difference. Furthermore, new ideas and ‘ways of doing’ within communities of practice continue to produce novel configurations that may then flow across space or re-emerge through time. These ideas will
be explored further in the following sections in the context of the long-standing ideas of diffusion, technological transfer, and technological innovation.

3.3.6 Movement of ideas between communities – diffusion

Diffusion has been one of those concepts within archaeology that has been criticized repeatedly for being a sort of conceptual 'hand-waving'. Certainly, it has frequently been used without appropriate discussion or elaboration, and as such tends to be veiled in the mysticism also shared by terms such as 'adaptation' and 'evolution'. While being treated as self-evident in casual use, they in fact remain opaque. While diffusion has never been totally rejected as a valid process within archaeology, its importance within explanation has waxed and waned (as outlined in Chapter 2). Its capricious and contingent nature was incompatible with the agenda of the New Archaeology – one cannot approach a will-o'-the-wisp nomothetically. Simply because a process is exasperatingly contingent, however, does not seem a good enough reason to sideline it from interpretation. If it contributes to the patterning of the archaeological record, we must pay it due attention and attempt to grasp some of its complexity.

Diffusion is an omnibus term, referring simultaneously to the movement of ideas, material traits or trait complexes, people (as in the case of demic diffusion), and social institutions (Trigger 1978b:217). Here, I shall differentiate between the movement of ideas and the movement of total technologies. I will cover this second process in the next section under the banner of 'technological transfer'.

Traditionally, there have been two ways of addressing the issue of diffusion: either, (1) by looking at artefacts and ideas to try and adduce why they would have spread across social boundaries, or (2) investigating why social
groups accepted or rejected them. The first view assumes an immutability of interpretation, that is, that the essential usefulness of the artefact/idea would have prompted its adoption by other social groups. As Johnson (1999:21) notes, a focus on 'things' devoid of people is essentially fetishistic, where "pottery styles and house types seemed to develop little legs and run around without any help from human beings". These sorts of ideas can be seen lurking behind many arguments for the adoption of 'superior' technologies, where the inherent worthiness of the idea/technology is thought to assure 'its' acceptance by people 'it' encounters in the course of 'its' travels.

The second theoretical tack for investigating why social groups accepted or rejected particular ideas/technologies can itself be broken into two further categories. The first is a nomological approach, where instead of looking to the perceived essential properties of technologies to discover why an idea was accepted, the essential properties of social groups themselves are the subject of discussion. Good examples of this are social evolutionary models, where the 'stage of development' can be seen to influence whether new ideas are accepted or not. The second is a more particularist approach that usually focuses upon case studies that draw out contingent factors to explain the success or failure of new ideas/technologies within a given social setting. Within this approach, it is held that the conditions associated with adoption of innovations within a given society are structurally similar to the criteria necessary for the acceptance of diffused items (Kroeber 1948:368). In both circumstances, the new idea/technology needs to be perceived as being useful by those who use and/or control technologies.
This latter contingency-based approach starts to broach the issues of context and 'meaning'. Unlike essentialist approaches, function or 'meaning' of artefacts is considered to be contextual. Feenberg (1999:117) suggests that function is a fetishistic form of objectivity, where “function is a relational term which we attribute to the object as a real quality”. Indeed, as pointed out by Ihde (in Feenberg 1999:xiii) “technology is only what it is in some use-context”. Within sociological SCOT approaches, the principal that artefacts may be understood and interacted with in a number of ways is referred to as ‘interpretative flexibility’ (Brey 1997:4). If function and meaning are taken to be non-essential properties of an artefact, it follows that it is not the role the artefact fulfilled within the donating social group that matters, but whether the receiving social group perceive a use for it within their own structures. This perception of usefulness will also necessarily be mediated through the *habitus* of the receiving social group. In this way, diffusion is more than a mere passing on – it requires *thinking about* by the receiving social group, who, if they accept the idea/item in some fashion, then integrate it into their own structures and practice, with it becoming part of *habitus* to be *thought with*.

The distinction between *thinking about* and *thinking with* is an important one when addressing issues of interpretation, meaning and knowledge. As part of daily practice, much of our behaviour and use of artefacts is routine and non-discursive. When we write, we do not think *about* the pen, we think *with* it (see Ingold 2000e:407 for a discussion). Only occasionally, especially when something is not functioning in its routine way, do we think about it and its workings. The pen leaking, not writing properly or jammed will prompt us to think about the pen itself. The distinction between *thinking on* and *thinking with*
is similar to Heidegger's distinction between 'occurrentness' and 'availableness' outlined by Ingold (2000a:168). Items that are 'available' are part of our everyday world, and have taken on a familiarity that makes them almost transparent. In Heidegger's terms, things only become 'occurrent' when we "self-consciously stand back from the action, assuming a stance of contemplative detachment" (Ingold 2000a:168). Thus, when a social group encounters a new artefact or idea, it is occurrent and needs to be thought about. If a place and purpose can be seen for the new item/idea, then it is positioned within the structure of daily life so that it can become available, or thought with. I see this as lying behind Kroeber's (1948:258) observation that when diffused elements are integrated into a new social setting, they become part of that culture "and are used as such".

This act of thinking is not necessarily restricted to the new item/idea itself (whether it be diffused or an internal innovation), but can prompt a rethink of other items and practices already embedded within the habitus and structures of daily life. To work with an example presented by Kroeber (1948:344-5), if metal tools are introduced to a social group for the first time, this prompts not only thinking about what metal tools are 'good for' and the role they would potentially fill, but also which tools are currently being used already within daily practice that provide competing alternatives. Thus, habituation in the uses of stone tools is now, itself, thought about. If it is decided that the properties of the metal tools perceived by the receiving group are better suited to performing certain tasks than stone tools, the metal tools are incorporated into practice. However, this may not happen wholesale. Kroeber (1948:344-5) presents an interesting example where metal tools were adopted by Yurok Indians for most
tasks, however they retained flint knives for several generations for the task of splitting and dressing salmon. Such a practice required highly specific motor skills and there needed to be considerable modification of gesture for the use of steel knives to be profitable.

A simple example such as the one just mentioned, while demonstrating a point, may be in some senses misleading. Whether a new artefact/idea is ‘approved of’ and integrated in the structures of daily practice is certainly not reliant on performance capabilities or efficiency alone. An entire constellation of other concerns and agendas may bring to bear on decisions about what the place (if any) of diffusing ideas/artefacts will be. Political agendas and power struggles are good examples of non-material aspects of structure that may influence adoption of ideas/artefacts. These concerns may manifest in a host of ways from controlling/manipulating access to resources, to symbolic acts of defiance. In any event, the sheer complexity of the process of the acceptance/rejection/modification of a new idea or artefact, which relies not just on myriad contingent variables, but peoples’ perception of these variables, would appear to make the task of predicative modelling a hopeless one.

As archaeologists, we can neither access what items specifically ‘meant’ to people, nor what peoples’ particular agendas or perceptions were. What we can assess though, are the contexts/structures into which new ideas or artefacts were adopted and the role they assumed. We can investigate how new ideas were integrated into structure, habitus and practice. We can also perhaps look at different levels of diffusion, and ask what that may tell us about the relationships between different social groups.
The gestures, structures and *habitus* of one social group are not like that of another. It necessarily follows then, that when a new idea about ‘doing’ or achieving a particular end is *thought about* by a receiving group, there will be modification. This modification will not only be in the way in which the idea is contextualised within daily practice, but also how it is achieved through a sequence of bodily gestures. Thus, while two artefacts from different sites may appear to be ‘the same’ upon visual inspection, both a contextual and discriptive technological analysis\(^{16}\) may demonstrate that the artefacts are enframed within quite different *habitus*. The concept of *habitus*, then, allows us to ‘get inside’ the long-standing archaeological issue of homology versus analogy (see Binford 1968a). If the techniques and context of production, use and deposition of an artefact are more than either a reaction to environmental conditions achieved in an efficient and adaptive manner or a reproduction of inherited norms, we have a new tool with which to shed light on this problem.

### 3.3.7 Movement of technologies between communities – technological transfer

Where movement of ideas may or may not represent close social contact, technological transfer indicates intensive or sustained inter-group relations. By technological transfer I mean the adoption by the receiving group of a total ‘way of doing’ rather than simply an idea. Thus, where replication of an observed metal tool form in local stone utilising local techniques would be diffusion of an idea, the diffusion of the process of metallurgy itself would constitute technological transfer. As noted by Inkster (1991:21), technological blueprints

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\(^{16}\) Including the isolation of production techniques and accompanying technological decisions from the selection of raw materials, through production, use, curation, and final deposition.
do not transfer easily. Not only does an idea have to be communicated, but also a set of skills and mechanical principles. Therefore, while diffusion of an idea can result in its total reformulation by the receiving social group, technological transfer necessarily has to involve active communication and (at least to a reasonable degree) shared understanding between the two parties. As Kingery (1996:192) points out, much technological knowledge is tacit, and the learning of complex technological procedures or skills involves "seeing and doing" rather than "written or verbal description". Technological transfer indicates the movement or close contact of individuals from different social groups rather than casual interaction or intermittent trade relations (Kingery 1996:192). This said, there will still be at least some reinterpretation of the function, potential or possibilities by the receiving group, as the new technological process still has to be enrolled into local structures, understandings and practices.

As with the adoption of diffused ideas, a transferred technology and/or process may act as a catalyst for new innovations or creative reformulations of practice (Inkster 1991:16; Feenberg 1999:80; Lemonnier 1993a:25). This again relates to the process of thinking about which, though incorporation into structure and practice, becomes thinking with.

3.3.8 Technological change – innovation

While internal innovation and diffusion have tended to be conceptually framed as opposing processes structured along inside/outside or endogamous/exogamous lines, there are many parallels. Whether ideas derive from ‘inside’ or ‘outside’ the adopting group, the idea/technique/artefact must
meet the same basic criteria in order to be incorporated into daily practice. As eloquently stated by Kroeber (1948:363):

*A cultural novelty always encounters existing cultural conditions, and it is these which determine whether, when, how, and in what form it gets adopted...In this matter of their fate, or at any rate their date, being determined by the cultural soil on which they fall, inventions from inside a society and diffusions from outside it are much alike.*

Issues of the general acceptance of novelty into social practice aside, how novel ideas themselves arise needs investigation.

In efforts to overcome the 'great men, great deeds' explanation of invention, the importance of antecedents, the reconfiguration of existing elements, and the trajectories of technological learning/knowledge have been stressed across a number of disciplines investigating the nature of innovation. All innovations are produced within a cultural setting drawing both on cultural knowledge, and the historical products of this (in the form of existing technologies). As noted, in philosophical parlance, by Hickman (1995:213):

*...the noetic tools of science are constructed, but ...they are [not] constructed out of nothing ... they are constructed out of previous tools and other artefacts. They are relations of relations.*

Barrett's (2000:65) "accumulated mass, the debris of history, which confronts the living" provides the performance space and ontological (and epistemological) context in which innovation happens. The "latitude of action" allowed by *habitus*, and the variable skill levels and understandings of agents, further allow for variation in practice and acts of creativity (Dobres 2000:135, 138-9; Gosden 1994:117). This given, technological innovations are frequently
incremental, or indeed reconfigurations of existing skills and/or knowledge (Bijker 1987; Spier 1970:19; Kroeber 1948:352-64). In this context, the ‘technological revolutions’ which are seen to pattern history and prehistory, can be reconceived as “multiple, mutually-influencing technological and social innovations” (Cook 1995:80). Cook’s (1995) dissection of the ‘Gutenberg myth’ and the ‘revolution’ associated with the invention and widespread adoption of the printing press demonstrates clearly that without the development of paper, and the rising interest in and rate of literacy within the middle classes, the printing press would not have assumed the importance that it did. Inventions do not stand alone – they are produced through a social field for a social field. That one works with the knowledge one has is a logical necessity, but innovation within the bounds of (or following directly from) an extant framework has the advantage of making any innovation more intelligible to the wider social group (Baker 1994:183; Carlson 1992:193).

If innovations are seen as incremental - whether in the transfer of knowledge from one domain of practice to another, the incorporation of a new discovery into extant fields of understanding/practice, or the reconfiguration of existing elements to produce novelty – they can also be seen as having ‘trajectories’. Hence,

…it is often difficult to determine reliably just what constitutes an invention or when it took place. The more the situation is analysed, the larger do the antecedents loom, and by comparison the less outstanding does the new step or increment appear. (Kroeber 1948:360)

I suggest here that technological innovations create trajectories, rather than follow them. There is no pre-determined course, but rather one that unfolds
under the guidance of social context, agential interests, and other factors of heterogeneous contingency (Bijker and Law 1992a). In the same way that artefacts do not need to be produced in a universally particular way (Dobres 2000:93), innovations and associated pathways are also characterised by choice.

3.3.9 Pathways of practice in time and space

None of the processes described above constitute monolithic categories. Rather, they are sectors along a continuum that overlap with each other. At one end of the continuum is internal innovation, where new ways of doing emerge within the community and are instantiated through practice and re-emergent through time. Various degrees of contact between different social groups constitute the middle of the continuum, ranging from trade relations (where even foreign goods in the absence of their makers may act as catalysts for thinking about practice) to co-residence and intermarriage where those with differently constructed habitus continually have to negotiate practice with each other. At the other end of the continuum, the complete replacement or absorption of a resident social group by an immigrant one represents a rupture in habitus, structure and practice.

With regards to archaeology, the isolation of patterns of technological choices relating to production, use, curation and discard of artefacts gives us insight into consistencies of practice and the parameters of these consistencies in space and time. Alternatively, it also allows us to isolate different attitudes to the production and use of material culture. These may be variations of degree, or represent a completely dissimilar approach borne of a different historical trajectory. What is important to reinforce here, is that different practices may
have independent distributions. Communities of practice are not, or not necessarily, equivalent to the Childean concept of 'peoples' (outlined in Chapter 2 section 2.3.2). The focus here is on 'social fields of play' and attempting to isolate patterns of interaction and/or re-emergence through space and time.

3.3.10 Summary

Building upon the recognition that the choice to work certain materials, and to work them in a particular way, is founded on cultural perception and knowledge, I have constructed a framework through which to mobilise assessment of social interrelationships and change. Built into this is the appreciation that the movement of ideas, goods and people represent scales of information flow (and information acceptance) along a continuum rather than separate, discrete categories. The concept of communities of practice is offered here as a way of conceptualising close social relationships, whether through time or across space.

3.4 Perceiving communities of practice in Island Southeast Asia and the Western Pacific

As stated in Chapter 1, I wish to test relationships between shell-working practices in Island Southeast Asia and the Western Pacific, rather than working within the established categories of 'Lapita', 'Austronesian' or 'non-Austronesian'. If there is validity in these categories, this should be demonstrated in the results of analysis. If the Lapita cultural complex is an extension of the Southeast Asian neolithic (as suggested by Bellwood 1997), which in turn is a monolithic culture/people that has supplanted earlier
inhabitants, this should be disclosed clearly in shell working practices as the unfolding of a particular *habitus* though space and time. Furthermore, it should be manifested as a distinct rupture when compared to the practices of pre-Austronesian inhabitants. At the other end of the scale, if Lapita shell-working is a natural extension of pre-Lapita practices in Near Oceania (e.g. Smith and Allen 1999), then not only should we see the re-emergence of those structures through time, but they should also contrast with the shell-working practices of Island Southeast Asia. Naturally, any result between these two posited extremes is going to indicate greater complexity in the movement of people and ideas.

While this approach may be able to give insights into social fields and networks through space and time, the focus on shell artefacts and their associated production techniques means that the picture given cannot be expected to be complete. It can however illuminate links that may not show clearly through the analysis of other forms of evidence. In any event, it is hoped that this will be a definite step forward from talking about a conceptually-nebulous 'similarity', in order to contribute to our understanding of the patterns of the past in Island Southeast Asia and the western Pacific.
Chapter 4: Methodology - *Opus operatum to modus operandi*

‘Within this island world [of Island Southeast Asia and Near Oceania] a similar family of techniques may have been in use...Exactly how these techniques developed and were deployed in various areas is thus of interest...’ (Gosden 1991a:261)

4.1 Introduction

If technological practices are culturally contingent, we must have a methodological tool that can draw out both technological choices made during the production process, and variability in these choices. *Chaîne opératoire*, as an analytical approach, offers just such a methodology. In this chapter I will initially give brief consideration to archaeological approaches to production methods, including the *chaîne opératoire*. The majority of the rest of the chapter will be devoted to an investigation of ‘shell’ as a material. This discussion represents a ‘first statement’, as shell has never been systematically studied in its capacity as a raw material for artefact production. At the end of the chapter, the analytical approach constructed for this thesis will be presented including questions that have been asked at a number of conceptual and analytic scales.

Phylum Mollusca, to which all ‘seashells’ belong, is the second biggest faunal phylum after the Arthropoda. Out of approximately 100,000 species of mollusc worldwide, the tropical Indo-Pacific biogeographic province is the largest and most diverse with about 10,000 species. As with the Arthropoda, phylum Mollusca embraces a startling amount of diversity in terms of biology, morphology, behaviour, ecology, and structure. Although framed within
generalities, Sections 4.3, 4.4 and 4.5 will focus primarily on issues and
variables relating to the Indo-Pacific mollusc taxa utilised for shell working in
Island Southeast Asia and the Western Pacific. These major species are
pictured in Appendix 1. Investigations of shell growth, structure, variation,
natural and culturally-induced taphonomic processes, and natural and cultural
patterns of shell breakage will be considered in order to establish parameters
for inference and guidelines for interpretation of the samples analysed.

4.2 Chaîne opératoire: basis, context and approach

A focus on technology and the way in which artefacts are produced has been a
concern both in American (processual and behavioural schools) and
Continental archaeology. Upon saying that however, the goals and
interpretative context into which such technological questions are embedded
are rather different (contra Schott 2003). The Americanist approach to the
study of technological behaviour is epitomised by the work of Schiffer\(^\text{17}\) (e.g.
Schiffer and Skibo 1987). While his approach recognises the non-
discursiveness of much technological practice and the practical basis of
learning (Schiffer and Skibo 1987:46-8), the focus on what people do and how
they do it appears largely as a prelude to the why. The why part of this
equation is grounded firmly in modern Western science and the essential
properties of materials (Schiffer and Skibo 1987:48).

\(^\text{17}\) I realise that this division into ‘American’ and ‘Continental’ is very generalised. In fact, many
of the most innovative investigations and thoughtful theoretical discussion of technology, choice
and human behaviour in recent times are to be found within the American literature (e.g. Dobres
2000; Pauketat 2001). Upon saying this however, the Schifferian approach has had, and
continues to have, a strong presence in Americanist archaeology.
If we are asking questions about how adaptive, knowledgeable (in a positivist sense), or ‘progressive’ ancient technologists were, such an approach is surely valid. That innate properties of materials impact on the final artefactual product is, of course an inescapable fact. Using innate properties as an explanation is, however, circular. As discussed in Chapter 3, such ‘why’ questions do not fall with the bounds of interest in this thesis. I have less interest in what people ‘should have’ done or why they ‘should have’ done it in such a way so as to maximise efficiency, fitness, or the potential inherent in the raw materials or production processes, than what they actually did for any number of reasons that, along with meaning, I think remain beyond the reach of the archaeologist. Following from this, I reject Schiffer and Skibo’s (1987:53) division of technical choices into ‘fundamental’ and ‘derivative’ categories; where ‘fundamental’ accounts for first-order technological decisions, and ‘derivative’ represents those second-order modifications that need to be made in order to articulate with first-order choices. If we step back from positivist and essentialist assumptions, first-order and second-order choices take on a ‘chicken and egg’ appearance. We have no way of knowing, for example, whether the desire to produce a new form of artefact prompted the selection of a different raw material or vice versa.

Practice theory takes a rather different approach – and indeed has different underlying aims. Pauketat (2001) has drawn the contrast between processual/behavioural and practice approaches using the example of the genesis of the central Mississippian site of Cahokia. After presenting both processual/behaviorist and practice-based interpretations, Pauketat (2001:85) asserts that:
...it is an error to seek the causes of Cahokia in the pre-Mississippian physical environment, subsistence ‘system’, or demographic profile. This is because, from a practice perspective, causes do not exist as abstract phenomena outside the realm of practices. The actions and representations of people at Cahokia were the processes that built Cahokia.

He goes on to state that:

...Cahokia cannot be explained with reference to an abstract behavioral logic ... because that logic completely misplaces the locus of long-term change. The locus of change was practice, set in the context of a continually redefined and revalued tradition (Pauketat 2001:86).

The major alternative approach to the reconstruction of ancient technological practices certainly appears more compatible with theoretical stances such as that expressed by Pauketat (2001), and indeed, maintained within this thesis. This alternative approach is expressed within the French technologie et culture movement and the accompanying chaîne opératoire methodology. While the proximate founder of this approach is recognized as being Andre Leroi-Gourhan (especially Leroi-Gourhan 1993 [orig. 1964, 1965]) the ultimate founder of an interest in the relationship between gesture and culture is Marcel Mauss. With the publication of Technique du corps (1935), Mauss presented a consideration of how bodily comportment and gesture are conditioned by social milieu and tradition (Dobres 2000:153). It is notable that he explicitly used the term habitus (Dobres 2000:153). Within this work, he discussed how even the simplest of bodily movements such as walking are variable across ethnic, gender, and age groupings (Dobres 2000:153). Through the everyday expression of such gestures, or enchaînements organique, not
only are these social acts given expression and perpetuated, they set social parameters on the ‘right’ and ‘wrong’ ways to do things (Dobres 2000:153).

While Mauss’ approach focused more on homogeneity and norms than variation, the creation of an explicit analytical grid through which to assess variation and homogeneity regarding culturally-based choices in behaviour was developed by Leroi-Gourhan (Leroi-Gourhan 1993 [orig. 1964, 1965]; Audouze 2002:286-7). This took the form of the chaîne opératoire. Rather than reconstructing sequential behaviour associated with technological production in order to provide a basis for establishing how progressive ‘technoscientific’ (sensu Schiffer and Skibo 1987) ideas were and why things were done in a particular way, chaîne opératoire approaches seek to understand the cultural basis of gesture itself. The constructed technical sequence is seen to show how cultural cognition was objectified in practice rather than elucidating how ancient technologists applied (discursively or otherwise) extrinsic essential principles in order to fulfil a particular functional goal. Thus, while Americanist production sequences describe the path that culminated in the genesis of ‘it’ and why ‘it’ should be as ‘it’ is, the French chaîne opératoire places as much focus on the path as the resultant ‘it’. Since my goal within this thesis is to compare techniques and the range of technological decisions made by groups situated differently within space and time, the French approach seems more compatible here. To adopt a cliché, ‘it’s the journey not the destination’ which is of primary interest here.

Before moving on any further, a discussion of what exactly a chaîne opératoire is, and the sorts of information it links together is necessary. Sillar and Tite (2000:4) outline five major areas where choices are made within any technological procedure. Firstly, the raw materials must be selected. Secondly,
a choice must be made regarding the tools to be used in the production process. Thirdly, there is choice involved in the selection of energy sources used to transform raw materials and/or power tools. Fourthly, techniques through which to manipulate raw materials and employ tools must be chosen. Fifthly, all of these must be co-ordinated into a *chaîne opératoire* in order to produce the final result. It is important to note that although such choices may be readily apparent to archaeologists or materials scientists, the existence of alternatives is frequently not apparent to practitioners themselves (Gosselain 1992). It is this very embedded and non-discursive feature of much technological practice however, that create the potential for ‘getting inside’ questions about change, persistence, social re-emergence/reproduction and social distance.

Whether coming out of an American or French approach to the reconstruction of ancient technological methods, archaeological science plays a major role. Naturally, the better one understands both material and parameters of action on a general level, the better one is able to interpret patterning in archaeological material. To this, much experimental work has been conducted, particularly in relation to lithic and ceramic technologies, in order to understand the properties of material under different conditions (see Schiffer and Skibo 1987:49). Shell structure, breakage patterns, taphonomy and complicating factors such as non-human breakage have tended to be the subject of assertion rather than investigation. In short, shell as a raw material has never been systematically investigated within archaeology (or anywhere else to my knowledge). For most of the remainder of this chapter, I will consider these background issues that must lie at the basis of any framework for interpretation of technological modification of a raw material.
4.3 Shell as a raw material

4.3.1 Introduction

Phylum mollusca is divided into a series of classes including, most prominently, gastropoda (e.g. whelks, limpets, abalone), bivalvia (e.g. clams, oysters, mussels), cephalopoda (e.g. *Nautilus*, octopus, squid), polyplacophora (chitons) and scaphopoda (tusk shells). Of these classes, the ones of greatest concern to this thesis are the gastropods, bivalves and cephalopods. Specific important families for this thesis include the Trochidae (top shells), Turbinidae (turbans, ‘cat’s eyes’), Cypraeidae (cowries), Nassariidae (nassa mud snails\(^\text{18}\)). Strombidae (conchs) and Conidae (cone shells) within the gastropoda, the Tridacnidae (giant clams) and Pteridae (pearl oysters) within the bivalvia, and genus *Nautilus* (the Nautilidae) within the cephalopoda. Shell parts and terms are names in Figure 4.1 for non-specific gastropods, Figure 4.2 for non-specific bivalves, Figures 4.3 and 4.4 for genus *Tridacna*, and Figure 4.5 for genus *Nautilus*. The conchological terms provided on these diagrams will be used throughout this thesis.

After a general introduction to shell formation and growth processes, issues pertaining to shell chemistry and microstructure will be discussed with special emphasis on the families and genera listed above. These technical details are critically important for understanding shell taphonomy and fracture, and have been little considered within archaeology. Given this, discussions and information presented here are drawn mainly from research in disciplines such as materials science, conchology, and palaeontology. As living entities, broad

\(^{18}\) Although nassarids are frequently referred to as ‘nassa snails’, *Nassa* is more correctly a genus within the unrelated Muricidae. Therefore, I will not use the term ‘nassa’ here when referring to the Nassariidae.
discussion of mollusc characteristics only goes so far; therefore a discussion of variables influencing local and individual variation will ensue. Finally, biogeographic patterns of shells across the study region will be considered. All of these discussions set the stage for detailed considerations of shell taphonomy and breakage that follow in the next two sections (4.4 and 4.5).

4.3.2 Shell growth and general structure

Shells are constructed of calcium carbonate (CaCO₃) interlaced in varying fashion with an organic matrix. The calcium carbonate is laid down as one of two CaCO₃ polymorphs, either aragonite or calcite, while the organic matrix consists predominantly of glycoproteins (Watabe 1988:69). The mantle of the animal secretes a substance known as extrapallial fluid, which holds concentrated calcium ions and lays them down in crystalline form as ‘shell’ (Wilbur and Saleuddin 1983:259; Claassen 1998:22). The shell itself is composed of multiple layers, the structure and composition of which vary from taxon to taxon. The outermost layer is generally a proteinaceous coating termed the periostracum, however some taxa, such as the cypraeids (cowries) and polyplacophorans (chitons), lack this coating (Watabe 1988:69). The calcareous layers below the periostracum are calcitic, aragonitic, or a combination of both, and may occur in a variety in microstructures and combinations thereof. The issue of microstructure and composition will be discussed in further detail in the next section.

During the life of a mollusc, a number of phases are passed through. I will not consider mollusc reproduction and larval stages here, except to note that strategies are many and varied. Once settled in a home environment, shell form tends to pass through three distinct stages: a juvenile form, a mature form,
and a senile form. Juvenile shells are generally fast-growing, with growth slowing at maturity (Vermeij 1993:28). Juvenile specimens are also often thinner and more fragile, with shell defences such as a thickened aperture lip (e.g. the Cypraeidae and Strombidae) and spines and varies (e.g. many members of the Muricidae and Cymatiidae) being added only in adult form (Vermeij 1978). The thin and vulnerable juveniles of such families tend to retreat out of sight into protected areas, such as under rocks and within recesses, during early stages of growth (Vermeij 1978:127, 263). The tip of the spire (or ‘protoconch’) is the remnant of the earliest stages of shell growth in gastropods, while bivalves grow outward from the hinge with the ventral margin (or dorsal margin in the Tridacninae) being the ‘growing edge’. Senile specimens are very slow-growing, with the shell being thickened rather than increasing in size. This frequently results in deformities in the shell, and the occurrence of ‘doming’ or ‘obesity’ in bivalve valves has been frequently noted (Vermeij 1978:14; Vermeij 1993:29).

Rather than being constant, shell growth is episodic. Contingent variables such as availability of food, temperature, population crowding and habitat disturbance all affect growth rate (Claassen 1998:25). Many taxa also have inherently episodic growth, which, in certain gastropods such as the Cymatiidae (tritons), is expressed in the occurrence of varices. The varix represents a period of slow growth, where shell builds up along the aperture/growing margin producing a bulbous section (Vermeij 1993:31). Growth spurs are represented by thinner shell walls, halting again intermittently to produce another varix (Vermeij 1993:31). These varices are designed to provide architectural strength to the shell – particularly in the face of crushing predators such as many fish and crabs (Vermeij 1993:124). In some taxa, such as members of the
Strombidae and Potamididae (horn shells), varices are constructed on the inside rather than outside of the shell (Vermeij 1993:31).

### 4.3.3 Shell chemistry and microstructure

As mentioned above, the two major construction materials for shell building are aragonite and calcite – both polymorphs of calcium carbonate. Calcite is the more stable of the two forms, and is also less dense, harder and less prone to dissolution (Solem 1974:10). Despite this, tropical shells are heavily biased towards aragonitic construction, while most calcitic shells are found in temperate or cold-water regions (Vermeij 1978:18-19). To complicate matters however, a variety of taxa found in tropical waters such as the Neritidae (nerites), genus *Patella* (a common genus of limpet) and the Haliotidae (abalone) alternate calcite and aragonite within the shell structure (Solem 1974:11).

Whether aragonite or calcite, calcium carbonate crystals are laid down as shell in a variety of defined microstructural types. These types include nacreous (mother-of-pearl), foliate, homogenous, prismatic, spherulitic and crossed-lamellar forms. These types are succinctly described by Wilbur and Saleuddin (1983:257):

1. *Nacreous*: tabular crystals arranged in laminae or columns
2. *Foliate*: elongate flattened crystals arranged side-by-side or in overlapping sheets
3. *Prismatic*: parallel polycrystalline elongate prisms enclosed in an organic sheath
4. Cross lamellar: tablet-shaped crystals, each composed of parallel rodlike elements which, in adjacent crystals, run in different directions and which, in alternate crystals, run in the same direction.

5. Spherulitic: spherical structures of elongate crystallites radiating from a centre.

6. Homogeneous and granular: Taylor et al. (1969) designate homogeneous as a term of convenience for any fine-grained structure. The grains may be irregular or rounded and are usually less than 5 μm across. Aggregates of larger size are called granular.

It should be noted that different microstructures can, and frequently do, occur within the same shell. Rather than considering further all these types, I will discuss only three in further detail, as these are most relevant to the major taxa under consideration in this thesis. These are nacreous, prismatic, and crossed-lamellar structures. Instead of dealing with these types in an abstract fashion, I will discuss them in terms of the major taxa under consideration in this thesis. It should be noted here that the study of shell microstructures is spread across a range of disciplines such as materials science/engineering, structural geology, biochemistry, conchology and palaeontology. Only a limited range of taxa has been physically studied and the purpose of such research in different disciplines is highly variable. The terminology employed is likewise varied. What follows, then, is a simplified discussion where I have had to frequently extrapolate out principles from specifics, and specifics from principles.

1. The Turbinidae: Turbinid shells are composed of a nacreous interior, and simple prismatic exterior layer. Nacreous microstructures are always constructed of aragonite, while prismatic forms can be generated from either calcite or aragonite. In the case of turbinids, the prismatic layer is aragonitic.
(Watabe 1988:74). Of the various microstructural types, the prismatic form is one of the least understood. It has a higher organic content than either nacreous or crossed-lamellar microstructures, and it appears as if this organic component is very strong, as prismatic structures are greater in tensile strength than crossed-lamellar microstructures (Currey 1988:191-2). The elongate prismatic crystals are aligned perpendicular to the periostracum, and this, combined with the high organic content, means that cracks tend to travel directly through the prismatic layer from the shell surface with little lateral dissipation (Currey 1988:191). This type of fracture pattern is well-displayed in Figure 4.6.

In contrast to prismatic microstructure, nacreous forms have received a good deal more scientific attention. Nacre is structured in thin sheets of aragonite aligned in parallel fashion. Organic material is present between these sheets (Watabe 1988:77). This sheet formation is shown clearly in Figure 4.7. In gastropod nacreous microstructures, nacre is not initially laid down in sheets. Rather, rounded and flattened crystals are distributed across the growing edge of the shell by the mantle of the animal. As they are deposited, stacks form (Wilbur and Saleuddin 1983:260). Such stacks are shown in Figure 4.8. These stacks expand both horizontally and vertically with growth, and eventually coalesce to form the solid sheets (Wilbur and Saleuddin 1983:260-1). Crystal size is largely a function of age, and as such, the lowermost crystals in a stack will be larger than the more recently-deposited crystals at the top (Wilbur and Saleuddin 1983:261). This feature lends growing nacreous stacks a conical appearance also visible in Figure 4.8. Organic material is also found between such stacks (Watabe 1988:77).
Nacre is one of the toughest molluscan structural materials, and also, through virtue of its structure, has the ability to stop cracks better than other microstructures such as prismatic forms (Currey 1988:186). Unlike prismatic structures, where fractures travel easily through the surface running adjacent to the elongate crystals, the overlapping sheets combined with conical stacks of differing diameters in nacreous structures make the path of the fracture much more complex. As with prismatic structures, cracks travel through the organics rather than the crystals, but the non-linearity of such organics in nacreous structures dissipate and spread the force. What results is a very rough fracture at the micron level (Currey 1988:186). This roughness can be seen in the Turbo marmoratus fracture shown in Figure 4.7. Nacre is tough when force is applied perpendicular to sheet direction, however it is certainly not tough if force is applied in the same direction as sheet orientation. In the case of the latter, the nacre will peel apart easily into aragonitic plates. This principle is shown diagrammatically in Figure 4.9.

With regards to the Turbinidae and shell-working, all this means that fractures are unpredictable on a number of levels. Firstly, the prismatic and nacreous layers are going to respond differently to force, and secondly, fractures in the nacreous structure itself will be unpredictable. This unpredictability of fracture would be accentuated when force is considerable and suddenly applied (as in direct percussion). This ‘impact force’ is substantially less predictable and able to be controlled than, say, compressive force (e.g. cutting, where compressive force is coupled with friction) where force is not as great or imparted solely at the brief moment of contact. Given that the stress that induces fracture is a function of force per area, the blunter the percussive object the less successful and predictable the fracture is likely to be.
Thus, if force can be concentrated on a smaller area, either through the use of a more angular percussive instrument or secondary percussion, the risk of undesired breakage is lessened. In terms of working turbinid shell, then, greater precision and control would be achieved through cutting or indirect percussion, rather than the blunt application of impact force.

Before leaving the Turbinidae, mention should be made of the calcareous operculum. I have found no references in the literature to the microstructure of turbinid opercula, however observation of the visual properties and fracture tendencies of fresh and archaeological examples suggest to me that the structure is prismatic.

2. **The Trochidae**: In the majority of respects, members of the Trochidae have very similar properties to the closely-related Turbinidae. Both have a prismatic outer layer and a nacreous internal layer, and so the same general principles of formation and fracture apply.

3. **The Conidae**: Cones exhibit a nearly wholly crossed-lamellar structure and are aragonitic. The structure is made up of first, second and third-order lamella. The third-order lamellae are the smallest structural unit and are tiny elongate crystals oriented in the same direction. These are stacked to form second-order lamellae, which are in turn stacked to form first-order lamellae (Watabe 1988:82). What results is a long rod-like structure, with the crystals laying horizontally across the long axis of the first-order lamellae. Between lamella, the direction changes markedly, usually by about 70° to 90° (Currey and Kohn 1976:1615). This structure is illustrated schematically in Figure 4.10. In *Conus*, there are three differently oriented cross-lamellar layers sandwiched together. The inner and outer layers are angled transversely to the long axis of the shell,
while the inner layer is oriented in a parallel direction to the same axis (Currey and Kohn 1976:1616-7).

As with nacre, crossed-lamellar structures offer no clean line of fracture through the shell. While cracks can travel through the organic matrix parallel to first order lamellae with relative ease for a short distance, the direction of lamellae will suddenly change. Thus, energy has to travel along the tortuous path of alternating lamellae, or break through them. The latter is pictured in Figure 4.11. The three differently oriented layers of crossed-lamellar formations mentioned above further complicate the nature of cracking in regard to the Conidae.

The angle at which the lamellae are laid down in relation to the growing edge is important to note with regards to fracture patterns. In bivalves, the first-order lamellae are oriented parallel to the shell margin in a concentric arrangement, and in gastropods such as species of Conus, they are arranged parallel to the lip (Watabe 1988:82). This means that compressive or tensile pressure at the edge of the margin of the bivalve or the lip of the gastropod will result in a fracture that naturally runs parallel to the growing edge and does not tend to journey further back into the shell. In Conus, this property of breakage may be magnified by the presence of sculptural growth lines on the external surface of the shell, which also run parallel to the lip (Ward 1988:145; Vermeij 1993:50). This type of fracture is thought not only to be a good defence against predators (discussed further below in Section 4.5.2), but also represents a clear breakage pattern found in the archaeological record as a consequence of Conus working. This detail will be elaborated upon with archaeological examples in the following chapters.
The organic content in crossed-lamellar formations is rather low as compared to prismatic and nacreous microstructures, with thin membranes surrounding lower-order lamellae (Watabe 1988:91; Dauphin and Denis 2000:376). This has taphonomic implications that will be discussed below in Section 4.4.

4. **The Strombidae**: As with the Conidae, the Strombidae are composed of aragonite arranged in crossed-lamellar formation (see Figures 4.12 and 4.13). Experimental work in materials science appears to be limited to the study of *Strombus gigas* – the largest of the strombid conches which is restricted to Caribbean waters. Studies of strength and toughness relating to *S. gigas* demonstrate that the crossed-lamellar microstructure imparts a 20-fold increase in the work of fracture and a three-orders-of-magnitude increase in toughness as compared to a conventional polycrystalline microstructure in the same material (Kamat, Su, Ballarini and Heuer 2000). The tendencies of some strombids to construct varices on the shell body or to thicken the lip of the shell provide a further measure of shell strength. It should be noted that members of the Conidae do not similarly augment shell architecture, however they do reabsorb about 25% of the inner whorls of the shell as they grow, which serves both to provide a larger internal cavity for the animal and free calcium carbonate to thicken the external (body) whorl (Vermeij 1993:33-4).

5. **The Tridacninae**: Molluscs within the Tridacninae are composed of a simple crossed-lamellar body with a complex crossed-lamellar layer on the internal surface of each valve (Watabe 1988:73). The construction material is aragonite (Dauphin and Denis 2000:371). Drawing on the available literature, it appears that tridacnids have a lower organic content than other crossed-lamellar shells (Dauphin and Denis 2000:372). Given the tendency for cracks to spread
through the organic fraction of the shell (as outlined above), it is perhaps the low organic content of the Tridacninae that increases brittleness and allows for lithic-like properties of flaking. Figures 4.14 and 4.15 show details of the first- and third-order lamellae respectively.

6. The Pteriidae: The pearl oysters have a nacreous inner surface and a prismatic outer surface which is covered in a fairly thick periostracum. The nacreous inner surface is aragonitic, while the prismatic layer is formed of calcite crystals (Watabe 1988:74). Nacre construction in bivalves proceeds differently from its formation in gastropods (outlined above for the Turbinidae). Instead of growing in conical stacks, bivalve nacre is referred to as 'sheet nacre' and is stacked in stacked in a 'brick wall' pattern over the inner surface of the shell (Chateignier, Hedegaard and Wenk 2000:1727). This formation is shown in Figure 4.16. The crystals themselves may be generated in a number of ways (including the 'screw dislocation' method shown in the inset of Figure 4.17), however growing crystals will only form over already completed nacre sheets (Wilbur and Saleuddin 1983:264). This creates the clear 'stepped' appearance shown in Figure 4.17, and represents a clear difference from nacre formation in gastropods.

Crystals within a prismatic layer are “essentially similar” regardless of whether they are constructed of calcite or aragonite (Watabe 1988:74). Thus, the discussion of prismatic structures in the Turbinidae (outlined above) also applies here. As with the Turbinidae, a nacreous layer is combined with a prismatic layer, and the different properties of fracture apply here too. Fracture of the calcitic prismatic layer of the pearl oyster Pinctada fucata martensii is shown in Figure 4.18.
7. The Nautilidae: *Nautilus* shells are composed of an external wall and numerous internal septa (refer to Figure 4.5) and have a complex combination of microstructures (Watabe 1988:91). The calcareous parts of the *Nautilus* shell are entirely aragonitic. The external shell wall consists of the periostracum, a spherulitic-prismatic layer, a nacreous layer, and a prismatic layer (see Figure 4.19). The spherulitic-prismatic layer is composed of an outer spherulitic layer, where organics coat the aragonite crystals, sandwiched against an inner prismatic layer, which has an organic layer along the outer part (Watabe 1988:91). The nacreous layer follows the columnar formation seen in gastropods, and it is aligned concentrically around the shell (Watabe 1988:91). The prismatic layer is made up of tiny spicular crystals oriented with their long axes perpendicular to the shell margin. The septa have a similar structural arrangement and, despite being internal, have a periostracal layer along their dorsal (convex) and ventral (concave) faces (Watabe 1988:91-2).

*Nautilus* differ from the other taxa discussed in that they are pelagic, rather than inshore hard- or soft-substrate dwellers. The considerable depths to which *Nautilus* descend mean that the shell is designed to withstand a different set of stresses and conditions – most notably that of water pressure. The shell itself acts as a buoyancy tank, with liquid being taken in or discharged to suit water depth and pressure. The domed nature of the septa means that there is tension rather than bending pressure being exerted upon the shell underwater, and the overall shape is such that this pressure is spread evenly (Currey 1988:198). The design and structure of *Nautilus* shells, being conditioned by a different set of constraints and demands to inshore molluscs, make discussion of fracture rather difficult. As Currey (1988:207) points out:
It is unknown whether the shell of Nautilus, when it breaks, breaks because the strength of the shell material has been exceeded or whether the shell fails through elastic instability. In elastic instability, which characteristically occurs in thin-walled structures, the deflections caused by the loads are what do the damage; the original shape, which was adapted for the loads imposed on it, becomes deformed into a shape that is less well adapted.

Here, I follow the line that the same basic principles of fracture relating to nacreous and prismatic structures apply. However, there may also be addition unpredictability in breakage, due to some degree of deformation in the shell out of its naturally-occurring context.

Of the other two families mentioned in the introduction – the Nassariidae and the Cypraeidae – little has been written. On the Nassariidae, I can find no information at all. Some crystallographic research, however, has been conducted on members of the Cypraeidae. The shell structure is largely crossed-lamellar, but as with Conus, there are different crossed-lamellar layers oriented differently and sandwiched together (Chateigner et al. 2000:1725; Dauphin and Denis 2000:371). There is a thin homogenous layer on the outer surface, and as mentioned above, no periostracum (Chateigner et al. 2000:1733).

4.3.4 Individual idiosyncrasies and variation

Although there are recognized general principles of molluscan structure and mechanics, every animal inhabits and adjusts to a specific local environment and faces a different set of stresses and challenges through its life. In short, each mollusc has its own unique life history. Many aspects of this life history
leave traces in shell morphology, structure and appearance. While the factors that affect individual animals are many and varied, I will outline two major causes of variation between both individuals and populations that result in different working properties of shell as a raw material: these are local environmental variation and shell repair/regeneration.

Many features of local environment and context will affect the growth, morphology and composition of shells. Higher temperatures and nutrient-rich conditions result generally in more rapid growth, meaning growth lines are more widely spaced (Vermeij 1993:28; Vermeij 1978:11). Food sources will affect the microstructure and coloration of shells (Chunhabundit, Chunhabundit, Aranyakanda and Moree 2001; Leighton 1961). Mass and thickness of shells of the same species may be variable between populations depending on intensity of predation in a given locale (Currey 1988:202). Bivalves that cement onto (e.g. the Chamidae and Spondylidae) and bivalves that bore into (e.g. Tridacna crocea) a solid substrate will grow according to the distinctive constraints of the substrate. Factors such as these mean that different conditions will produce diversity in shell shape, appearance and structure both within and between populations.

Shells may be broken or damaged during the life of the animal – most frequently through the action of predators. If the mollusc escapes, the shell may be repaired. Typical predators include birds that pick up and then drop shells from a height, crabs that crush shells between their pincers, crabs that ‘peel’ the shell back from the aperture (e.g. the Calappidae), and fish that crush their prey (e.g. the Diodontidae or ‘spiny puffer fish’). Non-human predation and resultant shell breakage patterns will be further addressed below in Section 4.5.2. Repair of damage is accomplished through the deposition of new shell,
which may or may not exhibit a similar structure to primary shell (Watabe 1983:289). Typically, if the breakage occurs in the growing regions of the lip (gastropods) or the margin (bivalves), then the structure of the repaired shell will be essentially the same (Watabe 1983:291). If, however, the damage occurs back from the growing edge and out of reach of the shell-generating mantle, the structure, morphology, and often mineralogy, is likely to be different (Watabe 1983:291). Different types of microstructures will also regenerate at different speeds. This difference in regenerative speed is more a function of the proportion of organics required than the crystal structure itself. Therefore, nacreous structures are slow to regenerate, due to their relatively higher organic content, than crossed-lamellar structures (Vermeij 1993:42-3).

Figures 4.20 and 4.21 show repaired breaks in two species of Strombus. These are typical regeneration scars in that they are evident down the entire margin of the shell and not simply in the damaged area, and there is a clear indentation when viewed in cross-section (Zuschin, Stachowitsch and Stanton 2003:41). Repaired areas of shell, due to their greater thickness, withstand fracture better than primary shell (Zuschin et al. 2003:53).

4.3.5 Biogeographic patterns of Indo-Pacific marine mollusca

The Indo-Pacific molluscan biogeographic province is the largest global region in terms of area and species richness (Gosliner, Behrens and Williams 1996:13). It spans both the Indian and Pacific oceans, from the east coast of Africa in the west to eastern Polynesia in the east. On a north-south axis, it extends up as far as southern Japan, and south as far as northern Australia (Vermeij 1993:155). Rather than being a continuous single region, the Indo-Pacific marine biogeographic area is composed of a mosaic of faunal
subregions. Each of these has different species compositions and unique endemic species (Gosliner et al. 1996:13). The Red Sea, the western Indian Ocean and the western Pacific are three areas with the highest species richness, and within these the “region with by far the highest diversity is defined by a geographic triangle formed by the Philippines in the north, Indonesia to the southwest, and New Guinea to the Southeast” (Gosliner et al. 1996:13). This zone falls within the geographic area of concern for this thesis, together with the less speciose oceanic western Pacific.

Shells of the tropical Indo-Pacific have a series of distinctive features that separate them visually and structurally from temperate species. Tropical Indo-Pacific taxa more frequently have spines, varices, and thickened lips, which Vermeij (1993:160-6) correlates with higher levels of predation in the tropics. Vermeij (1978; 1993) has devoted considerable ink to this subject, and interested readers are referred to his work for an extended discussion of differences between biogeographic provinces.

4.4 Shell taphonomy

4.4.1 Introduction

Shell taphonomy is a large and complex issue. Various areas of archaeological science, such as radiocarbon dating, oxygen isotope analysis, and amino acid racemization are all dependant upon a full and accurate understanding of decay processes. Aspects of shell taphonomy discussed here cover three distinct matters: (1) those processes that have a direct bearing upon the nature of shell as a raw material, (2) generic aspects of shell death and post-mortem processes that blur the margins between natural and cultural action, and (3)
taphonomic factors acting on total assemblages that affect interpretation of the shell component. In Section 4.4.2, I will consider taphonomic processes acting on individual shells. These include post-mortem loss of organics and its affect on shell strength and microstructure, natural processes acting upon post-mortem shell in coastal environments, and polymorphic and isomorphic recrystallization. I will also briefly discuss the issue of ‘old shell’, and its occurrence in archaeological deposits. Section 4.4.3 will cover taphonomic processes that alter natural and cultural shell assemblages including water action, bioturbation, dissolution, time averaging, and compaction. The important issue of natural versus cultural breakage in shell will be discussed in Section 4.5.

4.4.2 Taphonomic processes acting on individual shells

With the death of the animal, the organic components of the shell begin to break down swiftly. For nacreous shell, the breakdown is particularly fast due to the higher organic content. Experimental work with the gastropod Calliostoma ligatum (a member of the Trochidae) has shown that after only three days the shell loses about half its original strength in compression (Vermeij 1993:50-1). The loss of strength is less drastic for shells with a smaller organic fraction (Zuschin et al. 2003:57). With regards to tropical depositional contexts, Vermeij’s (1993:51) observation that organic decay is faster in warmer temperatures has especial significance (see also Zuschin et al. 2003:57). In the context of shell as a raw material for artefact production, then, nacre will be more prone to splitting between sheets (shearing), and will not preserve as well as shells with a low organic fraction and non-organic-reliant matrix (e.g. the Conidae and the Tridacninae). These observations apply to shell from the time
of initial working through to recovery by the archaeologist. That is, what is important from a raw material point of view is when the animal dies/is removed rather than when the artefact itself enters the archaeological record, and it cannot be assumed that a loss of structural integrity occurred only post-depositionally.

The break-down of the organic fraction can be accelerated through exposure to fire. This not only oxidises the protein component, but, if hot enough, can transform the shell into a white calcium oxide (CaO) with carbon dioxide (CO₂) released as a gas (Robins and Stock 1990:87). Crystallinity is lost between 500 and 700°C with aragonite converting to the more stable calcite at 520°C (Claassen 1998:61). Following a series of experiments, Spennemann and Colley (1989) concluded that shell burnt at high temperatures (i.e. over 700°C) would be so frangible that archaeological recovery was unlikely. Shells burnt in a fire with a temperature between 300 and 700°C degrees were more likely to survive, and would exhibit surface cracking, some fragmentation and take on a grey coloration (Spennemann and Colley 1989). It is also worth noting that Tridacna squamosa and Tridacna maxima samples used in these experiments fractured into rough, blocky pieces, and, in the case of Tridacna squamosa, lost its sculptural flutes (Spennemann and Colley 1989:53).

As mentioned above in terms of organic decay, shell degradation processes begin at the death of the animal. It is this feature of shells that allows archaeologists to distinguish, to some degree, between shells collected live and deposited on site, and those either collected as empty shells or present in archaeological deposits through non-cultural processes. Primary amongst these distinguishing features are evidence of intra-shell action of bioeroders and
encrusting species, and mechanical abrasion caused by 'beach-rolling' or hermit crab occupation.

A variety of organisms can adhere to or bore into the shell of the mollusc both during its life and after death. Such organisms include barnacles, bryozoans, corals and algae. Figure 4.22 shows two views of a *Turbo marmoratus* displaying a number of such organisms on the shell. When analysing archaeological shell, a rule of thumb is that encrustations observed on the outside of the shell mean that the animal may have been collected live by humans, whereas evidence of encrusting or adherent organisms within the aperture (gastropods) or inner surface of the valves (bivalves) indicate that shell entered the deposit post-mortem. A high frequency of the latter in a deposit suggests either (1) a natural shell accumulation, or (2) extensive disturbance. This logic, of course, is all based on the assumption that it was the animal rather than the shell that was sought by humans. In terms of shell-working, there is little basis to assume *a priori* that only live molluscs would have been collected for use. Therefore, rather than putting such encrusted specimens to one side in the analysis, human modification relating to shell working has been looked for as much in encrusted specimens as in 'fresher' specimens. This being the case, it should be noted that boring sponges (e.g. clionids) would weaken the structure of the shell, while layers of encrusting coralline algae would provide additional strength, complicate fracture and hinder bioerosion.

Mechanical abrasion is generally attributed to sand blasting and beach-rolling (Zuschin *et al.* 2003:46). Diagnostic features of these processes include muted shell sculpture, polished surfaces and the rounding of edges across the entire outer surface of the shell (Claassen 1998:58). As with internal encrustation, beach-rolled specimens are generally considered to be non-
human or intrusive (Claassen 1998:59). Again, however, if the goal was not meat, empty shells may well have been collected by human gatherers.

Chemically, post-mortem shell can undergo a number of transformations. The most common is the spontaneous inversion of aragonite to the more stable calcite. This process is termed ‘recrystallization’. Calcite is also less soluble than aragonite, which has implications for situations in which groundwater is percolating through a deposit (Moir 1990). Fossilization can also take place, with calcium carbonate being replaced by another mineral such as dolomite, silica, hematite or pyrite (Claassen 1998:60). Moir (1990) has hypothesised a situation in which Tridacna gigas is deliberately manipulated by the residents of Takuu Atoll to induce an isomorphic (aragonite – aragonite) transformation. She suggests that the transformation of aragonite ‘needles’ to ‘platy aggregates’ would have created a more robust working material that was better able to withstand taphonomic rigors (Moir 1990:340-1).

X-ray Diffraction (XRD) analysis will measure levels of calcite and aragonite within a specimen, and thus inform on whether polymorphic recrystallization (i.e. aragonite – calcite) has taken place. Such analysis, however, will not detect isomorphic conversion, such as that suggested by Moir (although trace elements can be somewhat indicative). Neither will it detect ‘old shell’ that has retained its structural and compositional integrity. The issue of old shell is not one that has (to my knowledge) been systematically investigated. By ‘old shell’, I mean shell, incorporated into archaeological deposits, that died – and thus began decaying – substantially before the time of site occupation and use. Dating this shell will therefore produce a misleading result. Such shell can be incorporated into archaeological deposits through natural processes such as wave action, bioturbation and time.
averaging/disturbance that mixes archaeological and subfossil accumulations. My interest here, however, is in the use of old shell for artefact production.

That prehistoric people would have selected old shell for the production of artefacts is a possibility that needs to be acknowledged. Upon saying this however, the ‘old shell’ phenomenon should not be used as a catch-all excuse to rule out shell dates that inconvenience general interpretation of the site. Where the presence of old shell is suspected, taphonomic or cultural reasons for this must be sought. With regards the production of artefacts, I suggest there are two major issues to be borne in mind. Firstly, due to general natural taphonomic processes, such as those described above, not all types of shell are likely to preserve. For example, large, thin shells will be much more prone to fragmentation and loss than small, robust species (Claassen 1998:58-9). Therefore, taxa such as *Nautilus* and *Pinchatad* are unlikely to be common in subfossil deposits. Secondly, it is doubtful whether prehistoric shell-workers would have accidentally selected subfossil shell for working. I think that they would have been well aware of differences in both appearance and depositional context between fresh and subfossil specimens. I contend, therefore, that where working of old shell is demonstrated, this represents an explicitly cultural technological choice. As such, patterning of this choice through space and time may be revealing (as outlined in Chapter 3).

**4.4.3 Taphonomic processes acting on shell assemblages**

Archaeological shell accumulations will be affected by the same range of taphonomic processes that affects sites generally. These processes include compaction and associated fragmentation, time averaging, and disturbance through bioturbation and wave action. There are also more specific processes
that will act differentially on calcium carbonate material such as acid dissolution. I will briefly consider these processes and their impacts here.

While the structure of shells generally enables them to perform well under compressive stress, the loss of organics and other diagenetic processes mean that shells are more susceptible to either fracturing through brittleness or plastic deformation. Brittle fractures occur when rigid skeletons are placed under strain, whereas plastic deformation often occurs in skeletons that have lost such rigidity (Zuschin et al. 2003:47). Variables affecting levels of shell breakage caused by compression within a deposit (including the ‘treading’ of the midden literature) include mechanical shell strength as well as extrinsic factors such as burial orientation, whether shell cavities are filled with sediment, and whether concretions are present on or inside the shell (Zuschin et al. 2003:47). Not only does such compaction result in (differential) fragmentation, but downward displacement of material is also a common consequence (Claassen 1998:81).

Compaction processes also have a further consequence – namely the phenomenon of ‘time averaging’. Palaeontological studies provide the generalization that the longer a shell deposit has been accumulating, the more likely it is that shells from successive generations and discrete depositional episodes will be mixed (Claassen 1998:77). Moreover, shell accumulations in deeper water and further from shore are likely to incorporate shells from an increasing temporal range (Claassen 1998:77). While this latter observation may not be of relevance to the vast number of archaeological shell accumulations, which were deposited on land, this must be a consideration when dealing with Lapita ‘stilt village’ assemblages where deposition was over water. Certainly, when more than one discard event is supposed, time averaging will be a taphonomic factor (Claassen 1998:86)
The mixing associated with time averaging is compounded by a variety of other taphonomic processes such as bioturbation and wave action. Water and animal action can either create shell accumulations or modify archaeological shell deposits. Birds can create 'midden-like' assemblages, while crabs and infaunal insects can disturb archaeological deposits (Claassen 1998:71-3, 78-80). Water-deposited cheniers are an example of natural accumulation, while wind is well known to deflate coastal midden sites (Claassen 1998:70-1). Wave action during storms will clearly affect shell deposits within reach (Bird 1992), however the stilt village phenomenon, often associated with Lapita, presents an altogether more complex case where wave action is a constant factor, along with tidal push and pull, and bioturbation. This is further complicated by humans depositing shells back into the dynamic environment from whence they came.

Being constructed of calcium carbonate, contact with acidic matrices or groundwater will dissolve shell. This process is rather logically known as 'acid dissolution’. Rain combined with atmospheric carbon dioxide will form a weak carbonic acid that will deteriorate shells (Claassen 1998:60). Plant roots will release nitric and sulphuric acids, as will decaying plant matter (Claassen 1998:60). This certainly has relevance for Lapita contexts, where sandy layers are often overlain by soils relating to gardening. The differences in preservation in these cases are plain, and will be further discussed in the proceeding chapters. In slightly acidic soils and colder temperatures, survival or the organic component rather than the calcium carbonate component is likely. Such was the case in the recent analysis of shell from the sub-antarctic Auckland Islands, where the periostracum from the mussels *Mytilus edulis aoteanus* and
Aulacomya ater maoriana was largely intact, while the nacreous portions of the shell were powdery and crumbled when handled (Szabó 2004).

The dissolution of shell has a number of follow-on effects. Firstly, many thin or porous shells, as well as shells with a high surface area to weight ratio, are dissolved altogether (Claassen 1998:60). Secondly, it makes evidence of working very difficult to accurately pinpoint and describe due to the fact that edges and surfaces will tend to be pitted and crumbly. Thirdly, dissolution will release calcium carbonate back into the environment. Free calcium carbonate in the matrix will often attract landsnails, who frequently find shell-building materials hard to obtain in a terrestrial environment. In this circumstance, the issue of how to separate intrusive landsnail remains from humanly-collected specimens arises. Criteria for separating these two categories have been outlined in Szabó (2003).

4.5 Varieties of shell breakage

4.5.1 Introduction

Discussion of the various taphonomic processes acting on shell has made it clear that shell breakage can occur for a number of reasons with many variables coming into play. In this section, I will consider more closely the problematic issue of shell breakage patterns. I will firstly introduce palaeontological and conchological work investigating breakage patterns that occur in the natural environment. I will then investigate the two cultural categories of subsistence related breakage (or 'meat extraction patterns') and shell breakage related to artefact production. Incorporating the information on taphonomic processes resulting in shell breakage outlined above, I will then
offer suggestions for separating kinds of shell breakage encountered in archaeological assemblages. This will form the basis for interpreting shell breakage in following analyses.

4.5.2 Non-human predator breakage patterns

In addition to the taphonomic processes of compaction, burning and wave action described above, that can all result in shell fragmentation, there are a variety of natural processes related to predation that can damage and break shell. The resulting fragments are frequently similar to human-induced breakage patterns (discussed in the following two sections). The major agents in the coastal environment are crushing crabs, peeling crabs, hermit crabs, crushing fish, birds that drop shells from heights, and drilling gastropods. All will be discussed briefly here.

Crabs of the tropical sand-dwelling genus *Calappa* (the Calappidae) are foremost amongst the ‘peeling crabs’. They have modified dactyls\(^9\) with a special projection that is used to lever pieces of shell back from the aperture. The resulting damage can be seen in Figure 4.23. Shells that generally avoid successful attack by calappid crabs include shells greater than 1.3mm thick, those with thickened aperture lips that cannot be easily snapped, narrow apertures into which the claw/projection cannot be effectively inserted (e.g. *Conus* and the Mitridae), and species that can retreat well back into thicker portions of the shell (e.g. the Terebridae) (Vermeij 1978:45-6). The breakage pattern produced by calappid crabs has parallels in human working of *Conus*, but features such as those just outlined can act as a guide to separating types of shell that are potentially calappid damaged from those that represent human

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\(^9\) The dactyl is the moveable ‘thumb’ of the pincer, while the larger part of the pincer into which it is set, is known as the propodus.
breakage. The issue of possible calappid breakage will be revisited for specific cases presented in Chapter 5.

Less specialised are the crabs that crush the shells of their prey. Common taxa in tropical Pacific waters include genus *Carpilius* (Brachyura: Xanthidae), genus *Eriphia* (Brachyura: Menippidae), genus *Ozius* (Brachyura: Menippidae), and genus *Daldorfi* (Brachyura: Parthenopidae) (Vermeij 1978:40-1; Zuschin et al. 2003:43). When crabs of these genera attack a gastropod or hermit crab, they will most frequently attempt to break off the spire (Vermeij 1978:40). This method tends to more successful with high-spired shells such as the Cerithiidae (Vermeij 1978:40). When the spire or body whorl cannot be crushed, the crab will attempt to break back the aperture (Vermeij 1978:42).

Studies of attacks by the crushing crab *Carpilius maculatus* on the gastropod *Trochus niloticus* have determined that the mollusc cannot be successfully attacked once shell diameter reaches 4cm (Vermeij 1978:42). *Conus* shells, with their low spire, thick body whorl and narrow aperture, resist crushing crab damage very well (Vermeij 1978:42). Figure 4.24 shows fatal damage produced by the crushing crab *Carpilius maculatus* on a *Trochus niloticus*. Such breakage patterns could easily be mistaken for shell-working or meat extraction if encountered in an archaeological deposit. This figure also demonstrates that ‘notching’, ‘pecking’, or even purported ‘drilling’ (see Smith and Allen 1999) cannot be assumed as unequivocal evidence of human modification. A similar problem is demonstrated in Figure 4.25, where typical crab damage of a cowrie coincides with ‘octopus lure’ and/or ‘vegetable peeler’ and ‘scraper’debitage (see also Spennemann 1993).
Various taxa of molluscivorous fish as well as some seabirds will also cause shell breakage. Fish in the Labridae (wrasses) crush shells using robust pharyngeal plates, while rays and pufferfish (the Diodontidae) crush shells in their jaws (Vermeij 1978:75). Such crushing fish taxa are more characteristic of tropical than temperate waters (Vermeij 1978:75). Gulls and crows will drop shells from a height of several meters onto hard surfaces in order to break the shell (Vermeij 1993:105). The action of both crushing fish and birds that drop shell should result in an undiagnostic breakage pattern, as shells will break across inherent lines of weakness.

Hermit crabs, by virtue of not being predators of molluscs, do not actively set out to break shells. In the case of the terrestrial Coenobitidae however, shells are modified in distinctive ways. The issue of coenobitid damage, its recognition, and its impact on shell accumulations has been little investigated (but see Walker 1994; Walker 1995: for examples from palaeontology) and is a subject I am currently pursuing further. While I do not wish to go into extensive detail here, it is clear that shell middens can be an attractive source of empty shells for coenobitid hermit crabs. This results in the removal of midden shell, and its replacement with a ‘hermit-crabbed’ example from an unknown original source. While the rates of occurrence of such hermit-crabbed shells in tropical middens are typically low, rates can be as high as 80% of the total shell assemblage (Szabó, unpublished data).

Due to variation in behavioural ecology, different species of coenobitid will prefer to inhabit different types of shell (Barnes 1999). Tree-climbing coenobitids will prefer slender tall-spired shells (such as shells of the Potamididae and the Cerithiidae), and burrowing coenobitids will preferentially select globose shells with large rounded apertures (such as shells of the
Turbinidae and Neritidae) (Barnes 1999; Carucci 1992:166). The major indicators of hermit crab occupation on gastropods are drag marks where the shell was in contact with the ground, and a widening of the aperture and removal of the columella through the mechanical abrasion of the crab extending out of, and retreating into the shell (Walker 1994; Walker 1995:372, 375). Figures 4.26 and 4.27 illustrate such damage. A propos archaeology, not only do hermit-crabbed shells skew the picture of midden contents, damage patterns can also blur with human modification. This may be the case with regards to 'abraders' produced from Terebralia shell, and this issue will be further considered in Chapter 7.

The final category for consideration here is the drilling gastropods. Species of the Naticidae (moon snails) and Muricidae (murexes, rock shells) are predators on other molluscs. To gain access to their prey, they use an accessory boring organ combined with the enzyme carbonic anhydrase to drill a hole through the shell (Vermeij 1993:105). The drill holes produced by naticids are generally conical, with a distinct bevel on the outer surface of the shell (see Figure 4.28), while muricid holes tend to have straight sides in profile (Rosenberg 1992:88). The holes made by both families are perfectly round, and this feature can often assist in distinguishing between holes produced through the action of drilling gastropods and those created through human agency. Drilling by predatory gastropods is also unlikely to be present in thicker-walled molluscs, as increasing shell thickness decreases risk of predation (Vermeij 1978:51, 80). Even if a shell displaying evidence of having been drilled by a predatory gastropod is identified in an archaeological deposit, this does not necessarily mean that it was not collected by humans. Clearly the
shell would have had no subsistence value, however the presence of a ready-
made hole may make it attractive with regards to shell-working.

4.5.3 Subsistence-related breakage

Within the Pacific archaeological literature, it has been suggested that shell
breakage for meat extraction is inefficient and unlikely (Smith and Allen
1999:293). It is unclear what the basis is for such assertions, especially given
the weight of ethnographic literature to the contrary. In ethnographic literature
pertaining to both Island Southeast Asia and the Pacific, cowrie (*Cypraea* spp.)
shells are repeatedly reported to be broken to enable extraction of the flesh
(Fox 1977a:140; Kirch 1979:133; Titcomb 1978:341), as are *Turbo* spp. (Koch
1986 [German original 1965]:8), *Lambis* spp. (Koch 1986 [German original
reports a process whereby *Telescopium telescopium* are broken in half by
delivering blows with a stone, with the flesh then being prized or sucked out.
The same breakage pattern is noted consistently in middens with this and other
turriculate gastropod species such as *Terebralia sulcata*, *Terebralia palustris*,
*Cerithium nodulosum* and *Melanoides* spp. (Szabó, unpublished data). *Trochus*
spp. are frequently recovered from middens with the apices missing – a pattern
linked ethnographically by Fox (1977a) to meat extraction. This breakage
pattern was consistently noted on specimens recovered from the Fijian Lapita
site of Naigani, and has been interpreted by Best (pers. comm. 2003) as
evidence of breakage for meat extraction.

One method of processing *Turbo setosus*, as witnessed by Stephanie
Garling in the Tanga Island Group, New Ireland, Papua New Guinea, is pictured
in Figures 4.29 to 4.32. Figure 4.29 shows the molluscs just after collection and
before any processing. Note that most of the opercula remain tightly closed. The shells are then placed onto an open fire with the aperture facing upwards to allow them to cook in their own juices (Garling, pers. comm.). This part of the process is shown in Figure 4.30. When cooked sufficiently the shells are removed from the fire, placed on the ground (limestone in this case) aperture/ventral surface downwards, and hit on the dorsal surface with a limestone nodule (see Figure 4.31). The animals, which remain attached to the operculum, are bitten off. The resulting fragments from this processing method are shown in Figure 4.32. It takes about three blows for an experienced shell-processor to crack open a *Turbo setosus* shell (Garling pers. comm.). This meat extraction method coincides well with both fragments and complete shells with holes knocked in the body whorl frequently recovered from Pacific archaeological deposits.

When analysing midden, repetitive breakage patterns of particular taxa emerge. In the course of midden analysis for this and other research, I have begun to record and tabulate breakage patterns associated with specific taxa, and the results will be presented in future publications. Broadly speaking, while breakage patterns are observed to be recurrent and patterned, variability arises from the fact that breakage/reduction is less careful and considered than that observed in shell-working. Breakage will follow natural lines of weakness within the shell. It is also likely that breakage would be easier with less overall damage to the shell if it were burnt beforehand, thereby reducing the organic component.
4.5.4 Breakage related to artefact production

When producing artefacts from shell, the goal will be not only to reduce shell, but to reduce it in a particular way. While natural processes and meat extraction will create breakage patterns that follow natural structural planes of weakness within the shell, this may not hold for breakage related to artefact production. Techniques such as cutting, grinding and drilling can all be used creatively to generate forms that often defy the structural tendencies of the shell. In short, if the structural properties of shell are understood by the human modifier, they can also be innovatively manipulated and problems raised by structure (at least partially) circumvented. Therefore, I take evidence of 'unnatural' breakage to suggest human modification.

Since the isolation and definition of breakage/modification related to artefact manufacture is the subject of the next three chapters, I will not go into further detail here.

4.5.5 Separating types of breakage

The discussions of shell structure, taphonomy and breakage patterns above all serve to inform the analysis of shell in this thesis. Too little attention has hitherto been paid to these issues in archaeological shell analysis, as witnessed by the fact that the vast majority of references in the preceding three sections are not archaeological. All aspects are surely domains for substantial further research. While much can be learnt from the palaeontological literature in particular, the task of isolating and defining human patterns of action on shell must surely be the responsibility of archaeology.

I suggest here that the defining characteristic of much humanly-modified shell is that it defies natural breakage/wear tendencies. Where problems of definition
occur, this is frequently related to either taphonomic condition, or
equivocal/equifinal breakage patterns - often with respect to initial reduction
through shattering or percussion. Green (2000:381) touches on this latter
problem when he rejects claims for pre-Lapita *Trochus* fishhook manufacture in
the Bismarck Archipelago, which are based solely on recovery of the initial
'blanks'.

For all assemblages, I will address depositional circumstance and
taphonomic condition. This is, however, necessarily hindered by differing levels
of information about each site and gross differences in sample collection (and
retention) strategies, and sample size. Where there is clear evidence of natural
breakage or modification, as informed by the discussions presented within this
chapter, these will be discussed. Due to the complexity, and oftentimes
uncertainty, of determining the relationship between particular processes and
action, and observed patterning in archaeological shell, problems and patterns
will be discussed on a case by case basis throughout the next three chapters.

4.6 Analytical Approach

4.6.1 Introduction

One of the aims of this chapter was to make clear the complexity of the issues
surrounding shell breakage, taphonomy, and natural/cultural modification. The
analytical approach needs to both address and attempt to cope with this
complexity. To this end, I have structured a series of research questions to be
addressed to samples at different scales. The broadest scale is the site itself.
Thus the presentation of the results of analysis from each site will consider
firstly the nature of each site, including: site type, issues of location, issues of
taphonomy, issues of time averaging, temporal and spatial patterning on an intra-site level and any additional specific details considered necessary for discussion. The next scale takes in the total shell assemblage and its internal subdivisions (i.e. midden shell, worked shell, natural shell). Questions asked at this scale are outlined in Section 4.6.2. Following discussions of the shell component of each site, a set of questions aimed at detecting patterning and local technological/cultural choices will be asked of both the worked and midden shell. Questions asked at this scale are outlined in Section 4.6.3. Finally, a specific set of questions have been framed in order to compare results from different assemblages. Issues of higher-level temporal and spatial patterning will be dealt with here. Questions asked at this scale are outlined in Section 4.6.4.

4.6.2 Questions asked of the total shell assemblage for each site

For each assemblage physically studied in this analysis, the initial aim was to study the contents of the shell midden as well as worked shell material and artefacts. This has generally been possible for Lapita sites, but midden was frequently either not available for study, or had not been retained during excavation. This is the case for most Island Southeast Asian sites. In some circumstances, on-site tabulations of midden shell exist, and these have been used where available. Detail is, however, variable.

Where midden was available for study, its analysis was approached in a standard way. Identifications follow Abbot and Dance (1982), Cernohorsky (1972), Dharma (1988; 1992) and Springsteen and Leobrera (1986), as well as comparative specimens from the personal collection of the author. All shell within the sample was analysed, with small shells and fragments not being
tacitly excluded. Mollusc remains were quantified using both ‘minimum number of individuals’ (MNI) and ‘number of identified specimens present’ (NISP) approaches. The former technique counts constant and recurring elements for each defined taxon, such as the spire, aperture, or left/right hinge, and takes the highest value as representing the minimum number of individuals necessary to generate the sample. The latter technique is a basic fragment count. Neither technique is perfect; while MNI tends to underestimate numbers or conflate counts across excavational units\(^{20}\), NISP will frequently overestimate them and is prone to masking such issues as differential fragmentation, both between species and discrete areas within the site. Used together, they provide a more accurate account. When the MNI results are compared to the NISP results, patterns of differential fragmentation are drawn out. While such differential fragmentation is frequently the result of taphonomic/diagenetic processes, it can also point to species regularly broken to facilitate meat extraction, or species broken in the process of working. Where results from different quantification methods were largely in agreement with each other, the MNI values alone have been reported. All graphs presented with midden results are based on MNI counts unless otherwise stated.

The purpose of studying the midden shell was two-fold. Firstly, it allowed me to isolate any worked pieces that may have been missed in an initial sort. Secondly, it provided a dataset that I could use to investigate questions of local availability of taxa and general selection of shell. With regards to the first point,

\(^{20}\) Inflated counts tend to occur when different non-recurring elements are used between excavational units, and conflated to give a final figure. This problem, termed aggregation, is discussed at length by Grayson (see Grayson 1984:29-49). While no quantification method is unproblematic, I try to minimise the aggregation problem by counting multiple non-recurring elements and selecting the highest value within stratigraphic units rather than arbitrary levels. Where stratigraphy is unknown/unclear, I take the highest value for each taxon within the total sample. This technique will tend to underestimate rather than overestimate frequency.
not only were any worked/possibly worked fragments separated out – so too were any fragments/whole shells belonging to the major taxa known to be used as a raw material from previous research. This allowed me to assess circumstances where shells were collected, and then rejected for working, as well as issues such as size range and taphonomic condition of shells collected for working. With regards to the second point, specific questions asked of the total shell assemblage from each site were as follows:

1) From what sorts of environments do midden species derive?
   a) Are/were these environments local?
   b) Is there differential focus on local collecting environments?

2) What can be said about shell-gathering strategies as they relate to subsistence?
   a) Are particular species focused upon?
   b) Are particular habitat zones targeted for collecting activities (e.g. upper/middle/lower intertidal)?

3) What do these results allow us to say about shell-gathering dispositions as they relate to molluscs collected for subsistence purposes?

4.6.3 Questions asked of each assemblage regarding shell-working

Shell artefacts, shell that had clearly been worked, and shell belonging to taxa commonly employed as raw materials were all studied separately from the midden shell. Rather than breaking discussion of results into categories based on different ‘types’ of artefacts within assemblages, I will discuss the worked shell material from each site in categories relating to raw materials. It is hoped that in this way, typological (and mental) barriers between different artefacts types can be overcome. In effect, it matters less here what ‘it’ is – the questions
revolve around how 'it' was made and the choices that lay behind 'its' genesis and curation. Questions asked of each such sample from every site were:

1) Which taxa are selected for working?
   a) Are these taxa likely to have been collected from local environments?
   b) Is collection of raw material likely to have coincided with collection of shellfish for subsistence, or,
   c) Do shells chosen for working represent secondary use of midden shell?

2) Are particular size classes within taxa selected for working?

3) Are shells that were collected post-mortem used for working?

4) What is the range of working techniques evidenced (e.g. cutting, drilling, grinding, abrading, piercing, percussion etc.)?
   a) Are particular techniques employed on specific shell taxa, or,
   b) Are particular techniques employed at specific points in reduction sequences across taxa (e.g. direct percussion for primary reduction)?
   c) How consistent are these choices within the assemblage?

5) Are particular artefacts likely to be curated?
   a) What is the range of techniques/strategies employed in curation?
   b) Are these choices made consistently within the assemblage?
   c) Is deposition likely to occur at a given point?

6) Is debitage re-used in any way?
   a) If so, how?
   b) How consistent are re-use strategies?

4.6.4 Questions asked across assemblages

The questions asked across assemblages follow directly from the results of analysis from each site, and are presented in Chapter 8. The aim is to assess
the extent to which similar/divergent technological choices are being made, and how technological choices cluster across space and through time. As stated in Chapter 1, I do not wish to assume, *a priori*, the validity of such archaeological conceptual entities such as ‘Lapita’ or ‘Austronesian’. Given this, comparison is done on a ‘level playing field’. The occurrences of distinctive technological choices in shell-working are plotted onto maps, and the spatial and temporal distributions discussed. Interpretation of patterning follows from the premises outlined in Chapter 3 pertaining to information flow and the nature of diffusion, technological transfer, and innovation. As pointed out in Chapter 3, these processes do not represent discrete categories, but rather nodes on a continuum that merge into one another. The comparison works on a series of levels, ranging from assessing patterning related to distributions of discrete technological choices to the co-occurrence of groups of technological choices.

Questions asked across assemblages include:

1) Can we see similar technological choices being made across sites?
   a) Or can we see the ‘same’ artefacts being produced in a different way?

2) If similar practical dispositions relating to shell-working are detected, are these:
   a) Across space?
   b) Through time?
   c) Both?

3) What is the scale of similarity?
   a) Are similarities related to only a few technological choices, or many?
   b) Do similarities relate to the working of some raw materials and not others?
4) What do patterns of similarity and dissimilarity tell us about social relations, information flow, and population movement across space and time within the study area?

4.6.5 Potential difficulties related to the answering of questions

Some of the potential problems encountered have already been mentioned. Firstly, taphonomic issues that relate to the integrity and quality of preservation of samples will affect the level of certainty at which conclusions can be drawn. The degradation of shell surfaces and artefacts make traces of working difficult to pinpoint and characterise. Time averaging and site disturbance will complicate the identification of chronological patterning within sites. These factors cannot be controlled for here, but will be discussed when encountered.

Further problems relate to the differing recovery strategies employed in excavation. As mentioned at the beginning of this section, typically all shell was retained in the Lapita samples analysed here. The same is not true of many Island Southeast Asian sites, where midden tended to be either dumped on site with cursory recording, or selectively sampled with retention of 'big or whole shells'. For the samples without accompanying, well-sampled midden, it means that questions relating to the midden (outlined in Section 4.6.2) cannot be answered effectively. Furthermore, for most of the Island Southeast Asian sites, only a selection of artefacts was available for analysis.

Variation in site type is an additional complicating factor cross-regionally. The Lapita assemblages analysed are, without exception, derived from open, coastal habitation sites. The majority of the Island Southeast Asian and pre-Lapita samples, on the other hand, are from cave or rockshelter contexts. A number of these sites in Island Southeast Asia incorporate burials. The clear
differences in depositional context means that a similar spread of artefact material cannot be expected. Neither is evidence of working likely to be found in many of these sites. In these situations, clues to working have to derive from the artefacts themselves. As with other variables, these issues will be addressed on a case-by-case basis.

Some mention of chronological issues must also be made. While the Lapita sites under consideration in this thesis are fairly securely dated, the problems that beset chronology in Island Southeast Asia are significant. The subject of the unreliability of many radiocarbon dates from Island Southeast Asia has been broached by Spriggs (1996a; 2003). Arguably, the gloomy picture painted in these papers represents only the tip of the proverbial iceberg. Cursory reporting of stratigraphy, sampling strategies and taphonomic issues make reassessment, based solely on available literature, supremely difficult. This problem is compounded further by the fact that important sites considered here have been destroyed – either through 100% excavation (e.g. Duyong Cave, Palawan Island), or natural processes (Leta Leta Cave, Palawan Island). Disturbance of Island Southeast Asian sites by treasure hunters is also an issue of some magnitude that is, most frequently, not considered. As with all other variables, chronological concerns will be addressed on a case-by-case basis.

Variation in sample size, condition, and site type across assemblages analysed, combined with chronologies that are often highly insecure, make statistical analysis problematic. Grossly incomplete understandings in many of the domains of knowledge and research discussed within this chapter mean that these variables cannot be controlled for at present. Furthermore, the current status of understanding of shell artefacts across the region make it far from clear what should constitute a ‘unit’, where the boundaries of units lie, and
what does or does not constitute a critical variable. Therefore, if patterns were
to emerge from statistical analysis, it would be unclear whether they related to
geography, temporality, artefact function, site function, resource availability,
taphonomy, sampling strategies, sample size, or cultural difference. In effect, I
believe statistical analysis would add very little at this preliminary stage. Given
this, I will rely far more on presence/absence of particular technologies and
associated choices than (apparent) frequency. Indeed, in the end, it only takes
one example of a particular technique to demonstrate that knowledge of it
existed at a particular juncture in space and time. Upon saying this, whether
there is one example of something across an archipelago or one hundred in one
site does make a difference. I will address issues of scale of occurrence non-
statistically and with requisite disclaimers. My aim, at this point, is to cast the
net as wide as possible/practicable in order to begin to grasp diversity and
pattern in approaches to artefact production from shell. The establishment of
potentially viable units for statistical analysis through an investigation such as
that presented here, as well as fuller and more accurate contextual information,
will doubtless make a statistical approach both more workable and useful in the
future.

4.7 Selection of samples for analysis

Contextual and background details about the assemblages analysed as part of
this thesis will preface the presentation of results from each site throughout the
proceeding three chapters. Regarding the selection of samples, an effort was
made to incorporate into this analysis samples with a geographical and
temporal spread sufficient to address the major research questions. For the
Lapita cultural complex, this meant examples from early/far western, middle/western and southern, and late/eastern Lapita phases. Early/far western Lapita is represented here by the shell assemblage from Kamgot, Anir Islands, New Ireland, Papua New Guinea, excavated by Dr Glenn Summerhayes and colleagues. Middle/western Lapita is represented by shell material from the seminal SE-RF-2 site in the southeast Solomon Islands excavated by Professor Roger Green and colleagues, as well as the new site of Vao in northern Vanuatu, presently being excavated by Dr Stuart Bedford and staff of the Vanuatu Cultural Centre. The southern Lapita province is represented by two samples; one from the Lapita type-site WKO-013A on Grand Terre, New Caledonia, and St-Maurice/Vatcha on the Isle of Pines. Rather than being samples from the original excavations of these sites, they are drawn from recent re-excavations by Dr Christophe Sand and colleagues from the New Caledonian Museum. It was originally intended that Tongan Lapita material excavated by Jens Poulsen would represent late/eastern Lapita; however, the devastating bushfires that hit Canberra in January 2003 destroyed the storage facility in which these assemblages were housed. Dr Simon Best generously offered the original sample from Naigani, Fiji, for analysis, and it is the material from the original excavation of this site that represents late/eastern Lapita in this thesis.

For Island Southeast Asia, it was considered important to analyse shell material from a spread of sites through the Philippines and eastern Indonesia. Within the Philippines, assemblages containing sizeable samples of worked shell tend to be patchily-distributed in terms of geography. Most of the known evidence for Neolithic shell artefact manufacture is concentrated in Palawan Island in the south-western Philippines. The samples analysed reflect this
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geographical skewing and material from the excavations of Robert Fox and the National Museum of the Philippines from Palawan constitute the bulk of the sample. Here, samples are drawn from the northern Palawan sites Leta Leta Cave and Paredes Grotto and the central Palawan sites Bato Puti, Sa’gung Shelf and Duyong Cave. A further sample from northern Palawan, from Ille Cave/Rockshelter currently being excavated jointly by the National Museum of the Philippines and the Archaeology Studies Program of the University of the Philippines, under the leadership of Professor Wilhelm Solheim II, was also analysed.

In addition to the material from Palawan, worked shell from Arku Cave, northern Luzon excavated by Barbara Thiel, and Kamuanan Rockshelter on Talikod Island in the Gulf of Davao, Mindanao, excavated by Professor Wilhelm Solheim II was also analysed. Material from two sites in eastern Indonesia - Golo Cave and Uattamdi in the northern Moluccas, excavated by Professor Bellwood and colleagues - supplement the Philippine material.

As noted by Green (2000:380), formal shell artefacts from pre-Lapita Near Oceanic contexts are rare. This, compounded with the infeasibility of studying material in Port Moresby\textsuperscript{21}, resulted in a rather limited range of options. The shell assemblage from the site of Pamwak on Manus Island, Papua New Guinea, with its distinctive set of Tridacna adzes, was analysed as part of this thesis. It was also intended that material excavated by Dr David Roe at Vatuluma Posovi and Vatuluma Tavuro, Guadalcanal, Solomon Islands, would be studied. Security concerns, however, resulted in the cancelling of a trip to Honiara to analyse this material. In its stead, shell material from Kilu Cave and

\textsuperscript{21} Potentially useful shell assemblages excavated as part of the Lapita Homeland Project, such as Balof 2 and Matenbek, have been repatriated to Papua New Guinea (J. Peter White, pers. comm.; Jim Allen pers. comm.).
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Palandraku Cave on Buka Island, Papua New Guinea, excavated by Dr Stephen Wickler, was studied at the University of Hawaii.
Chapter 5: Approaches to shell-working - the Lapita cultural complex

5.1 Introduction

Shell artefacts of distinct formal types have long been recognised as a central material component of the Lapita cultural complex, and a brief summary of the nature of Lapita worked shell assemblages has been given in Chapter 1. Despite this recognition, shell artefacts have not received a great deal of attention in their own right (but see Kirch 1988; Szabó and Summerhayes 2002). While spatio-temporal differences in Lapita ceramics have been documented (Anson 1983; Summerhayes 2000a), fine-grained comparative studies that may reflect similar patterning in worked shell assemblages has never been undertaken.

The volume of Lapita worked shell that has been excavated and reported upon since the 1970s is considerable. Thus, rather than attempting a systematic overview of current material and understandings, I have selected a range of assemblages for analysis that cover the geographic and temporal extent of the Lapita cultural complex. These have been detailed in Chapter 4. For all sites except Vao, midden was either analysed or detailed notes made. As is typical with Lapita sites, all are large, open and coastal.
5.2 Kamgot (ERA): shell assemblage and artefacts

5.2.1 Background and context

Kamgot is a large (400 x 60 m), open Lapita site located on Babase Island in the Anir Island group, New Ireland Province, Papua New Guinea (Figure 5.1)(see Summerhayes 2000b). Five seasons of excavation have taken place under the directorship of Dr Glenn Summerhayes. I joined Dr Summerhayes in the field in 2001, and thus have first-hand knowledge of the site. Twenty-three test pits have been excavated across the site, mostly 1m x 1m in dimension\textsuperscript{22}.

The matrix is sandy, and there are three major stratigraphic layers. The lowest is a white coral sand layer with frequent concreted areas and sparse cultural material. The middle layer contains the densest concentration of cultural material, which is chronologically and typologically associated with early Lapita. The matrix is orange/brown sand. The uppermost layer is organic-rich sandy soil. This layer is thought to be associated with gardening, and cultural material within it consists of both Lapita and post-Lapita archaeological remains. This general stratigraphic pattern is one seen across a number of Lapita sites, and although it is often interpreted as 'initial Lapita occupation on clean coral sand followed later by soil-formation and gardening', Best (1981b) offers an alternative explanation. Rather than seeing this characteristically Lapita stratigraphy as an artefact of human occupation/modification, Best (1981b:6-7) suggests that the difference in sediment composition and appearance results from post-depositional factors. Soil-forming processes would have been active in the upper layers for several thousand years, while leaching of this soil has

\textsuperscript{22} Some squares were extended by another one or more metres. Where this is the case, a letter has been added to the test-pit number (e.g. 1A and 1B). All 'lettered' squares are 1 x 1m in area.
produced staining and discoloration of the sediment below. The lowest ‘clean’ layer has remained unaffected by these processes active further up in the profile. If Best’s interpretation is accepted, this means that ‘layers’ or ‘units’ within sites with such stratigraphic cannot be considered a priori to represent discrete cultural occupations.

In the case of Kamgot, the radiocarbon dates (see Table 5.1) would seem to reinforce the interpretation that Unit 2 (the middle brown sand layer) was indeed deposited during the Lapita phase. Whether the lower Unit 3 is likewise connected with Lapita occupation, or, alternatively, whether cultural material in this unit represents downward movement of material from Unit 2, is currently unclear. Of the radiocarbon dates so far obtained, the sample situated deepest stratigraphically (Test-pit 1, spit 11) is considerably younger than dated samples from further up in the sequence, and has been rejected by Summerhayes (2001:32) as probably being contaminated. The other dates indicate that Unit 2 was deposited sometime within the early centuries of the Fourth Millennium BP, and thus accord well with our current chronological framework for Early Lapita (see Specht and Gosden 1997).

As stated above, twenty-three test-pits have been excavated at Kamgot. The layout of these squares is shown in Figure 5.2. Excavation proceeded in 10cm arbitrary spits, with smaller spits being removed only when layer boundaries were met with. All material was dry-screened through a 3mm mesh archaeological sieve, with retained material being picked out by hand. While much material has been transported to the Australian National University for further analysis, transportation problems meant that a large quantity of midden shell, as well as plain, undiagnostic ceramic sherds, was put into storage on Ambitile Island. All shell midden material held in storage on Ambitile was
analysed by me during the 2001 field season. This includes all non-artefactual\textsuperscript{23} shell from test-pits 10, 14, 18, 19, 20, 21 and 23. A considerable amount of cultural material recovered from Kamgot had been transported back to Australia, and due to this large amount of material, the shell assemblage has been sampled for this analysis. In addition to the midden studied in the field, midden shell from test-pits 1 and 2 was analysed. All worked shell and shell artefacts recognized at the time of initial sorting were studied. In addition, worked and potentially worked pieces encountered during midden analysis were removed and studied separately.

5.2.2 The total shell assemblage

The Kamgot shell assemblage represents a very good case-study of the problems inherent in the analysis of shell from tropical, coastal archaeological sites. While individual shells are well preserved, with only specimens from the gardening soil matrix of Unit 1 showing major structural deterioration, the entire assemblage presents a complex mix of natural, midden, and culturally-modified shell. Shells that had obviously entered the site post-mortem were noted at the time of analysis and quantified separately. This category included shells with predatory gastropod drill holes, specimens abraded by wave action/beach-rolling, and specimens that display evidence of having been inhabited by a coenobitid hermit crab. The total number of specimens showing such damage totalled 381, out of a total shell sample of 9,968 individuals\textsuperscript{24}. This represents 3.8% of the sample.

\textsuperscript{23} As categorised after initial sorting. A limited amount of worked shell was identified within these samples and transported back to Australia.

\textsuperscript{24} As calculated using a minimum number of individuals (MNI) quantification method. Opercula frequencies and the lower total out of left and right valve counts for bivalves have been excluded from this figure.
While this seems all very clear cut, a consideration of the relative abundance of species in the 'cultural' component of the sample suggests that there is considerably more 'natural' input than can be recognised by visual inspection alone. Figure 5.3 graphs the thirty most abundant mollusc species from the sampled Kamgot deposits. These totals exclude shell that was recognised as being a post-mortem introduction. The three most abundant species, *Planaxis sulcatus*, *Neritina communis* and *Pythia scarabaeus* comprise 48.15% of the total sample of individuals. *Planaxis sulcatus* (Gastropoda: Planaxidae) and *Neritina communis* (Gastropoda: Neritidae) are both small species with average maximum lengths of about 1cm. *Pythia scarabaeus* is a fully terrestrial snail in the Ellobiidae. Despite this, it is commonly pictured in marine shell compendia (e.g. Abbot and Dance 1982) as, along with its cousin genera *Melampus* and *Cassidula*, it inhabits vegetation close to the shore. All three species are found high in the littoral zone, with *Neritina communis* aggregating around areas of freshwater seepage (Morton and Raj n.d.:13). Figure 5.4 shows the zones of occurrence for these three species. Kamgot is interpreted as a coastal village, though exactly how 'coastal' is presently unknown. I suggest here, on the basis of the shell evidence, that sections of the ancient Kamgot village actually straddled the supra-littoral area, meaning various of the excavated areas were very close to the ancient high-water mark indeed. A detailed spatial analysis of the distribution and density of these species across test-pits is currently underway.

In terms of the Kamgot 'midden' this means that nearly half the assemblage is not a product of cultural deposition. I hesitate to call such shells

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25 A more detailed consideration of *Pythia scarabaeus* follows in the analysis of the shell assemblage from Nenumbo (SE-RF-2).
‘intrusive’ as they lived and died naturally within the bounds of the site. Shell material derived from the middle and lower intertidal zones, as well as freshwater and silty sand species, appear more likely candidates for representing ‘midden’. Certainly, many *Turbo* spp. specimens exhibit the hole in the dorsal surface that I have linked with cultural meat extraction practices (see Chapter 4, section 4.5.3). Given the posited proximity of the site to the high-water mark, however, the mixing of midden shell with wave- and storm-deposited shell naturally occurring in back beach deposits is to be expected.

While these complicating factors make the discussion of cultural shell gathering practices (as they relate to subsistence) difficult, the pattern of species present in the Kamgot deposits still informs upon the nature of the surrounding mollusc-bearing environments. Figure 5.5 graphs the relative importance of mollusc-bearing niches represented in the Kamgot deposits. The supra-littoral component, composed largely of *Planaxis sulcatus*, *Neritina communis* and *Pythia scarabaeus* with a more minor input by members of the Littorinidae, has been discussed above. The hard reef-flat intertidal environment is well-represented. No particular, or group of species dominate the sample numerically. Rather, this category is very diversely composed including at least\(^{26}\) ninety-six different species. Inhabitants of coral sand environments also contribute appreciably to the total sample – both in terms of numbers and species diversity. Fifty-seven species are represented in this category, and together they make up 15% of the total shell assemblage. The silty-sand bivalves such as *Anadara antiqua* and *Gastrarium tumidum*, so common at many Lapita sites (e.g. see Szabó 2001), are a minor component at

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\(^{26}\) I have excluded genus level classifications (e.g. *Conus* spp. and *Cypraea* spp.) from this total, however these aggregate categories containing specimens unidentifiable at species level undoubtedly mask even greater species diversity within the Kamgot deposits.
Kamgot, suggesting that silty sand environments were not local, not favoured, or not fully developed.

5.2.3 The worked shell component

The full assemblage of analysed worked shell from Kamgot is presented in Appendix 2.1. It contains details of raw materials, descriptions, measurements and provenances. Also included are summary reference codes, indicating the working techniques isolated for each example. Codes have been assigned conservatively, and where there is uncertainty either a code has not been assigned or the specimen has been categorised as ‘unclear’ (U).

The keys to the codes are presented in Table 5.2. ‘Cut’ refers to the process of cutting or sawing where shell is reduced by repeated and focussed abrasive action in a to-and-fro motion. ‘Ground’ refers to the process of moving the shell back and forth against a static object, such as a grindstone, to create an evenly-abraded surface. This is contrasted with the term ‘abraded’, which I use to refer to that process whereby surfaces are smoothed or sculpted through freehand abrasion with an abrading tool such as a coral file. Indirect percussion/pressure flaking refers to an unknown process whereby shell surfaces are chipped into shape using a sharp point. ‘Drilled’ refers to perforations created through sustained rotary motion, whether created by a simple hand-drill or technologically more complex pump-drill or bow-drill. ‘Scratched’ refers to the process of abrading with a sharp point to remove shell in highly specific areas. I use the term ‘incised’ where the ‘scratching’ process is deeper and where a blunter or more obtuse abrading instrument is used. ‘Wedged and split’ refers to the process whereby a sharp point is inserted into a section of shell forcing splitting of the shell along natural lines of weakness.
'Natural' modification refers to modification by non-human action, whereas 'meat extraction' refers to cultural breakage associated with subsistence rather than artefact production.

The species isolated as showing evidence of having been worked are summarised in Table 5.3. Given the diversity of shell species present in the total shell assemblage at Kamgot, this range of twenty species can be considered fairly limited. The vast majority of shell-working is restricted to specimens of *Trochus niloticus*, *Turbo marmoratus*, *Conus* spp. and *Tridacna* spp. Only single examples are present for *Haliotis* cf. *diversicolor*, *Lambis truncata*, *Cypraea annulus*, *Cassis comuta*, *Spondylus* sp., *Ostreidae* sp. and *Nautilus pompilius*. *Tectus pyramis* is represented by two examples only. In the Conidae, working is largely restricted to *Conus litteratus* and *Conus leopardus*, with a minor input from *Conus eburneus* and *Conus virgo*. *Conus marmoreus*, *Conus* cf. *distans* and *Conus* cf. *stercusmuscarum* are all represented by single examples. The worked shell will be discussed in raw material groupings including the Trochidae, the Turbinidae, the Conidae, the Tridacninae, and an aggregate 'worked shell of other taxa' category.

5.2.3.1 The Trochidae

All the worked shell within the Trochidae, with the exception of two specimens, derives from the largest Indo-Pacific species *Trochus niloticus*. *Trochus niloticus* is a common hard-reef intertidal grazer with a natural range encompassing the western Pacific and western Micronesia (Palau). Its importance as a commercial species within the mother-of-pearl industry has seen it translocated to other areas of the Pacific in recent times. *Trochus niloticus*-bearing localities east of Palau in Micronesia and Fiji and Wallis in the central Pacific represent modern commercially driven introductions (Eldredge
1994b:45). The results of the total shell assemblage analysis demonstrate that *Trochus niloticus* was available in the Anir Islands, and probably within the local Kamgot environment itself. *Tectus pyramis* is also one of the larger trochids and would also have been available locally. The preference for *Trochus niloticus*, then, is a cultural choice and not a product of restrictions of environment or raw material availability.

It is likely that *Trochus niloticus* specimens were collected as a part of day-to-day subsistence-driven gathering. When the total shell assemblage is considered in conjunction with worked examples, it is apparent that there is no clear focus on large individuals. Indeed, the results of midden analysis demonstrate that juvenile specimens of *Trochus niloticus* feature more prominently than mature examples (refer to Figure 5.3). It is possible that specimens of a wide range of size classes of *Trochus niloticus* were collected when encountered on the reef, the animals eaten, and then larger shells used secondarily for working. In any event, there does not seem to have been a focussed effort on procuring large *Trochus niloticus* at the exclusion of smaller specimens, although working does seem restricted to larger, mature specimens. There is no evidence within the Kamgot *Trochus niloticus* assemblage that specimens were gathered post-mortem.

Within Lapita assemblages generally, the two dominant formal artefact types that utilise *Trochus niloticus* as a raw material are one-piece jabbing fishhooks and rings. On the whole, neither is particularly common within deposits. The Kamgot assemblage is exceptional with regards to fishhooks, with a number of examples at various stages of working. There is only a single example of a *Trochus niloticus* ring, but debitage argued to be related to ring production is present. There is one unique artefact interpreted as being a
possible tattooing chisel. It is singular in being the only such artefact in shell found thus far within a Lapita site, and in the manufacturing techniques employed.

Preforms for both rings and fishhooks are fashioned from the anterior part of the shell, though from different localities within this (contra Smith 1991:104). Fishhook blanks consist of a triangular portion of the ventral surface of the shell along with the anterior section of the body whorl. Ring preforms are created from the region at and near the suture line between the body and second whorl. These two areas are shown in Figure 5.6. Blank production for the two types is different, so I will discuss first the evidence for fishhook manufacture, and then that relating to ring production.

The very first stage of working as regards the production of fishhook blanks is unclear. There is evidence within the Kamgot assemblage that direct percussion was used to detach the aperture portion of the body whorl. The resulting detached fragment represents the area from which fishhook blanks derive. Examples of the shells reduced by direct percussion are shown in Figure 5.7. Figure 5.7a shows a Trochus niloticus that has received at least three blows to the suture between the body and second whorls causing part of the body whorl and ventral margin to come away. Figure 5.7b shows a Tectus pyramis that has likewise been reduced by direct percussion, as the scars around the ventral surface indicate. As discussed in Chapter 4 (section 4.5.3), direct percussion is also a technique employed for meat extraction, complicating interpretation of the initial stages of working.

While the evidence from whole/reduced shells suggests that direct percussion was a likely first step in the production of a blank, the fishhook blanks and preforms themselves seem to tell a different story. In the three
examples from Kamgot where the body whorl edge has not yet been ground there are small chips presents along this surface. An example of this can be seen in Figure 5.8a(4). This indicates that the edge has been fashioned by a sharp point – either through indirect percussion or pressure flaking. There are no ‘intermediate’ examples to suggest that this fine reduction was performed on a piece of shell detached through direct percussion, but neither do the whole, reduced shells show evidence of having been worked with a sharp point. Given this, examples of the first stage of breakage cannot be unequivocally provided. Only when there is evidence of shaping or grinding can a fragment be said to be related to fishhook production rather than meat extraction.

After a blank has been produced, grinding ensues. Both the ventral surface and the body whorl edge are ground. In examples where this phase was not completed, it is apparent that the ventral face was ground first, followed by the body whorl edge (see Figure 5.8a). When this grinding process had been completed, three sides of the shank were fashioned (see Figure 5.8b). After grinding, the inner edge of the shank as well as the bend and hook are shaped. In all cases this has been achieved through the controlled use of a sharp point, using either an indirect percussion or pressure flaking technique. Examples at various levels of completion of this phase can be seen in Figure 5.8b, and Figures 5.9a-c. Once the general outline has been formed, the inner surfaces of the hook are abraded as well as sharp corners (see Figure 5.9d which has been partially abraded and Figure 5.10a which has been fully abraded). There is only one example of abraded notches for line attachment in the Kamgot assemblage (see Figure 5.9d).

The discarded preforms present in the Kamgot assemblage demonstrate a structural weakness inherent in the design. All preforms, with the exception of
the example illustrated in Figure 5.9d, have broken in the bend area. The point — or 'would-be' point — area has either come away completely or is adherent only by a thin portion of shell (e.g. Figure 5.9c). The shank is the most robust part of the hook. While it is the thickest part of the hook, it also has the advantage of following the natural curve of the shell. This means that advantage is taken of the natural strength and structure of the shell. The same cannot be said of the bend area and point, which run in line with the natural growth lines of the shell and thus along planes of natural fracture. Johannes (1981:119), based on ethnographic observation in the Palau Islands, notes the propensity of jabbing fishhooks in shell to break at the bend. The bend was thus often reinforced with a triangular keel (Johannes 1981:119). It is interesting that despite this inherent weakness, such fishhooks have been produced in the Pacific for over 3000 years27.

There is only one example of a *Trochus niloticus* ring within the Kamgot assemblage. This is illustrated in Figure 5.10b. The sides have been ground and the outer and inner surfaces abraded. While there are no *Trochus niloticus* pieces that could be called 'blanks' or 'preforms' of rings, there are worked fragments from the areas of the shell from which these derive. They have been tentatively associated here with *Trochus niloticus* ring production. The blank for a *Trochus niloticus* ring follows the central and posterior circumference of the body whorl for the most part, but for the ring to connect, the second whorl must bridge to the body whorl at the aperture region (see Figure 5.6). Not only does the ring blank need to be chipped away from the spire and ventral surfaces of the shell, it also needs to be detached from the shell’s internal architecture.

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27 New data from Timor demonstrate that *Trochus niloticus* jabbing fishhooks were produced on near-identical plans over 9,000 years ago (O'Connor and Veth In press).
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This means that the blank is produced by working from both the outer and inner surfaces of the shell. Fragments displaying such working are evident in the Kamgot assemblage.

There are three fragments of the posterior margin of the body whorl, terminating at the suture, which show chipping along the body whorl edge. This may represent the detachment of part of the body whorl and ventral surface to create the lower edge of the ring. There are four fragments of the anterior portion of the second whorl that show chipping along the second whorl edge. This may represent the detachment of the posterior whorls of the shell to create the upper edge of the ring. Finally, there are seven fragments of whorl at the suture encompassing the ventral surface of the second whorl that show chipping of the internal shell architecture. This may represent the detachment of the external ring from the 'core'. For this latter working to be been effected, the spire of the shell must be been absent leaving the internal structure of the second whorl exposed. While these assignations are speculative, the worked fragments cited here appear unrelated to fishhook production. Nevertheless, the 'chipping' mentioned above is of the same nature as that seen for the fashioning of the inner section of the hook in fishhook production, as has been associated here with either indirect percussion or pressure flaking.

While chipping, grinding and abrading techniques, associated with both fishhook and ring manufacture, characterise nearly all of the identified worked fragments of *Trochus niloticus*, a unique artefact shows a unique technological approach. A small artefact, worked on all surfaces, has been tentatively identified as a tattooing chisel. The significance of this has been discussed in Szabó and Summerhayes (2002:95). Rather than 'what it is', my major concern here is how it is produced. The sides and faces have been ground to give a
distinctive tapering appearance, both in outline and profile. One central tooth has been fashioned on both faces. Under low magnification, it is evident that this was done using a sharp point in a 'scratching' manner. This technique has no parallels within any of the worked shell studied as part of this thesis.

Rejuvenation of *Trochus niloticus* artefacts was reported by Smith (1991:104) for samples from the Arawe Islands, however this was not observed within the Kamgot sample.

5.2.3.2 The Turbinidae

All worked turbinid shell derived from the species *Turbo marmoratus*, also known as the 'green snail'. This is the largest member of the Turbinidae and it is common, although patchily distributed, throughout most of the Indo-Pacific marine province. Along with *Trochus niloticus* it is presently a commercially harvested species used in the mother-of-pearl industry. Its natural range in the Pacific, including Papua New Guinea, the Solomon Islands and Vanuatu (but not New Caledonia) has been extended recently by deliberate translocations to the Tuamotu, Society, Cook and Gambier island groups in Polynesia (Eldredge 1994b:55). Its distribution within Island Southeast Asia is not clear from the literature, but specimens were noted on the Batanes Islands in the northern Philippines (personal observation). Local informants stated that they were not a new introduction and there was a long history of *Turbo marmoratus* exploitation on Batan Island both for the animal and the shell.

At Kamgot, the only formal artefact type present associated with *Turbo marmoratus* as a raw material is a one-piece rotating fishhook. Finished and broken examples (such as that illustrated in Figure 5.12d), as well as preforms, indicate that hooks were u-shaped in outline. Kirch and Yen (1982:238-9) describe a number of *Turbo marmoratus* rotating fishhooks, along with
associated manufacturing debris, recovered from sites on the Polynesian outlier island of Tikopia in the Solomon Islands. From the excavated material, they outline the probable methods involved in manufacture (Kirch and Yen 1982:239). A blank was prepared by "chipping and filing" which provided the external shape for the hook. The interior of the hook was then removed either by drilling the preform centre, or "filing a notch to begin separating shank from point" (Kirch and Yen 1982:239). It is suggested that files of Acropora branch coral were used for chipping and filing, whereas the spines of the slate-pencil sea urchin Heterocentrotus mammillatus were used as abraders for final finishing (Kirch and Yen 1982:239).

Methods of manufacture at the earlier site of Kamgot illustrate a somewhat different approach. As with Trochus niloticus, it is unclear whether the first stage of reduction involved direct percussion. There is one example of a large Turbo marmoratus that shows clear evidence of having been reduced by a series of blows to the body whorl, starting at the aperture and moving back around the body of the shell. Most of the body whorl has been removed and the columella snapped. The pattern of the fractured edge indicates that at least eight separate fragments of body came away. These fragments represent the part of the shell from which blanks are created (see Figure 5.11). This breakage is excessive for meat extraction, and is presumably related to working.

Again, as with Trochus niloticus, the worked fragments and blanks tell a different story. Of thirty-three pieces of Turbo marmoratus that have been identified as worked, twenty-one are cut fragments. Only one of these fragments shows evidence of cutting on all edges with the other examples being a mix of cut, chipped and snapped edges. While most of the cut edges are
straight, there are four semi-circular fragments were the curved edge has been cut. Exactly how these forms were produced, and with what tools, remains unclear. Where the initiation surface of cutting can be determined, it is invariably the inner surface of the shell. This means that the shell would have to have been broken for cutting to take place and lends some support to an initial direct percussion stage in manufacture. Two examples of fragments with cut edges are illustrated in Figure 5.12a and 5.12b.

While cutting of *Turbo marmoratus* was not reported for the Tikopian sites (Kirch and Yen 1982:239), the “chipping and filing” of blanks and preforms characteristic of those assemblages is also in evidence at Kamgot. Four of the cut fragments also have chipped edges, while an additional three fragments are chipped with no evidence of cutting. The chipped notches created to separate the shank from the point in the creation of the form of the inner hook (see Kirch and Yen 1982:239) are also seen at Kamgot. One of two such pieces, which had apparently broken during manufacture, is illustrated in Figure 5.12a. In both specimens, the notch has not progressed far enough for the inner form to be apparent. The broken preform illustrated in Figure 5.12c, however, demonstrates the chipping of the inner surface as well as showing evidence of cutting at the bend region of the hook.

From the Kamgot evidence, a *chaîne opératoire* for the manufacture of *Turbo marmoratus* rotating fishhooks can be constructed. The whole shell was initially reduced using a direct percussion method with blows administered to the posterior surface of the body whorl. This generated medium- to large-sized fragments from the body of the shell. These fragments were then fashioned into blanks, primarily through cutting from the inner/nacreous surface of the shell, though chipping with a sharp point was also employed on occasion. The
interior of the hook was formed through the creation of a notch at one edge that was progressively chipped back to create the general hook form. Inner and outer edges of the hook were then abraded to smooth the edges. Unlike the evidence from Tikopia (Kirch and Yen 1982:239), drilling is not utilised in the removal of the interior of the hook, and cutting is used to fashion the blank.

The Kamgot evidence presents no obvious examples of either curation of finished artefacts or reuse of debitage.

5.2.3.3 The Conidae

The vast majority of worked shell from Kamgot is manufactured from species within the Conidae. Members of the Conidae in general are supported by two major littoral niches – hard reef-flat and clean sandy areas often with seagrass. As can be seen from Table 5.3, seven different species were identified as having been used for working. From the information provided by the general shell assemblage (see Figure 5.5), it is evident that the reef-flat and coral sand dwelling conid species selected for working were likely to have been available in the local environment. Very few of the Conidae are diurnal, most being either nocturnal or crepuscular (active at twilight and dawn) (Fiene-Severns, Severns and Dyerly 1998:44). This means that during the day, conids are less accessible to human gatherers, being either buried in the sand or hidden among rocks. This does not, however, mean that specimens were necessarily collected at night; many of the Cypraecidae and Neritidae are likewise nocturnal, and commonly found in midden deposits.

As to whether species utilised for artefact manufacture were collected as part of day-to-day subsistence is presently inconclusive. The data are, however, suggestive. Of specimens indicating working that could be identified to species, Conus litteratus and Conus leopardus are clearly dominant,
composing 26% of the overall Conus assemblage, and 86.6% of the Conus specimens that were identifiable to species (see Figure 5.13). C. leopardus and C. litteratus are among the largest species of Conus found within the Indo-Pacific biogeographic region, and are most commonly found in clean sandy areas, where they prey largely on worms (vermetids) (Hook 1999:109; Morton and Raj n.d.:149). Similar patterning means that they are easily confused. Both are patterned with concentric rows of black spots on a white background, however Conus litteratus has a purple-stained and more pointed anterior (Abbot and Dance 1982:249 see also Appendix 1). Confusion arises between the two species when the anterior portion of the shell is not present. Thus, I have separated the two species where possible and where the anterior portion was not present I have amalgamated the two into the category Conus litteratus/Conus leopardus.

While these species are certainly not uncommon, both their large size and status as high-order predators means that densities within a given environmental patch tend to be low. In short, they appear over-represented in relation to the other Conus species, dozens of which inhabit Indo-Pacific reefs. This suggests that these species were deliberately targeted for collection with a view to artefact production, and do not simply represent the parsimonious re-use of midden shell. This does not mean, however, that collected Conus were not eaten.

The issue of Conus consumption is complex. All conids are venomous. They are active predators that spear prey with a small ‘harpoon’ located at the end of a proboscis, and inject an immobilising toxin. Some species are more toxic than others, with toxicity broadly being related to prey choice. Thus, conids that prey on worms (vermetivores) are the least toxic, while fish-eating
(piscivorous) conids are the most toxic. Molluscivorous conids occupy an intermediate position\textsuperscript{28}. The toxins present in piscivorous conids are well-known to affect humans, with human fatalities resulting from envenomation by Indo-Pacific species such as \textit{Conus striatus} and \textit{Conus geographicus}. That Pacific Islanders were aware of the dangers is attested to in a number of historical accounts (e.g. Burrows 1940; Titcomb 1978:347). If only the fleshy foot of the animal was consumed, with the venom sack and spearing apparatus discarded, there should be no harmful effects (Bruce Livett, pers. comm.). At Kamgot there is no evidence, such as the presence of encrusting organisms within the shells or surface modification indicating water-rolling, to suggest that \textit{Conus} specimens were collected post-mortem. Whether the animals were eaten or not, however, remains an open question.

Formal Lapita artefact types associated with \textit{Conus} as a raw material include rings, ‘rectangular’ or ‘broad’ units, adzes and beads. All of these types are present in the Kamgot assemblage. I will discuss the production of each of these artefact types in turn, including issues of variability and where chaîne opératoire are seen to overlap or combine.

\textit{Conus} rings, or ‘armbands’ of much of the Lapita literature, are produced from the shoulder and posterior body whorl area of the shell. This area is highlighted in Figure 5.14. The first step in ring production is invariably the separation of the spire, shoulder and posterior body whorl from the anterior and main body sections. Both discarded bodies and body fragments as well as many detached spires indicate that this was achieved by administering a series of direct percussive blows to the body of the shell. The first blow was delivered

\textsuperscript{28} There have, however, been reported human fatalities from envenomation by the molluscivorous \textit{Conus textile} (McIntosh and Jones 2001). \textit{Conus marmoreus}, another molluscivore, is also well known to be highly toxic (De Bruyne 2003:206).
near the aperture with successive blows moving back, anticlockwise, around the body whorl.

This procedure results in debitage of three major sorts. Firstly, and most conspicuously, are complete or near-complete Conus bodies such as that illustrated in Figure 5.15a. There are fifteen such examples within the Kamgot Conus sample, six of which are from Conus leopardus, four Conus litteratus, and five are only identifiable to genus (Conus sp.). Where these specimens do not include the entire circumference of the body whorl, it is the lip/aperture area that has most frequently come away from the main body of the shell. The specimen illustrated in 5.15a can be seen to be missing the lip and part of the aperture region. Figures 5.15b and c, along with Figure 5.16a illustrate detached lip and aperture sections. These long aperture and lip sections are frequently labelled as 'knives' within Pacific and Island Southeast Asian assemblages (e.g. Ronquillo, Santiago, Asato and Tanaka 1993:6 and personal observation). While the use of these pieces as knives cannot be discounted, the lip area is naturally sharp. Thus, this feature does not represent human modification.

What is evident from the analysis of near-complete Conus bodies detached by percussion is that many smaller fragments of body typically come away during the reduction process. While some have small zones of crushing indicating a point of percussive impact (see the location of the bold arrows in Figure 5.15c and Figure 5.16a and b), many fragments appear to detach as spalls. As such, they display no features that suggest they are the result of purposive working. Such non-diagnostic body fragments have been included in Appendix 2.1, where they have been given the working code ‘unclear’ (U). Despite this, fragments such as those shown in Figure 5.16 c and d are taken
here to be associated with *Conus* working. That such fragments, where identifiable to species, derive predominantly from *Conus litteratus* or *Conus leopardus* is seen as support for this conclusion.

Shell microstructure can be seen to have a considerable effect upon the nature of breakage and the morphology of fragments generated as part of the percussive reduction process. The vast majority of fragments are longer on the anterior/posterior axis than on the perpendicular axis. In most cases, the long edges have followed the natural growth lines of the shell. This breakage is in line with that described as a defensive measure against shell breaking/crushing predators (see Chapter 4 section 4.3.3 The Conidae). In relation to fracturing through rather than across the shell, most fragments show evidence of fractures having broken directly through first-order lamellae. This creates a rough-textured edge such as that seen in Figure 5.15b and 5.16a. Occasionally, however, fractures have travelled in line with the first-order lamellae of the major, central shell layer creating a smooth and sloping edge. Fractures that travel with, rather than through, first-order lamellae frequently change direction upon reaching the innermost layer of shell where the first-order lamellae are differently oriented. At this point, the fracture runs across the top of the inner lamellar layer, leaving a thin flap of shell adhering to the side of the fragment. Such fracture patterns can be seen in Figure 5.15c and 5.16b. This type of fracture invariably occurs next to or at the initiation point of percussion.

Given that fractures most commonly travel on an anterior/posterior axis, there is a risk that, rather than travelling up the shell to the anterior, a fracture will travel into the posterior shoulder/spire area, thereby rendering the shell useless for ring production. Within the Kamgot sample, it is notable that evidence of ‘reduction gone wrong’, where parts of the spire and/or shoulder

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have come away, is largely restricted to species of *Conus* other than *Conus litteratus* and *Conus leopardus*. There is only one example of a *Conus litteratus/Conus leopardus* fragment showing breakage into the shoulder/spire area. Otherwise included in this category of detrimental breakage are two specimens of *Conus ebumeus* (see Figure 5.16e), one *Conus cf. stercusmuscarum*, one *Conus virgo*, and the single *Conus cf. distans*. All of these species, with the exception of *Conus virgo*, are considerably smaller than *Conus litteratus* or *Conus leopardus*. The *Conus virgo* represented here is a particularly small example. Although there are a number of possible explanations for this pattern, I consider two as being the most likely. Firstly, the smaller specimens may represent breakage for meat extraction. All of the specimens are too thick for crab damage to be likely. Secondly, reduction was attempted, but blows that would have effectively reduced a large *Conus litteratus* or *Conus leopardus* were too forceful and/or not precisely targeted enough for these smaller shells. This has resulted in more extensive damage than is usual. Neither of these explanations can be favoured at present, due to uncertainty regarding the status of conids within general subsistence on one hand, and uncertainties regarding the nature and variability of fracture patterns in genus *Conus*.

Where spires are successfully detached from shell bodies, grinding ensues. Fragments of ground spire indicate that the spire was ground flat on a single facet – probably against a grinding stone. The rough body whorl edge, where the body was detached from the spire, is also ground so that the surface is smooth and even. After this has been done, the inner whorls of the spire are removed. This is done by chipping at the natural suture lines in between the whorls with a sharp point. This stage is shown clearly in Figure 5.17d. Internal
whorl fragments are common in the Kamgot worked *Conus* sample, with twenty-five examples. Breakage has occurred most often along natural suture lines, and either one or two whorls are represented in each fragment. Two examples are illustrated in Figure 5.17a and c. The only example containing the apex of the spire is illustrated in Figure 5.17b.

After the creation of the preform through the chipping out of the inner whorls, abrasion follows to smooth the inner surface of the ring. Sharp corners are also rounded at this point and then different ring cross-sections take form. They are strongly influenced, if not governed, by the degree of abrasion, angle of abrasion, and the width of the ring (cross-sections shown schematically in Figure 5.18). For example, neither a domed plano-convex nor a square cross-section can be produced from a wide *Conus* ring, as there is simply not enough shell present to allow this. The level of abrasion of the corners of the outer surface is the major variable in controlling whether a narrow ring will have a square (less abrasion) or domed plano-convex (more abrasion) cross-section. The inner surface is both the last surface to be abraded, and the surface that receives the most variable amounts of abrasion. In many specimens, the only abrasion is to remove the rough edge left by removal of the inner whorls. Thus, only a narrow patch of the edge closest to the spire is abraded. In other cases, the inner surface is extensively ground with the corners also being abraded. Such extensive abrasion of the inner surface of the ring generally results in an elliptical cross-section. Whether different cross-sections are deliberately worked towards from the beginning of the production process, or whether outcomes vary depending on the particular shell being worked and the particular intentions and/or gestures of the person working them, remains unknown.
A selection of *Conus* spp. ring fragments from Kamgot is shown in Figures 5.19b-d and 5.20a-d. The specimen illustrated in Figure 5.19a has been ground and the inner surface chipped into shape, but it has not yet been abraded. The two grooved ring fragments, illustrated in Figure 5.20c and d, are the only specimens where the external surface has been modified with a design element. It is unclear whether the grooves were abraded before or after abrasion of the inner surface.

Variability in ring width has been mentioned above in relation to cross-section. It has, however, also enjoyed typological status ever since Poulsen’s (1967) original division of *Conus* rings into narrow and broad forms. Figure 5.14 shows the parts of the shell incorporated into each type. During analysis, it became clear that there was a number of ‘intermediate’ sizes which complicated any simple division into ‘broad’ and ‘narrow’ forms. In order to see whether there were indeed two distinct width classes of *Conus* ring, the widths of all ring fragments were recorded and graphed. The same has been done for all sites where *Conus* spp. rings are present, and the results are compared in Chapter 8. The results from Kamgot are presented in Figure 5.21. Also measured and graphed were estimated internal diameters of rings. As pointed out by Kirch and Green (2001:188) many examples of what have been termed ‘bracelets’ or ‘armbands’ would not have fitted an adult arm, and a wide range of ring sizes is evident. In order to assess the variability of ring sizes, internal diameters have been estimated wherever possible for all samples in which *Conus* spp. rings are present. These have been graphed and the results are compared in Chapter 8. The results for Kamgot are presented in Figure 5.22.

There is one highly deteriorated example of a ‘rectangular’ or ‘broad’ unit within the Kamgot worked shell assemblage (see Figure 5.23a). I have
previously argued (Szabó and Summerhayes 2002:96; see also Poulsen 1967:256) that these perforated units represent broken and curated fragments of broad *Conus* rings. While Poulsen (1967:257) suggests that the low frequency of broad rings within sites generally is due to their being “less popular” than narrow rings, I offer a different interpretation here based on foregoing discussions of *Conus* spp. microstructure and the primary reduction method for ring manufacture (i.e. direct percussion). Creating the blank for a broad ring can be seen to be much more difficult than creating a blank for a narrow ring. This is due to the risk, and incidence, of fractures travelling along natural lines towards the posterior of the shell. There is a better chance of success if one cuts the shell transversely to separate the anterior and posterior portions, and indeed this technique is seen at other sites and will be discussed further below. Cutting is, however, more labour-intensive. It is also not a common technique employed on *Conus* at Kamgot, being evidenced by only two specimens.

In short, broader rings are more difficult to produce than their narrower counterparts. I suggest that both the labour involved and the high chance of failure meant that broader rings were more valuable rather than less popular. That they would be curated when broken – either before or after they were finished – follows if they were prized or valued. No curation of narrow ring forms was noted within the Kamgot worked shell sample, or indeed within any of the other Lapita worked shell samples. The single example of a curated broad ring fragment at Kamgot is well worn on all surfaces. Two of the perforations have broken, and one of these is very worn indicating that use continued after breakage.
Conus spp. ‘adzes’ or ‘gouges’ have received little attention within the Lapita material culture literature, despite a long history of recognition (see Poul sen 1967:235-6). I use the term ‘adze’ here as a convenient referent rather than as a statement regarding function. Six examples are present within the Kamgot worked shell assemblage, all following a clear design plan. They are manufactured from a triangular section of the anterior part of the body whorl of a large Conus shell, where the extreme anterior of the shell forms the poll end. The species could only be identified for two specimens, and in both cases it was Conus litteratus/ Conus leopardus.

The edges of the artefacts make it clear that the preform was generated through direct percussion rather than cutting. In only one example (illustrated in Figure 5.23c) were the sides of the artefact ground. On all others they remain rough. The bevel is ground on a single facet from the interior of the shell, with only one example also showing evidence of minimal grinding on the external shell surface. The specimen illustrated in Figure 5.23b has a particularly low bevel angle (c. 15°), which, given the morphology of the adze, translates to a much larger bevel area. The bevel angle of other specimens is estimated at about 20°. Given the area of the shell from which the adze is produced, and the species of manufacture where identifiable, I suggest that Conus spp. adzes may have been fashioned from the debitage created by Conus spp. ring manufacture. Triangular pieces of body whorl incorporating the extreme anterior of the shell, such as those illustrated in Figures 5.15 and 5.16, are common throughout the Kamgot deposits, and would have provided ‘ready-made’ blanks.

Ground and perforated Conus spp. spires are present in two size classes in the Kamgot worked shell assemblage, with the smaller falling into the general
category of 'beads'. The larger size class is represented by two examples (see Figure 5.24a and i), though neither is particularly large with maximum diameters of 23.76mm and 17.00mm respectively. Both specimens are ground on both faces with a central perforation having been chipped out with a sharp point. The example illustrated in Figure 5.24i has a second perforation near the aperture area, and this has been drilled.

Within the 'bead' sample (n=11), there is a good deal of variety in terms of finishing, but the general manufacturing process is the same. The preform consists of the spire of a small Conus sp. shell. That the whole spire is used, rather than the centre of the spire of a larger shell, is evident from the general morphology and presence of the aperture area in most specimens. How the spire was separated from the shell is unclear, but the condition of the beads suggests that broken and beach-rolled specimens were not utilised. Both faces of the spire are ground, though there is great variance in degree of grinding, with some retaining the naturally-elevated spire morphology (e.g. Figure 5.24g) and others being ground flat (e.g. Figure 5.24d). In most cases, perforations were observed to have been chipped out along natural whorl suture lines. In three cases, the central perforation appeared to have been drilled from the outer face of the spire. This was indicated by a smooth inner surface and perimeter, as well as a slight bevel around the edge of the hole. This pattern could, however, represent abrasive wear of a chipped hole. The outer perimeter of the bead has been purposively abraded on five examples. With respect to manufacture, Conus spp. beads are generated in the same general manner as Conus spp. rings.
5.2.3.4 The Tridacninae

The Kamgot worked shell assemblage contains limited evidence for working of the 'giant clams' of the Tridacninae. Most formal artefacts are either restricted to the upper two spits of the site or are surface finds. Surface finds have not been included here. Members of genus *Tridacna* are clear-water reef-dwellers. While some species burrow into the reef itself (e.g. *Tridacna crocea*) others are more easily accessible to human collectors. This includes the three species represented in the Kamgot worked shell assemblage; *Tridacna maxima*, *Tridacna gigas* and *Tridacna squamosa*. All three, along with *Tridacna crocea*, are present on Ambitle and Babase Islands today, and results of the midden analysis indicate that environments capable of supporting these species would have been locally present at the time of occupation.

*Tridacna maxima* is the most common and widespread species of giant clam (Rosewater 1965:385). Its elongate and often irregular shape is a product of its ecology. *Tridacna maxima* partially embed themselves in coral reefs and are attached with strong byssal threads. The matrix constrains growth in directions that vary from individual to individual. This reef-burying, however, is never to the same extent as *Tridacna crocea* (Rosewater 1965:386; Lucas 1988:25). As the shell grows, the valves will often outgrow the coral matrix making them more visible and accessible to human collectors (Thomas 2001:89). Ethnographic reports of *Tridacna maxima* exploitation in relation to subsistence (e.g. Thomas 2001:89; Koch 1986 [German original 1965]:7) note that the shell is often left in position, with the animal being literally cut out of the shell by severing the adductor muscle. This tendency, were it the case in prehistory, would certainly skew our picture of the subsistence importance of these molluscs.
*Tridacna gigas* is the largest tridacnid, and indeed, the largest living bivalve. Rather than living on or in the reef, *Tridacna gigas* lived unattached on sandy lagoon bottoms. Its location means that it cannot be gathered during regular reef gleaning. Instead, diving from a canoe is reported ethnographically (Thomas 2001:89; Koch 1986 [German original 1965]:7). Ethnographic accounts of *Tridacna gigas* exploitation state that, as with *Tridacna maxima*, the animal is cut out of the shell in situ (Thomas 2001:89; Koch 1986 [German original 1965]:7). After the removal of the animal, the shell can either be left in place or transported back to shore (Thomas 2001:89). In cases where it is transported, the size is such that a medium-sized canoe can only transport one entire shell and animal at a time (as observed by Koch 1986 [German original 1965]:7). The practice of relocating young *Tridacna gigas* to more accessible locations or personal 'lagoon gardens', and waiting for them to reach a size considered suitable for consumption, has been reported at a number of Pacific Island locations (Moir 1990; Thomas 2001:89 and references therein)\(^\text{29}\). In relation to its use as a raw material for artefact manufacture, the 'pre-treatment' or 'seasoning' of *Tridacna gigas* valves, by leaving them in saltwater for up to a generation, has been reported by Moir (1990). The resulting isomorphic recrystallization of the shell has been discussed in Chapter 4 (section 4.4.2).

*Tridacna squamosa* is rarely mentioned in ethnographic accounts, but recovery of the remains of this species in sites is not uncommon (Szabó unpublished data). Both adult and juvenile examples occur in the Kamgot total shell assemblage. *Tridacna squamosa* is found on the surface of protected

\(^{29}\) Such a practice was witnessed on Ambitle Island while conducting fieldwork at the Kamgot site. Some of the shells pictured in Appendix I derive from this 'garden', which belongs to Paul Nebil.
reefs attached to the substrate by weak but copious byssal threads (Rosewater 1965:380-1).

What is clear from the ethnographic portrayals of Tridacna spp. gathering is that the large and heavy shells were often left in situ. The awkwardness of transportation suggests that when the shell was brought back to the site, this was done for a reason. This does not automatically mean, however, that they were transported back to the site with a view to artefact production. Again, looking to ethnographic work, Tridacna spp. valves were used for a number of purposes, many of which required no modification of the shell. Such uses included containers for cooking and storage, feeding troughs for animals, mortars, and as part of decorative or ritual features (Koch 1986 [German original 1965]:7; Thomas 2001:90). Rather than seeking to interpret patterns of Tridacna spp. use in Lapita sites using ethnographic evidence, I have drawn on the ethnographic material here to illustrate both logistical factors resulting from the ecology and size of the shells, and the variety of uses to which such shells could be put. The complexity of modern Tridacna exploitation and use certainly indicates that we must be cautious in our interpretation of Tridacna spp. remains recovered from archaeological sites.

This caution should extend to interpreting patterns of Tridacna spp. working. Tridacna shell has the capacity to fracture conchoidally, and this feature has sometimes set archaeologists on a course of searching for Hertzian initiations and other 'lithic--esque' features within samples (e.g. Smith 1991:48-78; Cleghorn 1977). While classic 'flake features' may very well be present in a given worked Tridacna spp. sample, this does not mean that 'flaking' was the major, or only, way of reducing valves and blocks of shell. When reducing massive Tridacna spp. valves to produce preforms for adzes and other tools,
the use of fire is occasionally mentioned. As outlined in Chapter 4 (section 4.4.2) fire can fracture *Tridacna* spp. valves into rough blocky pieces (Spennemann and Colley 1989:53). Such pieces frequently have very sharp edges (personal observation). While fire-fracturing of *Tridacna* spp. valves could occur incidentally on-site, with, for example, fires being lit on midden deposits, ethnographic accounts from Polynesia indicate that fire was used as a deliberate strategy for the creation of preforms from *Tridacna* spp. valves. In relation to the production of adze preforms, Emory (1975:109) reports that a *Tridacna* spp. valve was buried on edge in the sand, and then the protruding edge was exposed to fire. This part of the shell could then be knocked away easily with a hammerstone. Emory (1975:20) describes a similar process for the manufacture of ‘food pounders’, where a large *Tridacna* spp. valve was reduced by fire separating the thick hinge area. This hinge section was then further reduced by wrapping either end of the piece in *Pandanus* leaves and subjecting the middle portion to fire on all sides, which resulted in bulbar ends used for pounding.

The use of fire for the primary reduction of shell is restricted neither to *Tridacna* spp. nor to Polynesia. Sillitoe (1988:382) reports fire as a primary reduction technique in the manufacture of ‘kina’, or crescentic artefacts of the gold-lipped pearl oyster *Pinctada maxima*, in the Wola region of the New Guinea highlands. The outer periostracum and any encrustations are scraped and/or ground off, and then hot embers are used to ‘burn out’ the centre of the valve producing the crescent shape (Sillitoe 1988:382). A ridge of clay is moulded and applied to the surface of the shell to delimit the preform edge. The rest of the valve is then buried in a bank of earth while embers are piled on the protruding section of the valve and are aerated (Sillitoe 1988:382). The soft
flakes resulting from fire exposure could then be knocked gently away. Only a limited amount of shell was exposed to fire for risk of damaging any of the shell that would constitute the final artefact. The preform was secondarily fashioned through a process of grinding and abrasion (Sillitoe 1988:382).

Recorded techniques such as those just outlined present complications for the interpretation of archaeological *Tridacna* spp. remains recovered from sites. It is unclear what the signature of reduction by fire would be, and how one could separate this from shell exposed to fire when this is not related to working. Most *Tridacna* spp. pieces identified within the total shell assemblage from Kamgot show no evidence of having been ‘flaked’ in a traditional sense, but yet could still be related to shell working. There are a number of ‘flake-like’ pieces, but they have no features diagnostic of Hertzian initiation such as a bulb of percussion. As pointed out by Smith (1991:64), other initiation types, such as bending\(^{30}\) and wedging, do not leave the characteristic and diagnostic traces left by Hertzian initiation, and thus their possible application in the working of *Tridacna* spp. cannot be ruled out. As also pointed out by Smith (1991:60) and Moir (1990:334), *Tridacna* spp. valves appear to flake more easily when the cleavage was parallel to the first-order lamellae.

Identification of ‘worked’ *Tridacna* spp. here is conservative. It is entirely possible (or indeed probable), that many of the ‘flake-like’ pieces recovered from excavations at Kamgot are associated with *Tridacna* spp. working. Despite the fact that more experimental work has been conducted on *Tridacna* spp. than on any other Indo-Pacific shell (Moir 1990; Smith 1991; Cleghorn 1977), it is clear that fracture patterns and working methods are still far from

\(^{30}\) In fact, flakes with bending initiations have been identified within the Golo Cave worked shell sample and are further discussed in Chapter 6. It is notable however, that the raw material in that instance was the operculum of the green snail *Turbo marmoratus*, which is microstructurally different to the crossed-lamellar tridacnids.
understood. This is a feature not only of the complexity of the shell structure, but also of the variety of breakage patterns, the limited size of samples from any given site, and taphonomic condition. In this, Kamgot is no exception. The sample is simply not large enough for any potential patterning in valve breakage and fracture to be apparent. The difficulty in accurately separating ‘midden’ shell from ‘worked’ shell in this instance, also makes it difficult to comment upon whether _Tridacna_ spp. were collected for subsistence purposes. This is compounded by the likelihood that only the flesh was brought back to the site, thereby leaving no archaeological trace. There is no evidence, however, that _Tridacna_ spp. valves were brought to the site post-mortem.

There are two formal artefact types produced from _Tridacna_ spp. shell present within the Kamgot worked shell assemblage; adzes and rings. As mentioned above, the majority were surface finds and have not been included here, barring one fully-ground adze manufactured from the hinge region of the shell, regarded as typologically associated with Lapita. Of those that remain, no formal _Tridacna_ spp. artefacts were found below spit 3 (at a depth of 30cm), with no adzes being found deeper than spit 2. Three adzes were recovered from Kamgot deposits, one of which was made of _Tridacna maxima_ and the two others of an unidentified species of _Tridacna_. The fully-ground hinge-section adze is also of an unidentified species of _Tridacna_. The adzes are illustrated in Figures 5.25 and 5.26. Of the three adzes manufactured from the body of the valve, two specimens are heavily eroded with the outer surfaces being powdery and crumbly (Figure 5.25a and b). Both are triangular in outline and have a long, thin cross-section. The outer surface of the shell constitutes the dorsal face of the adze, with the bevel being ground from this side only. Both specimens are too eroded to estimate percentage of grinding of the dorsal
surface, however remnants of shell sculpture indicate that neither was fully
ground. Adzes of this description are associated with Lapita as well as post-
Lapita sites, and as such, are not chronologically diagnostic.

The two remaining specimens, illustrated in Figure 5.26, are distinctive in
terms of morphology and manufacture. Although a surface specimen, adzes of
the type illustrated in Figure 5.26a are chronologically associated with Lapita
(Green 1991:300). The outer surface of the shell constitutes the dorsal surface
of the adze, while the hinge surface forms the ventral surface. Part of the
lateral tooth of the valve remains, indicating positioning on the shell. The bevel
has been ground on a single facet from the ventral/hinge surface, and the
cutting edge is slightly curved. The poll end has broken away. The adze has a
plano-convex cross-section. These features, combined, place it in Kirch and
Yen’s ‘Type 6’ category (1982:222). Given that the adze is fully ground, the
surfaces offer little insight into production techniques.

The adze illustrated in Figure 5.26b falls into Kirch and Yen’s (1982:222)
‘type 4’ category in many respects, but it is very robust for an adze
manufactured from the main body of the valve. The outer/dorsal surface has
been fully abraded with gently sloping sides. This gives it a rather compressed
plano-convex cross-section. The inner/ventral surface has been ground flat,
with the bevel having been ground on a single facet from this face. The poll end
is rounder in outline that the ‘type 4’ adzes shown in Figure 5.25. It is possible
that it falls within the parameters of Kirch and Yen’s ‘type 6’ (Kirch and Yen
1982:222), though it is more likely that it falls between types 4 and 6. As with
the previous example, the degree of grinding and finishing make production
processes difficult to comment upon.
Two types of *Tridacna* spp. ring are present within the Kamgot deposits; a massive broad form, and a delicate grooved form. The first type is represented by two examples, however one is a surface find. The other is illustrated in Figure 5.27a. The cross-section is hexagonal, with both sides of the ring having been ground flat and the inner and outer surfaces having been abraded on two sloping facets meeting at a soft point in the centre. As with the *Tridacna* spp. adzes, the grinding and abrading processes have erased traces of earlier working. It is thus unclear how the preform was shaped, and how the central core was removed. The second type of ring is illustrated in Figure 5.27b. As with some of the *Conus* spp. rings discussed above, a groove has been abraded around the centre of the outer surface. The sides have been ground flat and the inner surface well abraded. As with the above example, the grinding and abrading of the artefact have removed clues as to how the preform was shaped and the central core removed.

Of the remaining worked pieces identified within the Kamgot shell assemblage, two have been abraded, while seven present evidence of percussive techniques. The first of the abraded pieces is clearly part of a larger artefact. Both faces have been partially ground. On one face a semi-circular projection has been fashioned and abraded smooth, while on the other face a circular depression has been formed through abrasion. It is manufactured from an unidentified species of *Tridacna*. The second piece has been abraded rather than ground, with the natural contours of the body of the valve still being evident. The edge has been smoothed and rounded by abrasion.

The remaining worked pieces all show signs of having been flaked — though none extensively. The hinge of a *Tridacna gigas* exhibits flake scars near the lateral tooth that have been created through direct percussion to the
inner surface of the shell, while two flake scars at the umbo demonstrate working from the outer surface. A smaller fragment of an unidentified species from the same portion of the hinge displays similar evidence, suggesting a pattern of *Tridacna* working. A further four fragments show signs of flaking on the main body of the shell, with blows being delivered to both the inner and outer surfaces of the valve. Included in this category is a fragment of *Tridacna gigas*, two of *Tridacna squamosa* and one of an unidentified species of *Tridacna*. The final worked piece is the only unequivocal ‘flake’ in the assemblage. The initiation point is evidenced by crushing, but a bending initiation means there is no bulb of percussion. The inner surface of the shell is directly opposite the initiation point, and the line between these two features is the narrowest section of the flake. The force created by the blow has apparently changed direction upon reaching the shell interior, and dissipated at right angles back into the shell creating a ‘plunging flake’ with a feather termination. This pattern is likely to be a function of force applied, but the resulting flake morphology will be dependent upon both the microstructure and the gross morphology of the shell.

5.2.3.5 Worked shell of other taxa

Worked shell identified as being produced from taxa other than those mentioned above includes seven examples deriving from seven different families. Five of these are illustrated in Figure 5.28.

The first is a ground and perforated disc of *Spondylus* sp. or ‘thorny oyster’ (Figure 5.28a). The edges have been abraded, so it cannot be discerned whether the preform was chipped or cut. Both surfaces have been ground, and the central perforation has been drilled from one face only. The wide bevel around the hole indicated that the drill point tapered sharply.
The second specimen (Figure 5.28b) is a reduced and ground *Cyprea annulus* or 'gold-ringed cowrie'. The dorsum has been removed, but subsequent grinding has obscured how this was achieved.

The third specimen is a large, hewn and perforated disc (Figure 5.28c). The lack of diagnostic features makes identification to species difficult, but it has tentatively been identified as *Ostrea* sp. (oyster) based on the foliate microstructure and general texture of the shell. A worn adductor muscle scar on the inner face makes it clear that the raw material was a bivalve. This specimen was previously identified as having been made from *Hyotissa hyotis* (also in the Ostreidae) by Szabó and Summerhayes (2002:96-7), but this is now considered unlikely on structural grounds. The preform has been hewn out of a large, flat valve. Although the edges have been partially abraded, they are still quite irregular. The internal perforation has likewise been hewn. There is no evidence of grinding.

The fourth specimen is a small ground and perforated piece. Based on texture, microstructure and coloration, the raw material has been identified as *Cassis cornuta*. It is triangular in profile with the two longer sides having been ground. A small perforation has been drilled at one end. Drilling has proceeded from both sides, and there are bevels on each side indicating the use of a tapering drill point.

The fifth specimen is a worked fragment of the small abalone *Haliothis diversicolor*. The flat, narrow ventral surface of the shell near the spire has been roughly chipped away from the rounded dorsal surface. This edge is somewhat irregular and has been smoothed either through wear or light abrasion. The outer surface of the shell has been abraded smooth.
The sixth specimen is a reduced *Lambis truncata*. Only the anterior portion of the body is present. The shell has been reduced by direct percussion in the same manner as *Conus* spp. specimens in the course of ring manufacture.

The final specimen is a small, cut fragment of a *Nautilus* sp. shell. The piece is from one of the inner septa, rather than the main body of the shell. In the centre is the natural septal hole for the siphon of the animal. Four edges have been cut.

### 5.2.4 Summary of results

Shell-working practices at Kamgot are diverse and evidence of shell artefact production is ubiquitous. *Conus* spp. working dominates the worked shell assemblage with rings, adzes and beads being the major formal artefact types produced. A detailed investigation of all *Conus* spp. fragments has allowed the description of a *chaîne opératoire* for ring production which involves the reduction of a *Conus litteratus* or *Conus leopardus* shell – most often through direct percussion – followed by the grinding of the body whorl and then spire faces. The inner whorls are then chipped away along suture lines and the inner surface and corners abraded. The possibility was also raised that *Conus* spp. adzes are produced from the debitage of ring manufacture. It was further suggested that the perforated units or plaques of *Conus* are likely to be broken, curated broad *Conus* spp. rings. *Conus* spp. beads mimic the *chaîne opératoire* of ring production on a smaller scale.

 Artefacts in *Trochus niloticus* are mainly one-piece jabbing fishhooks. These too are of standardised production and a *chaîne opératoire* has been outlined. Despite the presence of only one *Trochus niloticus* ring fragment,
debitage relating to the production of this artefact type is argued to be present. The working of *Turbo marmoratus* at Kamgot is notable as this is not generally associated with Lapita deposits. The worked pieces are clearly patterned and a patchy *chaîne opératoire* for one-piece rotating fishhooks is in evidence.

While production of major artefact classes is apparently highly standardised, some unique artefacts present evidence of what is perhaps experimentation or the transferral of techniques more typically associated with other materials. The 'tattooing chisel' in *Trochus niloticus* is a case in point. The teeth have been literally 'scratched' into the surface of the shell and this technique is not seen either within the Kamgot assemblage or elsewhere. The only other recorded tattooing chisels for Lapita deposits are a series of examples in bone recovered by Poulsen in Tonga (see Poulsen 1987:207, plate 68:14-16). The teeth on these latter examples have not been 'cut' in the classic sense, and it would be interesting to assess whether a similar 'scratching' technique was applied to the manufacture of bone artefacts. Also of note is the unique perforated disc created through the application of a rough cutting technique not, apparently, applied to other raw materials/artefact forms.

The results of the midden analysis indicate that raw materials used for shell artefact production at Kamgot would probably have been locally available. Furthermore, all shell appears to be fresh; there is no evidence for working of subfossil shell.
5.3 Nenumbo (SE-RF-2): shell assemblage and artefacts

5.3.1 Background and context

The seminal Nenumbo (RF-2) site in the Reef Islands, southeast Solomons (see Figure 5.29) was probably the most important site in defining the Lapita cultural complex as we conceptualise it today (e.g. see Green 1976; Green 1979). This large, coastal 'western' or 'middle Lapita' site was first excavated by Roger Green in 1972, with another season in 1976-7. Intensive surface survey, with a focus upon isolating intrasite variation, both defined the limits of the site and acted as a basis for deciding where to excavate profitably (Green 1976:251). The stratigraphy is another example of the 'classic' Lapita pattern. The lowest layer is sterile white coral beach sand, which is overlain by a 'grey' sand that contains Lapita period material. The uppermost layer incorporates ash from the eruption of the nearby Tinakula volcano. Based on observations of continuity regarding fishbone and midden shell, as well as the declining quantities and sherd size of earthenware as one moves up through the sequence, Green suggests that the grey and overlying 'black' layer signal the same occupation, where gardening practices have redeposited material from the grey layer upwards into the black (Green 1986:120; Sheppard and Green 1991:89).

Four radiocarbon determinations on charcoal have been published for the Grey layer (Sheppard and Green 1991), while a further two determinations on shell from the Grey layer have recently been obtained (Jones, Petchy, Green, Sheppard and Phelan in press). The shell and charcoal dates together have been used to calculate a marine ΔR value (-81±64) for the Reef Islands, applicable between 2000 and 3000 BP (Jones et al. in press). Calibrated dates
using the new ΔR value are presented in Table 5.4. The dates group around the period from c. 2700 – 3200 B.P., as would be expected for a middle/western Lapita site.

The extensive areal excavation (153.5 m²) has meant that questions pertaining to intrasite variation and patterning could be investigated (e.g. see Green 1976 for plain earthenware distributions, and; Sheppard and Green 1991 for distributions of sherds, faunal remains and lithics). Such an analysis has not, to date, been conducted with shell artefacts and manufacturing debris recovered from Nenumbo. While the data collected as part of this thesis would facilitate such an analysis, questions of intrasite patterning are not of central concern here and will be investigated separately.

The midden shell was subsampled and analysed by Pamela Swadling with results and interpretations being presented in Swadling (1986). Of eight boxes of shell midden recovered from the site, two were studied by Swadling and then repatriated to the Solomon Islands. The remaining six boxes, still housed at the University of Auckland, were studied as part of this research and summary results are presented below.

5.3.2 The total shell assemblage

The shell from the grey layer is, on the whole, well-preserved. The same problem that besets shell in the upper gardening soil layer at Kamgot, however, is in evidence here in 'Black layer 1'. Shell from this layer is generally degraded and of a chalky texture. Frequencies of hermit-crabbed shells, as gauged during midden analysis, are low.

As pointed out by Swadling (1986:137) the extensive reef and lagoon complexes around the main Reef Islands contain a diversity of molluscan life
that is reflected in the Nenumbo shell midden. The dominant mollusc taxon in
the sample analysed by Swadling is Turbo spp. (including Turbo argyrostromus,
T. chrysostomus and T. setosus) which constitutes 32% of grey layer 2 and
28% of black layer 1. Trochus spp. (including Trochus niloticus, T. maculatus
and Tectus pyramis) contributes 15% of grey layer 2 and 12% of black layer 1,
and Tridacna spp. (including T. maxima and T. squamosa) makes up 3% of
grey layer 2 but 13% of black layer 1. Also worthy of mention is Nerita spp.
(including N. albicilla, N. lineata, N. plicata, N. polita and N. undata) which
makes up 6% of grey layer 2 but is not recorded for black layer 1, and Anadara
antiquata which makes up 4% of the grey layer 2 sample and 9% of the black
layer 1 sample. In all, Swadling (1986:140) identified 28 mollusc taxa\(^{31}\) for the
grey layer 2 sample and 15 for black layer 1, and a total of 506 shells\(^{32}\) were
included in the analysis.

My analysis of the remainder of the Nenumbo shell midden resulted in the
identification of 2280 shells\(^{33}\) belonging to 127 different species. Of these, 82
were gastropod species, 44 were bivalve species, and the remaining taxon was
the cephalopod Nautilus pompilius. Chitons (polyplacophorans) were also
present but were not separated into species, and are thus not included in the
aforementioned totals. This increase in the number of species identified is
probably a direct result of larger sample size. Figure 5.30 graphs the twenty
most abundant species identified in black layer 1 and grey layer 2 respectively.
Eighteen of these species overlap between the two layers, meaning that twenty-

\(^{31}\) Although Swadling (1986:140) refers to totals of mollusc species present, these totals appear
to include echinodermata (urchins rather than molluscs), and supra-species groups such as
"Chitinidae [sic] spp." (which presumably refers to chitons or Polyplacophora more generally
rather than members of family Chitonidae) and "freshwater snails".

\(^{32}\) Swadling (1986) does not detail quantification protocols in the published report, and it is thus
unclear whether counts refer to fragments or estimated individuals.

\(^{33}\) This refers to estimated minimum number of individuals, and thus does not include fragments
with no countable elements or both left and right valves of bivalves.
two species are graphed in total. Opercula counts have been included along with the species to indicate the cumulative presence of *Turbo* (the most common taxon identified by Swadling 1986).

The major discrepancy between Swadling’s (1986) results and mine is the overwhelming dominance of the gastropod *Pythia scarabaeus* in my analysis. This mollusc comprised only 3% of Swadling’s grey layer 2 sample, and it is not recorded at all for black layer 1. Rather than reflecting either bias in identification or gross differences in cultural deposition patterns as they relate to shell within the site, I think the reason for this patterning lies in the nature of the site environs. As mentioned above in the Kamgot analysis, *Pythia scarabaeus* is a fully terrestrial snail in the Ellobiidae. Swadling (1986:139) categorises *Pythia scarabaeus* as a resident of “muddy shores near high tide level”. While this is certainly true of other genera within the Ellobiidae, who have their “geographical headquarters in tidal swamps” (Morton and Raj n.d.:168), genus *Pythia* is found further inland and is completely terrestrial (Morton and Raj n.d.:168). Interestingly, a recent conchological survey in Papua New Guinea recorded many empty *Pythia scarabaeus* shells on the ground, but noted live specimens only in association with the ‘screw-pine’ *Pandanus* (Martens 1997). Given the ecology of *Pythia scarabaeus*, I suggest that it naturally occupied vegetation surrounding, and possibly within the bounds of the Nenumbo site, and its presence within the deposits is a result of natural death and accumulation rather than of human deposition.

The case of *Pythia scarabaeus* aside, environmental niches represented by the other identified species mainly fall into two categories: hard reef flat intertidal, and clean coral sand (see Figures 5.31 and 5.32). Together these two environmental niches furnish 66% of shells from Black layer 1 and Grey
layer 2. The supra-littoral category consists largely of *Pythia scarabaeus*, but also includes litorinid gastropods of genus *Tectarius*. Silty sand and/or mudflat species represent a minor (4%) component of both Black and Grey layers.

What is notable about the hard reef flat intertidal and clean coral sand categories, is that no one (or small group of) species dominates. Indeed, fifty-six species are represented within both of these environmental categories.

A series of conclusions can be drawn from the data gathered here about shell-gathering strategies of Nenumbo inhabitants. Firstly, both hard and soft shore zones were targeted consistently for exploitation, but within these zones, types of prey taken were diverse. In short, gathering reflects a broad-spectrum approach rather than one where particular habitats or taxa are targeted. Secondly, there appears to be no clear focus on collecting large molluscan prey. Species such as *Atactodea striata*, *Fragum fragum* and the various species of the Neritidae prevalent in the sample are all rather small species rarely exceeding 2cm in maximum length. Rather than size, the focus seems to have been on collecting visible and/or easily-accessible species. Both *Atactodea striata* and *Fragum fragum* are frequently abundant just under the surface of clean sandy shores (Morton and Raj n.d.:151; Thomas 2001:86), representing easily collectable targets. Hard-shore gastropods such as members of the Neritidae tend not only to be accessible and visible, but many are also gregarious. This is particularly the case with dwellers of the upper-intertidal zone such as *Nerita plicata* (Demond 1957:287) who cluster together to minimise moisture loss. Thus, despite their small size, many individuals can be collected within a short time. Thirdly, a range of coastal zones were exploited by the inhabitants of Nenumbo, but the vast majority of species present in the Nenumbo deposits derive from the middle and lower intertidal
zones. Supra-littoral (or ‘splash’) zone species found above the upper-intertidal present in the Nenumbo midden are restricted to members of genus *Tectarius* (if *Pythia scarabaeus* is discounted as a human introduction to the site). Likewise, upper-intertidal species such as *Nerita plicata*, limpets of the Patellidae and false limpets of the Siphonariidae, are infrequent in Nenumbo deposits.

Fourthly, the question of size-based selection *within* species groupings may need further investigation. Swadling (1986) asserted that clear decreases in the sizes of *Trochus niloticus*, *Tectus pyramis* and *Anadara antiquata* through time at Nenumbo indicated population pressure induced by human predation. This works on the *a priori* assumption that human gatherers would have selected the largest individuals available/encountered. The case rested upon a series of measurements on individuals from each of these species, and notes regarding morphological changes in the case of *Trochus niloticus*. While I have no wish to reinvestigate this question in any detail here, what became apparent during analysis was that many specimens measured actually represented species other than those of interest\(^{34}\). The impact of this problem is yet to be calculated, and thus, for the meantime, Swadling's arguments for size decrease, or the related argument for over-predation cannot be accepted here.

From the analysis of the midden shell, it is clear that inhabitants of Nenumbo exploited a range of local environments and zones, without a co-ordinated focus on a handful of preferred taxa. Rather, easily-collected and fortuitously-encountered individuals from local environments comprise the Nenumbo shell midden.

\(^{34}\) Many specimens measured as *Anadara antiquata* were in fact individuals of the considerably smaller species *Fragum fragum*, while a number of specimens labelled as *Tectus pyramis* were re-identified as the smaller *Tectus fenestratus*.  

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5.3.3 The worked shell component

The shell artefacts recovered from the Nenumbo excavations were separated and analysed by Green. Although an analysis of these shell artefacts has never been published in full, reference to various of the artefacts has been made within Green’s publications (e.g. Green 1979). These artefacts, together with worked shell isolated during midden analysis, are the subject of discussion here. All artefacts and worked, or potentially worked, specimens are described in Appendix 2.2. Nine species exhibit signs of having been worked, not including two aggregate categories where only genus level identifications could be made (Conus spp. and Tridacna spp.). These species are listed in Table 5.5. Techniques employed in working, as well as the resultant artefacts will be discussed in family groupings.

5.3.3.1 The Conidae

The vast majority of worked shell pieces present in the Nenumbo assemblage are manufactured from members of the Conidae. Species able to be identified utilising morphology and remaining colour patterning were Conus litteratus, Conus leopardus, Conus cf. virgo and Conus marmoreus. Specimens not able to be identified (usually due to deterioration of the shell surface or total loss of colouring) were grouped together under the category Conus spp.

The analysis of the midden indicates that environments supporting Conus spp. were being regularly exploited by the inhabitants of Nenumbo. The ecology of Conus litteratus and Conus leopardus has been discussed above. The molluscivorous Conus marmoreus is flexible in terms of habitat, being found in sandy, weedy and hard reef-flat environments (Demond 1957:329).
There is some evidence for the working/utilisation of shell gathered post-mortem, and these specimens will be considered on a case-by-case basis.

Using standard Lapita terminology, artefact types represented include broad and narrow rings, with one grooved narrow example, perforated or ‘broad’ units, and beads. With regards to rings, blanks, preforms, debitage, unfinished and finished and broken pieces are present.

The production of *Conus* spp. ring blanks using a direct percussion technique has been elaborated above with reference to Kamgot. This technique is also in evidence at Nenumbo with an example being illustrated in Figure 5.33a. The second method, alluded to above as allowing greater precision but being more labour-intensive, is cutting. Two near-complete bodies that have been detached by cutting are present within the Nenumbo worked shell assemblage (see Figure 5.33b), along with five fragments showing evidence of cutting at the posterior end (see Figure 5.34a). Visual inspection of cut *Conus* bodies and fragments exhibiting cut marks demonstrates that, rather than cutting straight through or ‘slicing’ the body, segments of the body whorl were cut consecutively moving around the shell’s circumference. Faceting and differing bevel angles of cuts on the same shell attest to this.

As with Kamgot, the next step after successfully detaching the spire from the body of the shell, is grinding of both the spire and body surfaces. Heavy erosion of the majority of specimens representing this stage of manufacture makes conclusive statements impossible, however it appears that the body surface was ground first, followed by the spire surface. The least deteriorated example is illustrated in Figure 5.34b. No examples of preforms or fragments of ground spire are present within the Nenumbo shell sample, but the presence of fragments of unfinished ring suggests that this may be related to sampling or
spatial/depositional factors as the removal of the inner spire whorls is a necessary intermediate stage. Figures 5.35a and c show examples of uncompleted rings, where the interior has not been abraded and part of the second whorl remains. Figure 5.35b along with Figures 5.36a-e show examples of ring fragments of different cross-sections. As for the Kamgot sample, cross-section is a factor of width of ring and degree of abrasion. Figure 5.36e shows the one grooved Conus sp. ring present in the Nenumbo sample.

There are five fragments of broad rings, including two perforated examples. All are well finished and abraded except for the example illustrated in Figure 5.37a where the interior has not been fully abraded and parts of the second whorl remain. With regards to the perforated examples (Figure 5.38a and e), perforations have been drilled from both inner and outer faces with the holes connecting in the centre. As with the Kamgot Conus spp. ring sample, ring widths and estimated internal diameters have been graphed. The ring width graph (Figure 5.39) clearly shows two distinct width ranges corresponding to ‘narrow’ and ‘broad’ ring forms. There is also a wide range of internal diameter sizes present, with the broad rings also having the largest internal diameters.

Aside from rings and perforated ring units, the other formal artefact type at Nenumbo manufactured from Conus spp. was a small bead. There are three examples within the Nenumbo sample, which are illustrated in Figure 5.38b-e. While these small, perforated Conus spp. spires are outwardly similar to specimens from Kamgot (illustrated in Figure 5.24), upon closer inspection there are distinct differences. The high elevation of the spires – as seen in cross-section – and the nature of the surfaces and edges indicate that these spires have not been ground. All surfaces are smooth and well-rounded, with
the inner spire surfaces being as worn as the outer surfaces. This suggests that the specimens had been broken through natural processes such as wave or predator action and subsequently water rolled. The perforations are difficult to assess; partly due to the fact that the strings of accessioning tags had been looped through them creating an unknown degree of abrasive wear/damage. Such perforations at the apex of the shell, however, are consistent with beach rolling. A number of specimens with apical perforations created by attritional processes have been collected by the author while beach-combing on tropical shores. In short, while these three specimens may be culturally-modified, nothing in their morphology or condition demands this explanation. This does not mean, however, that they were not utilised in the same fashion as humanly-manufactured Conus spp. beads.

5.3.3.2 The Pteriidae

The pearl oysters Pinctada margaritifera (black-lipped pearl oyster) and Pinctada maxima (gold-lipped pearl oyster) are widespread throughout tropical Pacific waters, although the natural range of the latter does not extend beyond the Solomon Islands (Eldredge 1994a:33). As with other commercially significant species, such as Trochus niloticus and Turbo marmoratus, current ranges are partly a product of recent human introductions (Eldredge 1994a:33-5). Pinctada spp. live subtidally in clear lagoonal waters, and thus, as with Tridacna gigas, were probably collected by diving.

Within the Nenumbo worked shell assemblage, there are six pieces of pearl shell that display cut edges. Cutting is invariably effected from the inner surface of the valve. Two fragments with a cut edge are illustrated in Figure 5.41a and b. While such pieces are sometimes referred to as 'knives' or 'fishhook tabs' (e.g. Spriggs 1991), no such interpretations are offered here.
Convincing examples of fishhooks of *Pinctada* spp. are restricted to the Fijian Lapita site of Lakeba (Best 1984:448-51), and the tidy, sharp edge produced by cutting may or may not have been functional in its own right.

### 5.3.3.3 The Tridacninae

Two species within the Tridacninae were identified as having been worked; *Tridacna maxima* and *Hippopus hippopus*. Ecology and procurement strategies regarding *Tridacna maxima* have been outlined above in section 5.2.3.4. *Hippopus hippopus*, or 'bear paw clam', lives on sandy substrates intertidally and subtidally. While attached by byssus threads to coral rubble in juvenile stages, adult animals rest unattached on their hinge in the sand (De Bruyne 2003:264). The results of the midden analysis indicate that the clean reef and coral sand environments supporting these two species were regularly exploited by the inhabitants of Nenumbo, and that these environments were probably local.

Formal artefacts recovered from Nenumbo are all manufactured from *Tridacna maxima* or unidentified *Tridacna* sp. Five adzes were recovered, three of which were surface finds. A fashioned and abraded slingstone (Figure 5.42a) was also recovered as a surface find, and, given its provenance, will not be further discussed here. The three surface adzes (see Figures 4.43a and b, and Figure 5.44b) all fall into Kirch and Yen’s (1982) ‘type 4’, the characteristics of which have been outlined above in section 5.2.3.4. The specimen illustrated in Figure 4.43b has been water-rolled. While not a hinge-section adze proper, the specimen retrieved from the lower grey layer (see Figure 5.44a) does not follow the normal ‘dorsal region’ pattern, and appears to have been made from a portion of shell close to, but not including, the hinge. The long axis of the adze runs at a c. 45° angle to the shell ribs, as in a ‘type 4’, however it is fully ground
unlike the standard ‘type 4’ adze. The final adze was recovered from the base of the upper black layer. It is a hinge section adze that has probably been fully ground, although much of the surface has eroded away. The cross-section is roughly plano-convex and the bevel has been ground from the inner/ventral surface.

There are two pieces of worked *Hippopus hippopus* within the Nenumbo worked shell assemblage. The first (see Figure 5.45c) is a fragment from the dorsal margin of a large valve that has been perforated by drilling. Drilling has proceeded from both sides of the valve. The edges do not appear to have been cut, but degradation of the shell makes this difficult to assess. The second worked piece is a long piece of a *Hippopus hippopus* valve, taking in two major valve ribs, that has been roughly cut down one side. Again, condition precludes further comment.

There is a number of tridacnid fragments in the Nenumbo midden sample, deriving from *Tridacna gigas*, *Tridacna crocea*, *Tridacna maxima*, *Tridacna squamosa* and *Hippopus hippopus*. Only one piece, however, shows categorical evidence of being related to working. This is a conchoidal flake with a Hertzian initiation and feather termination (see Figure 5.41c). Unfortunately, it is a surface find which may or may not inform on manufacturing techniques related to artefacts found within the Nenumbo deposits. The small flakes lacking diagnostic features discussed in relation to Kamgot are not in evidence at Nenumbo.

5.3.3.4 Worked shell of other taxa

Aside from artefacts discussed above, four artefacts utilising three different species were also identified within the Nenumbo assemblage. The first is the dorsum of a *Cypraea mauritania* where the edge has been abraded around the
full circumference (see Figure 5.45a). Unlike so many other *Cypraea* spp. specimens variously referred to as octopus lures, scrapers and peelers, this example shows categorical evidence of having been modified, and this modification does not coincide with natural or meat extraction breakage patterns. The second artefact is a highly eroded shaped and abraded piece of the lip of a *Cassis cornuta*. Severe damage by clionid sponges has resulted in the central hole visible in Figure 5.45b. The use of the lip of *Cassis cornuta* as a raw material for artefact manufacture is more typically associated with post-Lapita sites in the region (e.g. see reports in McCoy and Cleghorn 1988), and the fact that this artefact is found in the top ten centimetres of the deposit may signal that it is a later intrusion.

That some post-Lapita material may be present at the very top of the Nenumbo deposits is lent support by the presence of a broken adze/gouge of *Terebra maculata* (see Figure 5.46b). Artefacts of this type occur widely across Island Melanesia, but are restricted to the last 700 years - although their occurrence in Micronesia may be slightly earlier (Spriggs 1997:195). The final artefact is also of *Terebra maculata* and is provenanced to the top ten centimetres of the lower grey layer. The apex of the spire has been removed by being partially cut and then snapped off. Apices of *Terebra* spp. shells have been reported as drills by Davidson (1971:70), and the lack of reported lithic drills for Lapita sites renders this an interesting possibility.

**5.3.4 Summary of results**

There is clear evidence for the manufacture of *Conus* spp. rings, as well as the working of pearl oyster (*Pinctada* spp.), *Hippopus hippopus*, *Cypraea mauritania*, *Cassis cornuta*, *Terebra maculata* and possibly members of genus
Tridacna at Nenumbo. Of these, only Cassis comuta does not have a firm Lapita stratigraphic association.

Conus spp. ring blanks were produced through cutting in some cases and percussion in others. Regardless of which method of initial reduction was used, the next step involved grinding of both the body whorl edge and spire, and removing the inner whorls of the spire to generate the preform. Abrasion of corners and the inner surface represents the final stage. While there is no evidence for the curation of narrow rings, there is evidence that broken broad ring pieces are perforated and continue in use in modified fashion rather than being simply discarded.

Fortuitous collection and use of shells modified through natural processes is probably represented by all Conus spp. beads present at Nenumbo. At least in the case of these beads, this may indicate that the final form and/or raw material was regarded as more important than the fact that labour was involved in their creation.

Working of pearl oyster is confined to cutting within the Nenumbo sample, while cutting and snapping techniques are linked with Terebra maculata. While Tridacna spp. adzes are present at Nenumbo, there is no clear evidence for their on-site manufacture. Rather, the only member of the Tridacninae represented by unfinished artefacts is Hippopus hippopus. A single Cypraea mauritania has been abraded smooth around the edge.

Habitats supporting the mollusc species utilised as raw materials at Nenumbo are indicated to be locally present and regularly exploited by the midden data. Given this, it is possible that the various species of mollusc linked with artefact manufacture also made a contribution to subsistence.
5.4 Vao: shell assemblage and artefacts

5.4.1 Background and context

The site of Vao is located on the sheltered southwest coast of Vao Island, off the east coast of Malekula Island, Vanuatu (see Figure 5.47). It was excavated over two seasons in 2002 and 2003 as part of the ‘Distance Education in the South-West Pacific: Culture Heritage Training’ programme, sponsored by the Sasakawa Foundation, and managed in Vanuatu by Dr Stuart Bedford. Bedford, staff from the Vanuatu Cultural Centre and Vanuatu Culture Heritage Site Survey, as well as local members of the Vao community, participated in the excavation and much of the on-site analysis (Bedford and Leavesley 2003).

The Vao site is located on a raised beach terrace, and contains both Lapita and post-Lapita material. Layers and lenses of tephra, as well as debris from cyclonic sand storms indicate the relatively undisturbed nature of the site (Bedford 2003:154). While radiocarbon dates are pending, the lower layers at Vao are believed to be late Lapita based on the coarse and simplified nature of the dentate-stamped motifs on the ceramics. The faunal assemblage is large and varied, with pig bone being plentiful along with lesser amounts of dog, chicken and turtle bone (Bedford 2003:154).

5.4.2 The total shell assemblage

Analysis of excavated midden shell was carried out on-site as ‘shellfish workshops’ organised as part of local culture heritage training. Voucher specimens were brought back to New Zealand, and identified by the author. While relative frequencies of taxa and contributions of different mollusc-bearing niches cannot be commented upon, the species identified presented a very similar picture to Kamgot and Nenumbo, where hard reef-flat and coral sand
species comprise the bulk of midden remains. Bedford comments of the midden shell that “changing species preference and size reduction could all be clearly identified” (Bedford and Leavesley 2003:23). The specific evidence for this and the case for such changes resulting from changing preferences rather than a changing environment remain to be articulated in forthcoming publications.

5.4.3 The worked shell component

Given that Vao is a stratified site containing Lapita as well as more recent material, only material from a depth of 120cm is presented here. This is believed to represent Lapita-period shell-working (Bedford, pers. comm.). The voucher specimens suggest that shells utilised for working would have been present in local environments, although the stated changing patterns in shellfish preference/availability complicate any simple assessment made on voucher specimens alone.

5.4.3.1 The Trochidae

No pieces of *Trochus niloticus* related to fishhook manufacture were identified within the Vao sample. Ring fragments and evidence of working were present in limited amounts. Two fragments of rings produced from *Trochus niloticus* were identified, and are illustrated in Figure 5.48. Both are considerably thinner and more delicate than the single example from Kamgot (Figure 5.10b) and are finished differently. While the Kamgot example was fully abraded, the Vao specimens are ground on the sides, with unworked interiors. The prismatic outer surface of the shell remains intact on the specimen shown in Figure 5.48b, and has been lightly abraded. The prismatic layer has come away along
most of the length of the fragment illustrated in Figure 5.48a, so finishing cannot be commented upon. All corners are sharp and unabraded on both specimens.

Two additional fragments were identified as having being worked; one of *Trochus maculatus* and the other of *Tectus pyramis*. Both are fragments of the posterior section of the body whorl and the anterior section of the second whorl, with the suture between the two contained in between. The main body edges do not show any signs of working, but the inner wall of the suture shows evidence of having been chipped with a sharp point. This pattern is the same as working observed on *Trochus niloticus* fragments argued to be related to ring manufacture at Kamgot. While the selection of these smaller species of the Trochidae for ring production is atypical, half a *Tectus pyramis* ring was recovered at a depth of 90-100cm within the Vao deposits demonstrating that this species was utilised as a raw material on occasion.

5.4.3.2 The Conidae

Formal artefacts utilising members of the Conidae as raw material include narrow rings, and single examples of an adze/gouge, shaped and perforated ‘pendant’, ground and perforated *Conus marmoreus* spire, and bead. A modified, whole *Conus marmoreus* was also identified as having been worked.

The lack of an available midden sample for analysis precludes comment on fragments and breakage patterns for the Vao assemblage, and the initial stages of ring production at the site cannot be outlined. One broken preform, however, does attest to the production of *Conus* sp. rings at Vao. Seven narrow ring fragments are present in the Vao sample, six of which are illustrated in Figures 5.49b-c and 5.50a-d. One example has the central abraded groove also seen at Kamgot and Nenumbo (Figure 5.50b). All fragments have been well abraded. Colour markings remain on three of the specimens, indicating
that the raw material in all cases was *Conus litteratus* or *Conus leopardus*. The broken preform (see Figure 5.49a) has been ground flat on both faces and the central whorls have been removed by chipping with a sharp point along whorl suture lines from the outer face of the spire. The distribution and frequency of different *Conus* spp. ring widths is graphed in Figure 5.51, while frequencies of different internal diameters are graphed in Figure 5.52.

While at first glance, the ground *Conus marmoreus* spire illustrated in Figure 5.53a appears to coincide with a narrow ring preform (compare with Figure 5.49a), closer inspection indicates that it may be a broken, finished artefact in its own right. Both faces of the detached spire have been ground, and the central whorls removed. Under low magnification, traces of chipping remain, but subsequent to the chipping out of the central whorls, the inner surface has been abraded smooth. This pattern of working follows *Conus* spp. bead-making practices, with both spire surfaces having been ground and the central perforation chipped out. The outer perimeter is unworked, though in the case of beads most abrasion is seen at the aperture region, which is missing from this example.

The specimen illustrated in Figure 5.53b is also a uniquely-worked specimen in *Conus marmoreus*. The shell is whole except for a perforation at the apex that has been created by chipping at the suture lines with a sharp point. Two distinct ‘entry points’ are visible under low magnification.

The one *Conus* sp. adze found below 120cm at Vao (see Figure 5.54a) closely follows the pattern outlined for Kamgot (see section 5.2.3.3). The adze is manufactured from a triangular piece of the anterior section of the second rather than the body whorl, where the extreme anterior forms the poll end. The bevel has been ground on a single facet from the inner surface of the shell.
A further two artefacts are single occurrences within the Vao assemblage. The first is a shaped and drilled 'pendant' (see Figure 5.54b). The general morphology is that of a primary spine of the urchin *Heterocentrotus mammillatus*, a perforated example of which was recovered from Kamgot. The piece has been ground on six facets longitudinally, giving it a hexagonal appearance in cross-section. Colour markings present on one facet allowed its identification as *Conus* sp. The perforation is drilled from one of the long faces and from the small end of the artefact, with the two drill holes meeting at an angle. A single *Conus* sp. bead was also recovered, and is pictured in Figure 5.55. Both faces have been ground and the periphery has been abraded. The regularity of the central perforation suggests that it has been drilled, but its close following of whorl suture lines means that chipping and abrasion cannot be ruled out.

No curation or use of shell collected post-mortem is evident in the Vao *Conus* spp. assemblage.

5.5.3.3 The Tridacninae

Three artefacts in *Tridacna* spp. were identified within the Vao worked shell assemblage, along with a worked *Hippopus hippopus* valve. Two of these were ring fragments with the third being a ground hinge fragment. The ring fragments (Figure 5.56b and Figure 5.57a) are unlike either the massive or slender types seen at Kamgot (see Figure 5.27). Both faces have been well ground, and the outer periphery abraded on two sloping facets meeting at a rounded point. While the inner surface of the ring has been abraded into a gently rounded form on the specimen shown in Figure 5.57a, the specimen illustrated in Figure 5.56b shows different finishing. There is a steep bevel
running from one face only, which suggests that the central core of the ring was removed by working from a single (in this case the inner) face.

A ground *Tridacna* sp. hinge fragment, illustrated in Figure 5.56a, is clearly part of a larger artefact. Its on-site attribution of a 'broken adze piece' is likely. All non-broken surfaces have been well ground on a number of facets, and then the facet edges smoothed through abrasion. The shape of the piece, as well as the fact that both faces slope down to the cutting edge, indicates a lenticular rather than plano-convex or quadrangular cross-section.

While there are no flakes or fragments of *Tridacna* spp. clearly related to working, one near-complete *Hippopus hippopus* valve may offer clues about initial stages of adze production. Three large pieces of valve refit to form nearly the complete valve. It is evident upon refitting that the valve has been shattered by repeated blows to its centre. There is a good deal of crushing at this point, and a distinct, jagged hole, indicating shattering is not due to fire or simple breakage. Cracks have radiated out from the area of impact, shattering the valve into at least four large pieces. Although this breakage is the result of direct percussion, it can hardly be called 'flaking'. If such a method routinely constituted the initial steps toward blank production, the prevalence of *Tridacna* spp. pieces with little or no evidence of working and apparently 'shattered' edges, makes more sense.

5.5.3.4 Worked shell of other taxa

Only one definitely worked piece derives from a family/sub-family other than the Trochidae, Conidae or Tridacninae. The dorsum of a *Cyprea mappa* has been detached from the ventral part of the shell through percussion, as evidenced by a small zone of chipping and crushing (see Figure 5.57b). Subsequently, the edge has been abraded. A bevel has been worked across the centre of the
dorsum, creating a sharp edge. This bevel has been worked from the outer surface of the shell. As discussed in section 5.3.3.4 with regards to worked *Cypraea mauritania* at Nenumbo, convincing examples of worked cowrie shells are rare. Attribution of function is problematic with such a simple artefact – or indeed any artefact. The clearly-modified sharp edge and general form coincide with what Kirch (1997:213–4) has called a 'scraper' or 'peeling knife' for vegetables, though the form is surely not as common as he suggests.

### 5.4.4 Summary of results

While little information is presently available on the Vao excavations, it is clear that this is a significant site for understanding both Vanuatu prehistory and Lapita/post-Lapita history in general. Evidence of Lapita shell-working is varied and abundant, though the greatest contribution of Vao is likely to be forthcoming assessments of continuity and transformation in shell working into and through the post-Lapita period.

There is evidence for the working of both *Tridacna* spp. and *Trochus* spp., but worked pieces and artefacts of *Conus* spp. dominate. There is nothing in the *Conus* spp. ring/adze/bead sample to suggest that manufacturing techniques were any different from those outlined for Kamgot, although in the absence of debitage, this cannot be confirmed. A single grooved specimen links stylistically to examples recovered from Kamgot and Nenumbo. In addition to more standard forms of Lapita *Conus* spp. working, the Vao sample contains a number of unique specimens. A ground and perforated *Conus marmoreus* spire evidences the application of the same techniques and *chaîne opératoire* seen in the production of rings, however the end result is morphologically different. A largely unworked *Conus marmoreus* with an apical perforation, on
the other hand, does not coincide with standard *Conus* working practices and is somewhat enigmatic. A long shaped, ground and perforated *Conus* sp. pendant appears to mimic the morphology of a spine of the urchin *Heterocentrotus mammillatus*. A perforated spine of this species of urchin has been recovered from Kamgot (Szabó and Summerhayes 2002:96, figure 6e) with grooved specimens being recovered from Arapus and Ifo in Vanuatu (Bedford and Spriggs 2002:146, figure 9o), Naigani and Lakeba in Fiji (Best 1981a:15; Best 1984:461) and from early phases on Tikopia (Kirch and Yen 1982:271). As an artefact in shell it is unique and working protocols do not coincide with other forms.

There is limited evidence for the working of *Tridacna* spp. in the Lapita deposits at Vao, but a single deliberately shattered valve of a *Hippopus hippopus* may offer insights into the primary reduction of large valves generally. Focused battering of an area in the central part of the valve has prompted fatigue fractures running in several directions, this has caused the piece to shatter into a number of small, workable fragments. While direct percussion is used, this method can surely not be characterised as ‘flaking’.

### 5.5 Lapita (13A): shell assemblage and artefacts

#### 5.5.1 Background and context

Site 13, or ‘Lapita’, is the site that lent its name to the widespread cultural complex. It was first recorded by Sarazin (1917) and Piroutet (1917) and excavated by Gifford and Shutler, who recognised the extra-areal linkages of the cultural material to locales such as Watom (Gifford and Shutler 1956:94). The site is located in a bay on the Foué Peninsula on the west coast of the main
island, Grande Terre (see Figure 5.58). While Gifford and Shutler (1956:7) recognised two distinct localities (WKO013 and WKO013A) along the strip of land leading from the mainland to the peninsula, more recent work (Galipaud and Kasarhérou 1986) has led to the discovery of a third locale (WKO013B). Severe erosion at WKO013B and a proposal to develop the shore for shrimp farming close to WKO013A led to a series of salvage excavations at the two locales in 1992, 1994 and 1995 (Sand 1998:8). The shell sample looked at here derives from recent excavations at WKO013A, and only this location within the Lapita site will be further discussed.

The estimated extent of locale 13A is around 20,000m² and the area is associated with recent gardening (Sand 1998:10; Gifford and Shutler 1956:1). The southern part of the site faces the sea, and the central and northern sections slope down to a dried mangrove swamp (Sand 1998:10; Gifford and Shutler 1956:7). While there is variation across the locale, the stratigraphy of the bulk of the site (see Sand 1998:12-13) is comparable to that described for Kamgot and Nenumbo above. A lower sterile beach sand layer is overlain by cultural deposits within a grey sandy matrix. The uppermost layer is a sandy horticultural soil containing mixed deposits of both Lapita and post-Lapita age. A deeper more complex stratigraphy is seen in the vicinity of the dried mangrove swamp, which was used as a "dumping area" (Sand 1998:12-13). Radiocarbon dates have been published by Sand (1998:28-9), and group around the early- to mid-first millennium B.C.

5.5.2 The total shell assemblage

Gifford and Shutler (1956:30, 47-50) identified seventy-four mollusc species recovered from their excavations at Site 13 (including location 13A). While
representative samples were retained for most squares within the excavation, a
total shell sample was retained from one square, allowing quantification and
discussion of abundances (Gifford and Shutler 1956:30). Gifford and Shutler
(1956:30) noted the most abundant species to be *Anadara antiquata* and
*Gafarium tumidum*, while *Clypeomorus moniliferus*, *Chama limbula*, *Donax (?)
faba*, *Atactodea striata*, *Saccostrea cucullata*, *Striostrea mytiloides* and
*Terebralia sulcata* contributed in lesser amounts. A recent reanalysis of this
material by Miller (1997:35, 37) concluded that there was probable shoreline
environmental change in the vicinity of Site 13, with a shift from sand-dwelling
species in lower layers, to mudflat and mangrove species in upper layers.

All midden shell was retained from recent excavations at Site 13A. As part
of this research, the extensive midden was not fully quantified. Instead, species
occurring within the sample were noted along with annotations regarding their
relative abundance as gauged visually. In concurrence with earlier results from
Gifford and Shutler (1956) and Miller (1997), the dominant species were noted
as *Anadara antiquata*, *Gafarium tumidum*, *Saccostrea cucullata*, and *Terebralia
sulcata*, with the addition of *Isognomon* sp. Many other species were present in
lower levels; particularly those of the Neritidae, Chamidae, Planaxidae,
Psammobiidae and Mytilidae. The trend noted by Miller (1997) of a shift from
sandy to muddy collecting environments was not observed here, with sand-
associated species such as *Strombus luhuanus* and *Atactodea striata* occurring
in numbers in the upper levels. Perhaps, rather than observing the simple
siltation of a sandy environment, we are seeing the presence of two adjacent
environments, the extent and biomass of which were fluctuating through time. It

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35 I have listed revised names here, as most of the species listed by Gifford and Shutler (1956) have subsequently been relegated to synonyms.
is also likely that shell deposition patterns and resultant site formation processes were more complex than can be accommodated with reference to depth alone.

I would place some species included in the ‘sandy’ category by Miller (1997:31), within a hard reef-flat category\textsuperscript{36}. These include \textit{Trochus niloticus}, \textit{Turbo} spp. and \textit{Pinctada} sp. This re-ascription is important, as it draws out a further pattern in mollusc exploitation evident at Site 13A. It is clear that, at the time of occupation, extensive sandy and muddy habitats were located close to the site. The presence of trace quantities of clean reef species is significant in that these species would have been collected from further afield, and that these species/genera are associated with artefact manufacture. The results from Site 13A indicate that although the gathering of molluscs for subsistence may have been flexible and attuned to local environments, the collection of shell as a raw material for working was much less so. The exception here is worked shell of the Isognomonidae, specimens of which occur in muddy environments. However most worked examples represent expedient tools and this will be further discussed in the next section. A similar pattern of obtaining specimens for working from outside of local environments has been noted for the Fijian Lapita site of Natunuku (Szabó 2001).

5.5.3 The worked shell component

The species selected for working at 13A follow the same pattern as those selected at other Lapita sites discussed. The range, however, is more restricted. This is likely to be because these species did not occur locally at 13A, as they did at Kamgot, Nenumbo, and Vao. Although fragments of

\textsuperscript{36} While Miller (1997:31) associates \textit{Cerithium moniliferum} with sandy environments, it is here classified as a mud-dweller along with other members of its re-ascribed genus \textit{Olypeomorus}. 209
Tridacna spp. were recovered from the 13A deposits, the only categorically-worked pieces are surface specimens, which have not been included in this analysis. Species utilised for shell working at 13A (not including surface specimens) are listed in Table 5.6.

5.5.3.1 The Trochidae

As commented upon above, the presence of Trochus niloticus at Site 13A does not match local palaeoenvironments suggest by the midden, and effort would have gone into its procurement. Trochus niloticus is the only species of the Trochidae represented within the worked shell assemblage, however a small number of shaped and ground Trochus conus were identified within surface collections. No specimens showed obvious signs of having been collected post-mortem. Formal artefact types represented in the sample are rings and fishhooks. Intermediate stages of manufacturing are missing from the sample in both cases, however the evidence from fragments and reduced whole shells shows the application of different techniques when compared to other Lapita sites.

Five whole Trochus niloticus shells have been partially reduced by a combination of chipping with a sharp point to make an ‘incision’ in the shell, and then cutting or ‘sawing’ from this incision point. These incisions are typically made on the body whorl posterior to the keel that is present in mature specimens. The placement of such incisions, and the cuts that extend from them, are congruent with the production of blanks for Trochus niloticus rings. Without evidence of further working, however, this cannot be confirmed. Two rings are present within the 13A worked shell assemblage; one finished (see Figure 5.59b) and one apparently unfinished (see Figure 5.59a). The finished example has been fully abraded and has a square cross-section, while the
unfinished example is much less robust and has only been ground on the two detached surfaces; the inner and outer shell surfaces are unworked.

There are a further five fragments that show evidence of having been worked. They all derive from the ventral surface of the shell — the same portion from which fishhook blanks were created. Three of these fragments have small notches along the body whorl edge, coinciding with other examples described above. The remaining two fragments have cut-marks analogous to those described for the whole *Trochus niloticus* shells. In both cases the cut notch is positioned on the ventral surface of the shell, however, cutting has not progressed far enough to assess whether this working is related to the creation of fishhook preforms.

Two fishhooks manufactured from *Trochus niloticus* have been recovered from the 13A deposits. The first example, illustrated in Figure 5.60a, coincides with one-piece *Trochus niloticus* jabbing fishhooks described for Kamgot. The outer edge of the shank follows the curve of the body whorl, while the bend and point are fashioned from the ventral surface. In line with the pattern described for Kamgot (section 5.2.3.1), breakage has occurred in the bend area of the hook. The specimen has been well abraded and two notches, presumably for line attachment, have been abraded at the end of the shank leg. In contrast with the one notched specimen from Kamgot (see Figure 5.9d), the notches have been abraded on the outer rather than inner face of the shank. The second fishhook, shown in Figure 5.60b, is a rotating rather than jabbing fishhook. Although smaller and finer than either the former example or those present at Kamgot, it appears to be manufactured from the same portion of the shell. Grinding and abrasion of all surfaces preclude comment upon preform creation.
5.5.3.2 The Conidae

Where identifiable, artefacts in Conus spp. shell predominantly utilise Conus litteratus and/or Conus leopardus, with a minor input from Conus virgo and Conus marmoreus. As detailed above (section 5.2.3.3 and 5.3.3.1) Conus litteratus, Conus leopardus and Conus marmoreus all inhabit weedy sand environments, with Conus marmoreus also being found on hard reef flats. Conus virgo is more commonly found in muddy sand environments (Abbot 1991:74). The presence of quantities of Atactodea striata and, in particular Strombus luhuanus, within the midden indicates that environments likely to have supported Conus litteratus, Conus leopardus and Conus marmoreus were exploited by the inhabitants of 13A. That such environments were not exploited regularly or consistently may be reflected in the patchiness of Strombus luhuanus occurrence within the midden, with heavy concentrations in some areas and levels, and few examples in others. Muddy sand environments supporting Conus virgo would, on the basis of the midden evidence, have been present and regularly exploited.

Formal artefacts produced from members of the Conidae include rings, as well as a single bead and single ground spire disc. With regard to rings, primary reduction employing both direct percussion and cutting techniques is in evidence at 13A. Although a surface find, the Conus shell shown in Figure 5.61 demonstrates well the method of reduction by percussion (see also Figure 5.62a). Complete cut bodies are also restricted to surface finds (see Figure 5.62b), with one such specimen showing both cutting and percussion (see Figure 5.62c). That cutting was a technique employed by Lapita inhabitants of 13A is evident from the cut body fragment shown in Figure 5.63b. Fragments
argued above to be related to reduction by direct percussion were also present (e.g. Figure 5.63a).

The preform stage of ring production is evidenced largely by ground fragments of inner spire whorls that have been removed than ring preforms themselves\textsuperscript{37}. As at other sites, ground fragments of the inner whorls of the spire have been broken away largely along natural suture lines (see Figure 5.64b-d). Eight fragments of Conus spp. rings were recovered from within the 13A deposits, with a number more being collected as surface finds. A selection is illustrated in Figures 5.65 and 5.66. One grooved ring fragment, comparable to specimens recovered from Kamgot, Nenumbo and Vao, was found within the 13A deposits (see Figure 5.65c), while a further two were recovered as part of 1995 surface collections. As a rule, exterior grooving is the only outer-surface modification seen on Conus spp. rings, but one example recovered from 13A has an incised pattern running around the perimeter. The design can be seen in Figure 5.66c.

All Conus spp. ring specimens bar one fall into the 'narrow' ring category. The single 'broad' example is highly eroded and shows no evidence of curation. Ring widths are graphed in Figure 5.68, and diameters are graphed in Figure 5.69. A single surface specimen has been curated, and is illustrated in Figure 5.67a. The ring has broken before completion and has been perforated at both corners of one broken end. Sand (2001:83) cites further New Caledonian examples of perforated broad ring pieces, some of which fall into the category of the 'rectangular unit'. He does not, however, explicitly link the process of perforating broad ring fragments with curation and reuse (or 'redesignation' if the ring had not been completed).

\textsuperscript{37} Though see Figure 5.64a for a surface example of a ring preform.
As noted above, there are two further formal artefact types manufactured from *Conus* spp. shell. The first is a ground disc that has broken in half. Both spire surfaces have been well ground and the outer perimeter abraded. The innermost whorls have come away, and due to the roughness of this edge as against the well-abraded nature of the rest of the artefact, it is interpreted here as breakage rather than as a perforation. The second artefact is a *Conus* sp. bead. The spire of a small *Conus* sp. shell has been ground on both faces, and a central perforation has been drilled from the outer spire surface. The edge has been abraded.

5.5.3.3 The Isognomonidae and Pteriidae

The Isognomonidae, or ‘tree oysters’, typically inhabit muddy areas where they attach themselves to the aerial roots of mangroves with byssus threads (De Bruyne 2003:238; Abbot 1982:54). The 13A midden composition indicates that habitats capable of supporting *Isognomon* sp. were located close by. The species represented at 13A is probably *Isognomon isognomon*. A single cut fragment of *Pinctada* sp. (Pteriidae) would have had to come from a clean reef/lagoon source, and was probably not available in the immediate vicinity.

*Isognomon* sp. fragments display a number of different working techniques including cutting, abrasion, chipping with a sharp point, and drilling. There does not seem to be an observable pattern to this working with both hinge and body fragments being worked in different ways. Neither are there any formal artefacts within the worked shell assemblage identified as having been manufactured from *Isognomon* sp. although Sand (1998:19) notes the presence of “small pearl shell beads” at the site. The specimen illustrated in Figure 5.70a is an *Isognomon* sp. valve with a circular piece hewn out at the thickest part. It is possible that this represents blank production for the beads referred to by
Sand (1998:19), but this cannot be confirmed from a single occurrence. A single fragment of pearl oyster (*Pinctada* sp.) has been cut on three edges with the exterior having been lightly abraded.

### 5.5.3.4 The Tridacninae

As mentioned above, no categorically worked pieces of *Tridacna* spp. or *Hippopus hippopus* were recovered from within the deposits at 13A. Despite this, two surface artefacts are, in current understanding, believed to have an exclusively Lapita association (C. Sand, pers.comm. 2001). The first is a long unit with double perforations at each end illustrated in Figure 5.70b.

Morphology and surface features indicate that this was manufactured from the hinge region of the shell. The second artefact, illustrated in Figure 5.71a, is a preform for a hinge-section adze, which has been shaped and partially ground.

### 5.5.3.5 Worked shell of other taxa

The only artefacts that are not produced from the taxa already discussed are three small disc beads. One of these specimens still has radial patterning visible (see Figure 5.71d) and has been identified as being produced from a bivalve in either the Cardiidae or Arcidae. The other two beads (see Figures 5.71b and c) have no distinguishing features and cannot be identified. The two beads of identified shell have been ground on both faces, while the Cardiidae/Arcidae specimen has only been ground on the outer-shell face. All specimens have been abraded around the periphery and drilled.

### 5.5.4 Summary of results

While in many respects the 13A worked shell sample coincides with that seen at other Lapita sites, it is especially notable for the fact that worked shell taxa were
unlikely to have been locally available. Thus, while arguments for fortuity in the selection of raw materials could feasibly be run at other sites located adjacent to coral reefs, 13A reinforces choice of raw material is neither expedient nor lacking intention. The same pattern noted at the Lapita site of Natunuku in Fiji (Szabó 2001) further strengthens this argument.

The *Trochus niloticus* sample offers an interest possibility for the initial creation of ring preforms. The 13A material indicates that the anterior and posterior portions of the shell were separated through a process whereby incisions were made around the body whorl of the shell, followed by cutting between incisions. How widespread this technique was is presently unknown – largely due to the paucity of evidence at other Lapita sites.

5.6 St Maurice-Vatcha: shell assemblage and artefacts

5.6.1 Background and context

The St Maurice-Vatcha site is situated on a Quaternary sand-dune at the southern end of the Isle of Pines, off the south coast of Grande Terre, New Caledonia (see Figure 5.72). Originally designated as two separate sites, they have now been recognized as different locations within the same site. The St Maurice site was first investigated by the geologist Avias (1950), who noted the connections between the dentate-stamped ceramics recovered here and at the Watom site in the Bismarck Archipelago (Sand 1999:307). The discoveries by Avias prompted further investigations at the site, and these were undertaken by Golson (1962). During the 1970s, the nearby Vatcha site was investigated by Frimigacci who reported a particularly early date for the lowest cultural deposits (Frimigacci 1970) which has since been rejected (see Sand 1999:310-1). In order to clarify stratigraphic patterning at the site and shore up the chronology,
both the St Maurice and Vatcha locales were re-investigated in 1995-6 by the Department of Archaeology of the New Caledonia Museum (Sand 1999:311).

The areas of the site excavated in 1995/6 are shown in Figure 5.73. The matrix is sandy across the site, with Lapita material being associated with a grey sandy layer, with sterile sand below and reworked sand above (see Sand 1999:311-313). Radiocarbon dates obtained from recently excavated material indicate that occupation of the site began around 950 B.C. and ended 150 to 200 years later (Sand 1999:315).

5.6.2 The total shell assemblage

As with Site 13A, the shell midden material from St Maurice-Vatcha was not quantified. Instead, species occurring in the deposits were identified and notes were made regarding their relative abundance. Species identified, and their associated ecological niches, indicate that the residents of St Maurice-Vatcha were predominantly exploiting clean, sandy intertidal areas that probably had some level of sea-grass cover. Dominant species include *Atactodea striata*, *Strombus luhuanus*, *Donax cf. faba* and *Chama* sp. Lesser contributions are made by *Saccostrea cucullata* and *Gafarium tumidum*. A fairly standard sandy shore suite of species accompanies these major species including various species of *Cerithium*, *Asaphis violascens*, various species of *Polinices* moon snails, and various members of the Ranellidae. A smaller rocky reef component, dominated by *Saccostrea cucullata* and *Chama* sp., is supplemented by smaller amounts of *Septifer bilocularis*, members of the carnivorous Muricidae, and various species of the Neritidae, Trochidae, and Turbinidae in low frequencies. In nearly all excavated locales, the lower-most

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38 More familiar in the Pacific archaeological literature under its older name, the Cymatiidae.
spits are comprised of natural rather than midden shell. This is indicated by a high frequency of abrasion through beach-rolling, predatory gastropod borings, juveniles and tiny shells, and the dominance of an unidentified species of Glycymeris. Consistent amounts of a species of the large landsnail genus Placostylus surely represent a food source, given the lack of other terrestrial snails in the deposits.

5.6.3 The worked shell component

The range of species utilised for working (see Table 5.7) is more extensive than is seen in Site 13A, but artefacts manufactured from Conus spp. are strongly dominant within the sample. Certainly, sandy environments capable of supporting Conus litteratus and Conus leopardus were regularly exploited as evidenced by the midden composition. The smaller Conus eburneus is likewise a sand-dweller (Abbot 1991:81; De Bruyne 2003:203). The small reef-flat component in the midden assemblage indicates that Trochus niloticus was available to the residents of St Maurice-Vatcha, and would have been encountered while reef-gleaning. The same holds for members of the Spondylidae and Chamidae. The low frequencies of Tridacna spp. and possibly also Pinctada sp. could have also been sourced from this reef area if a lagoon was present. Nautilus macromphalus represents a chance find, as Nautilus are pelagic with empty shells occasionally washing up onto beaches. The waters around New Caledonia, however, are well known as a breeding ground for Nautilus spp. and shells are not uncommon. While Nautilus was necessarily gleaned post-mortem, no other worked shell shows evidence of deriving from a shell collected dead/empty.

39 Conus eburneus has an average maximum length of c. 5cm, although many of the St Maurice-Vatcha specimens are slightly larger than this.
5.6.3.1 The Trochidae

_Trochus niloticus_ is the only member of the Trochidae identified as having been worked within the St Maurice-Vatcha shell assemblage. Formal artefact types creating from _Trochus niloticus_ include one-piece fishhooks and rings. Evidence for fishhook production, and limited evidence for ring production is provided by a fragment from the posterior of the body whorl at the suture line showing chipping with a sharp point (see Figure 5.74a). One piece of the ventral surface/body whorl juncture which has been ground on the ventral surface (see Figure 5.74b), as well as what is clearly a partially-ground fishhook blank (Figure 5.75a) and a broken preform (Figure 5.75b), attest to the manufacture of one-piece _Trochus niloticus_ fishhooks at St Maurice-Vatcha. Together, these pieces indicate that fishhook manufacture followed the same procedure as has been described above for other Lapita sites. There is one definite ring fragment in the sample, as well as another ground and abraded piece (see Figure 5.75c) that may or may not derive from a ring.

5.6.3.2 The Conidae

Formal artefacts in _Conus_ spp. are restricted to rings and beads with the exception of one unique perforated artefact. The debitage and broken worked fragments, however, seem to indicate that artefacts not represented in the sample were also being produced. Although _Conus eburneus_ occurs in low frequencies in other assemblages studied, at St Maurice-Vatcha it is being extensively exploited and worked. Working of _Conus litteratus_ and possibly _Conus leopardus_, is limited with only two _Conus litteratus_ bodies detached using direct percussion (see Figure 5.76b) and one large specimen of what is
probably *Conus leopardus* or *Conus litteratus*, detached by cutting (see Figure 5.76a). Fragments from these large species are also few.

In contrast, partially reduced shells, bodies and body fragments and detached spires of *Conus eburneus* dominate the sample (see Figure 5.77a-c, Figure 5.78b and d and Figure 5.79a,b, and d). There is evidence of both reduction by percussion and cutting for this species. After the spire has been detached, the outer spire surface is abraded down to a low, domed morphology rather than ground flat. What happens after this step is unclear. There are no small rings at the site indicating 'mini-ring' manufacture, despite the fact that the *chaîne opératoire* follows so closely that observed for initial stages of ring production. Likewise, there are no *Conus* spp. perforated discs.

While *Conus eburneus* is conspicuous for a good deal of debitage and preliminary working with no apparent finished artefacts, the larger *Conus* species are well represented by finished/near finished rings, but little debitage. As mentioned above, detached bodies of large species are few. Ground spire fragments, typically chipped out during ring preform creation, are plentiful (see Figure 5.80a-e). The occurrence, however, of spire fragments ground in facets rather than flat (e.g. Figure 5.80c and e), may have connections to bead production instead of/as well as ring production. This is discussed further below in relation to *Conus* spp. beads.

Both finished and unfinished plain *Conus* spp. rings (see Figure 5.81a-c) are plentiful in the St Maurice-Vatcha worked shell assemblage (n = 40), though fragmentation is high with many specimens being too small to estimate internal diameter. What is distinctive about the *Conus* spp. ring sample is the high frequency of abraded or incised external decoration. Five ring fragments have a central groove abraded around the exterior; an addition also seen at Kamgot,
Nenumbo, Vao and 13A. Four of these are illustrated in Figure 5.82a,b,d, and e. The specimen illustrated in Figure 5.82d is unfinished, with the interior still rough and much of the second whorl attached. This indicates that grooves were abraded before the final stage in the chaîne opératoire of abrading and smoothing the interior surface. A further two specimens in the St Maurice-Vatcha sample have multiple grooves, with the ring illustrated in Figure 5.83c having two and the ring illustrated in Figure 5.83b having three. Two fragments of different rings are incised with chevron designs. While the grooving of rings appears to be widespread, the practice of the incising of designs on Conus spp. rings is restricted thus far to New Caledonia.

Conus spp. ring widths at St Maurice-Vatcha overwhelmingly fall into the ‘narrow’ category, with a single example of a broad ring collected as a surface find (see Figure 5.83). The finished, worn and broken ring has been curated by drilling two holes in adjacent corners. Discard or loss apparently occurred upon the breakage of one of these perforations. Conus spp. ring widths for St Maurice-Vatcha are graphed in Figure 5.84. Diameters, where they could be gauged, are graphed in Figure 5.85.

There is a variety of beads within the St Maurice-Vatcha sample, although the majority are ground disc beads manufactured from Conus spp. spires (n = 16). All are ground flat on both faces with drilled central perforations. While Conus spp. beads at other Lapita sites discussed have been observed to be manufactured from small species of Conus, two preforms in the St Maurice-Vatcha sample display a different method. The two preforms illustrated in Figures 5.86a and b indicate that preforms were chipped into shape from the central/apical whorls of a medium to large Conus species. Whether grinding preceded the chipping out of the preform is unclear. Before the abrasion of the
outer perimeter, holes are drilled from both faces meeting at the centre. Given that only the central whorls of a medium to large Conus sp. spire are utilised, it is possible that the faceting observed on ground Conus spp. spire fragments (see Figures 5.80c and e) is related to bead preform generation. The fact that the beads are created from the centres of larger spires may indicate creative use of debitage generated by Conus spp. ring manufacture by the residents of St Maurice-Vatcha.

The final Conus sp. artefact is a unique and potentially curated piece. A roughly triangular piece of the body of a Conus sp. shell has been perforated in three places (see Figure 5.87a). The inner shell surface in particular is eroded and irregular, but it is mentioned here as another probable example of the curation of broken broad Conus spp. rings.

5.6.3.3 The Tridacninae

A small but varied selection of artefacts in the St Maurice-Vatcha assemblage are manufactured from Tridacna spp. A single ring fragment comes from a large and robust specimen (see Figure 5.87b). All surfaces are well abraded. A bi-perforated unit made from the hinge section of a Tridacna sp. valve is likewise well finished, leaving little traces of working (see Figure 5.87c). A further five valve fragments show evidence of grinding and/or abrasion. On the whole, evidence of Tridacna spp. working at St Maurice-Vatcha is limited with relatively low amounts being present in the total shell assemblage.

5.6.3.4 Worked shell of other taxa

Additional artefacts were identified as having been produced from taxa not already discussed. Most of the identifications are broad or tentative due to a general lack of identifying features. A species belonging to either the
Spondylidae or Charmidae was used in the creation of two beads. One is a disc bead that has been ground on both faces, partially abraded around the perimeter and drilled (see Figure 5.88d), while the other is a longer fully abraded bead drilled end to end (see Figure 5.88a). Another of this latter type of bead is also present, but the raw material could not be identified (see Figure 5.88b). A plaque of what appears to be Cassis cornuta has been cut from the body of the shell, with edges and surfaces being lightly abraded (see Figure 5.88c). Two small, drilled disc beads of nacreous shell have been identified here as having been produced from Nautilus macromphalus. A reduced Nautilus macromphalus, with most of the body chamber removed, was also identified from the deposits. Finally, two fragments of pearl oyster display a single cut edge each. One specimen definitely derives from an Isognomon sp. valve, while the other may be either Pinctada sp. or Isognomon.

5.6.4 Summary of results

Conus spp. dominates the worked shell assemblage at St Maurice-Vatcha, however the pattern of debitage is minimally reflected in finished and broken artefacts present. Working of the smaller Conus eburneus is indicated throughout, but it is unclear what the final product of working was to be. This pattern would seem to indicate the movement and deposition of finished artefacts off-site. Kirch (1988) has interpreted this pattern, observed at other sites, as evidence of trade. This is possible, though potential reasons for the movement and deposition of artefacts off-site – via either natural or cultural agency - are many.

The bead sample from St Maurice-Vatcha is notable for its diversity in raw materials and manufacturing techniques. Evidence for Conus spp. bead
manufacture indicates that ground apical whorls, generated as a by-product of ring manufacture, were reworked into bead preforms. Nacreous and non-nacreous shells were also manufactured into beads. While the naturally-round spires of small Conus spp. shells are used as template for bead manufacture at other Lapita sites, the method observed at St Maurice-Vatcha involves fashioning the preform from a larger piece of shell. This approach is technologically closer to the chipping out of round preforms from other taxa, such as Nautilus sp., utilised for bead manufacture at St Maurice-Vatcha.

5.7 Naigani (VL 1/25): shell assemblage and artefacts

5.7.1 Background and context

The Naigani site is situated on a dune located on the east coast of Naigani Island, located off the east coast of Viti Levu Island (see Figure 5.89). It was discovered during the digging of surface ditches for the Naigani Resort, and the significance of the recovered potsherds was realised (Best 1981b:1). Salvage work was carried out in 1981 by Dr Simon Best and the Fiji Museum. In total, 83.5m² were opened up and all material below the top 25cm was sieved using either 7.1mm, 3.55mm or 2.5mm mesh (Best 1981b:1). The early occupation material was screened through the finest sieves (Best 1981b:1). A plan of the excavated area is shown in Figure 5.90.

As discussed above in relation to Kamgot stratigraphy (see section 5.2.1), Best (Best 1981b:6-7) interpreted the Naigani three-layer stratigraphy as clean coral sand topped with a humic layer related to horticulture, which has leached downwards producing a stained central layer. Visible stratigraphy thus relates to post-depositional processes and any one-to-one relationship with site
occupational phases is not expected. After the stratigraphy and relationship between layers had been established, the uppermost layer (A) was simply removed, with underlying material being excavated by trowel (Best 1981b:7).

Four radiocarbon determinations on shell were obtained on shell from the site, and were presented in Kay’s (1984) Masters thesis. The raw dates have been recalibrated here using Calib 4.4 (Stuiver and Reimer 1993) and are presented in Table 5.9.

5.7.2 The total shell assemblage

A sample of the shell assemblage was analysed by Kay and presented in her Masters thesis (Kay 1984:140-3). Included was shell from squares 2, 4, 7-ext and 9. The sample is dominated by Trochus niloticus (n=311) (Kay 1984:142), many of which had spires removed, consistent with meat extraction patterns (Best 1981b:8 and pers. comm. October 2003). Following Trochus niloticus in frequency are Asaphis violascens, Saccostrea cucullata and Gafrarium tumidum (Kay 1984:141). In total, Kay (1984:141) identified 31 species. The method of quantification is not elaborated by Kay, and thus it is unclear whether bivalve counts have been differentially inflated by counting both valves.

The total shell assemblage was analysed as part of this thesis. All shell present was included in the analysis. The large Trochus niloticus specimens were left in the field due to their bulk, but the stated total of 311 has been included in final calculations here. Thirty-four species were identified within the total shell sample. Species represented by three or more individuals are graphed in Figure 5.91. While other total shell assemblages discussed so far represent a fine-grained collecting strategy, where no particular species stand out as being focused upon, Naigani clearly diverges from this pattern. The
species diversity is lower than either Kamgot or Nenumbo, though this at least in part relates to the fact that the Naigani sample is only one-fifth the size of the Nenumbo shell sample, and many times smaller than that analysed for Kamgot. The relative utilisation of niches for gathering shell is graphed in Figure 5.92. The reef-flat intertidal environment clearly dominates, due largely to the high numbers of *Trochus niloticus*. If *Trochus niloticus* is removed from the calculations, the input from silty sand/mangrove environments nearly equals that of the intertidal reef-flat, with a slightly more minor contribution from clean coral sand environments.

In the context of Naigani, these results are interesting. The site is situated close to both coral sand and mangrove environments (Best 1981b:3-4), but a clean, hard reef-flat environment is not mentioned by Best as being located in the vicinity of the site. The island has a fringing reef, and its resources are “by repute ... said to be extensive” (Best 1981b:3). Thus, it appears that in addition to exploiting local littoral habitats, shellfish were also being collected from further afield. This conclusion is supported by the conspicuous presence of the freshwater bivalve *Batissa violacea*, which could not have occurred on Naigani Island naturally, due to the fact that the only fresh water on the island is spring-derived.

The spatial patterning of molluscs, and *Trochus niloticus* in particular, was both recorded and commented upon by Best (1981b). He notes (Best 1981b:16) that *Trochus niloticus*:

“...tended to occur in groups throughout the site together with a few stones, and occasional patches of what is taken to be a grey ash.”
Such patterning has not been observed at other Lapita sites discussed within this thesis, and discrete cooking and dumping events are suggested. This information, together with observations regarding exotic lithic material, ceramic temper, and shell, may indicate that Naigani was not a permanently inhabited village site – as sites such as Kamgot and Nenumbo are interpreted to be. Evidence for the manufacture of pottery, lithic artefacts and shell artefacts, however, indicate the site was something more than a transitory habitation. The answer, on the current evidence, would seem to lie somewhere in between though high mobility is indicated by the evidence.

5.7.3 The worked shell component

As with Site 13A, the range of shells selected for working at Naigani is restricted, with Conus spp. being overwhelmingly dominant. The results from the midden analysis indicated that environments supporting the species of Conus present were being regularly exploited by the residents of Naigani. Shell species utilised for working are outlined in Table 5.10.

5.7.3.1 The Trochidae

Despite the dominance of Trochus niloticus within the shell midden sample, there is little evidence of the species being worked, and no finished/near-finished artefacts are present. Only three pieces of body whorl from near the aperture show crushing linked with direct percussion. Whether this action was related to working or to meat extraction, however, is unclear.

5.7.3.2 The Conidae

There is clear evidence for the production of narrow Conus spp. rings within the Naigani worked shell assemblage, with a focus upon Conus litteratus and
Conus leopardus. There is evidence for reduction of the whole shell using a
direct percussion technique (see Figure 5.93 and Figure 5.94), but no evidence
for reduction by cutting. As at other sites, the detached Conus spp. spires were
ground on both body and outer spire faces – apparently in that order (see
Figure 5.95). The distinct domed profile of the specimen illustrated in Figure
5.96a demonstrates that the smoothing of the spire surface was not always
done by grinding flat on one facet on a grinding stone. The inner whorls were
removed by chipping with a sharp point, and this can be clearly seen in Figure
5.96b (see also Figure 5.98b).

While the Conus spp. ring chaîne opératoire matches closely that of other
Lapita sites to this point, there is a step within the Naigani Conus spp. sample
that is not in evidence elsewhere. While broken, unfinished rings across the
various samples make it clear that the removal of the second whorl and the
smoothing of the inner surface were the final steps in ring production, evidence
of the smoothing and rounding of the external perimeter while at the preform
stage is generally lacking. The Naigani sample has three examples of this
stage, with Figures 5.97a and 5.98a showing facets where sharp corners have
been partially ground down, and the ring preform in Figure 5.97b showing a
finished exterior and unfinished interior.

A selection of finished Conus spp. rings are illustrated in Figures 5.98c
and 5.99a-e. Figure 5.99e shows the sole example, across all the Lapita
samples, of a Conus spp. ring with a triangular cross-section that is firmly
provenanced to Lapita levels. All rings at Naigani are very narrow (see Figure
5.101). Diameters are likewise small (see Figure 5.102). Three examples of
small Conus spp. rings are contained within the Naigani worked shell sample.
These are illustrated in Figure 5.100a-c. The form and finishing coincides with
that of larger rings, however the lack of a full chaîne opératoire means that an identical production method cannot be confirmed.

The two ground Conus spp. spires illustrated in Figure 5.100a and b, and it is possible that they shed light on small ring production. The spires of an unidentified Conus species and a Conus marmoreus have been detached from the bodies and ground on both faces. Both have central perforations. Although ‘ground and perforated Conus spire discs’ are a reported Lapita artefact type (Spriggs 1997:88), it is possible that these represent the blank stage of Conus spp. small ring production.

Ten small Conus spp. beads were contained within the Naigani sample – four of which are pictured in Figure 5.103 and 5.104. Many of the specimens are well worn, and there is no obvious evidence – such as that noted for St Maurice-Vatcha – of bead production on-site. Less worn specimens indicate that the central perforation was made by chipping with a sharp point. In contrast with St Maurice-Vatcha, smaller species of Conus were used as a raw material, and the whole spire was utilised.

5.7.3.3 The Tridacninae

There is some evidence for the working of Tridacna spp. at Naigani, with cutting, grinding, drilling and abrasion techniques all observed. Figure 5.105a shows a hinge fragment of a large valve of what is probably a Tridacna maxima. The valve itself is eroded and has seen significant damage through the action of clionid sponges. The cardinal hinge tooth has been cut all the way across. The purpose of this cutting is unclear, but this section of the valve is used for the manufacture of Tridacna long units; two examples of which are present at Naigani. These artefacts are discussed below further.
Two fragments of *Tridacna* spp. ground on three facets are clearly broken sections of a larger artefact/s (see Figures 5.105b and c). The two main facets of each are ground at right angles with a central facet smoothing the corner between the two. This pattern does not coincide with either ring or adze production witnessed at other Lapita sites.

The final two worked pieces of *Tridacna* spp. are long unit preforms. The example illustrated in Figure 5.105e shows that the hinge portion of the shell was used for blank creation. Both specimens are well ground and abraded, and drilling has begun at both ends of the example shown in Figure 5.105d.

While *Tridacna* spp. were definitely being worked at Naigani, employing a number of techniques, the roster of finished/near-finished artefacts is few. This is another possible indicator of sporadic or ephemeral occupation at Naigani.

5.7.3.4 Worked shell of other taxa

Two additional worked shell artefacts were not manufactured from the taxa discussed above. The first is a whole *Terebra maculata* with the apical whorls of the spire removed (see Figure 5.106a). This pattern coincides with that seen on a single specimen in the Nenumbo sample. The provenance for this artefact is not securely Lapita as it is from a square at the top of the dune where the Lapita layer is thinnest. Despite this, the occurrence of a similar specimen from the lower levels at Nenumbo strengthens a Lapita association. The second artefact is a piece of *Pinctada cf. margaritifera* valve, which has been cut along five edges (see Figure 5.106b). The cuts do not penetrate all the way through the shell but are partially cut and then snapped. This technique appears to limit irregular breakage and guide fracture perpendicular to the shell microstructure.
5.7.4 Summary of results

The Naigani worked shell sample shows a clear focus on the working of Conus spp., supplemented by more a limited use of Pinctada cf. margaritifera, Terebra maculata and Tridacna spp. Conus spp. rings are present in a variety of diameters and cross-sections, including ‘mini-rings’ and a single example of a triangular cross-section. A full chaîne opératoire for ring manufacture is also present. Conus spp. beads are present, but there is no evidence for their production on-site.

5.8 Summary of Lapita shell-working practices

There are a number of major observations regarding Lapita shell-working practices that can be made on the basis of the analyses presented here. Most prominently, these relate to patterns in the collection and selection of raw materials, commonalities in the working of the various major taxa, and strongly-directed ideas about the range of formal artefacts to be produced. These patterns combine to establish clearly that Lapita shell-workers had specific and shared ideas about which artefacts to produce, and how they should be produced. Despite these clear trajectories there is also diversity and difference. This is evident both between individual sites and as a cline along west-east/early-late lines. I will further elaborate on each of these general observations respectively.

5.8.1 Raw material selection and collection

Given the sheer number of molluscan species that inhabit the tropical Indo-Pacific region, it is notable that only a few are selected as raw materials for working. Furthermore, these choices are highly uniform from site to site.
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*Conus litteratus* and *Conus leopardus* consistently dominate Lapita worked shell assemblages, with *Conus marmoreus*, *Conus eburneus*, *Conus virgo*, *Tridacna* spp., *Trochus niloticus* and *Pinctada* spp. rounding out the list of major raw materials. All these species are associated with either clean coral reef environments or weedy coral sand, and worked shell assemblages like that at Site 13A demonstrate that even when these environmental niches were not represented in the immediate area, efforts were made to obtain the ‘correct’ species for artefact production.

Where clean coral reef or weedy sand environments were local – as indicated by results of the midden analyses – there is little to suggest that strategies for gathering molluscs for subsistence purposes differed from those employed for the collection of shells destined for working. Worked specimens and associateddebitage rarely display evidence of post-mortem collection, with notable exceptions being the naturally-formed *Conus* spp. beads from Nenumbo and worked shell of the pelagic Nautilidae. Given the apparent overlap in shell-gathering approaches related to subsistence and artefact production, it is difficult to determine whether worked specimens potentially represent secondary use of midden shell. Even if this is the case, however, it is apparent that selection procedures are no less stringent, and materials are not selected simply because they are near to hand.

### 5.8.2 Shell-working techniques and protocols

Consistency, as seen in the selection of raw materials, is also a major theme in the application of certain techniques and protocols in Lapita shell working. This consistency works on two levels: in the various techniques employed when
working specific raw materials, and in the broader chaîne opératoire associated with particular artefact types.

All the major taxa utilised for artefact production have a distinct range of associated working techniques. These relationships seem to be at least partially linked to the structure and mechanical properties of the various materials themselves. Thus, direct percussion is dominantly associated with those taxa having crossed-lamellar microstructures, such as Conus spp. and Tridacna spp. Pressure flaking and/or indirect percussion, on the other hand, is primarily associated with those taxa having a composite prismatic/nacreous microstructure, such as Trochus niloticus and Turbo marmoratus. It is likely that the zig-zagging fracture paths, with their tendency to dissipate energy, seen in crossed-lamellar structures make the application of blunt force less risky than with prismatic microstructures, where straight cracks can travel for some distance uninhibited, or nacreous microstructures that crack and splinter unpredictably (see discussion in Chapter 4, section 4.3.3; 1: The Turbinidae). Thinner and more brittle nacreous shells, such as those in the Pteriidae and Nautilidae, were dominantly worked through cutting.

These techniques and taxa associations are chiefly relevant in the context of primary stages of reduction. Secondary techniques, such as grinding and abrading, were applied broadly to a range of different taxa exhibiting a variety of microstructures. Given that these latter techniques are not applied to effect breakage, but rather are finishing and shaping techniques, it is understandable that they are not closely aligned with specific microstructures.

The chaînes opératoire applied to create particular artefacts represent more complex procedures, where techniques and gestures are combined in particular ways. It is at this level that the cohesiveness of Lapita shell-working
is most apparent. Due to their dominant status numerically in all Lapita assemblages, artefacts in *Conus* spp., and their associated *chaîne opératoire*, provide the most robust and clear examples of this unity.

Whether for the production of rings, perforated discs or beads, the initial stage of working always involves the separation of the posterior of the shell from the anterior/body. This process was effected either through direct percussion or cutting. While the former is the more commonly-applied technique, evidence of the latter is seen within the worked shell samples from Kamgot, Site 13A, and St Maurice-Vatcha. I have suggested that the more labour-intensive process of cutting was applied primarily in the manufacture of broad rings, where blank creation was an inherently riskier process than for narrow rings. Cut edges, however, are also evident on small *Conus* spp. specimens at St Maurice-Vatcha, where the final artefacts could not have been broad rings. The reasons for the use of cutting in this circumstance are unclear.

Subsequent to the separation of the anterior and posterior portions of the shell, grinding of opposing faces of the posterior/spire portion ensued. This is the case for rings, discs and beads. Following grinding, as much of the central spire surface was removed as required to generate the finished artefact. Thus, for beads and perforated discs only a small central hole was made, whereas for rings most of the spire was removed. While the small central perforations seen in beads and perforated discs were frequently created through drilling, chipping at the whorl sutures along natural lines to remove sections of shell was also common. This latter technique is also that seen in the production of broad and narrow rings. Abrasion of inner and outer surfaces to give a smooth and regular finish was the last action performed to make the artefact ready for use.

Curation techniques, in the form of perforating the corners of broken broad ring
fragments, are also consistently replicated between Kamgot, Nenumbo, Site 13A and St Maurice-Vatcha. This broad chaîne opératoire, and the physical evidence that indicates its application, is seen consistently from one Lapita site to the next.

Although the evidence is patchier, repetition of chaîne opératoire across several of the sites can also be observed in the production of Trochus niloticus fishhooks, and Conus spp. adzes. The low levels of identified manufacturing debris associated with Tridacna spp. artefacts and Trochus niloticus rings mean that definite conclusions as to similarity or difference in chaînes opératoire cannot be assessed.

5.8.3 The Lapita shell artefact suite

The consistency seen in raw material choice, the application of particular working techniques, and the chaînes opératoire followed from site to site, is reflective of strongly allied approaches to shell-working across the Lapita spatio-temporal range. This unity is further echoed in the similarity in composition of Lapita shell artefact assemblages from the various sites. Narrow Conus spp. rings constantly dominate, with Conus spp. broad rings and beads, Trochus niloticus fishhooks and rings, and Tridacna spp. rings, adzes and perforated units rounding forming the bulk the list of repetitively-occurring artefacts. Despite the strong recurrent features, however, there is also observable diversity in and difference between various shell artefact assemblages. This manifests both as a spatio-temporal phenomena and a marker of localised variation in practice.
5.8.4 Diversity and difference in Lapita shell-working

As with the recognition that the suite of motifs employed in the decoration of Lapita dentate-stamped earthenware, and the diversity of vessel forms produced, contract as the Lapita period progresses (see Anson 1983; Summerhayes 2000a), diversity and variation in shell artefact assemblages also appears to reduce. Thus, the Kamgot assemblage is characterised by the greatest diversity in raw materials, artefact forms, and manufacturing techniques. Artefacts in *Turbo marmoratus* as well as the presence of worked *Nautilus* spp. and *Spondylus* sp. testify to this. Naigani and Site 13A, on the other hand, are strongly focussed on the production of artefacts in *Conus* spp. with artefacts produced from other taxa making up only a minor component. While this may, to a certain extent, be linked to sample size, this narrowing of focus is also seen in large eastern Lapita assemblages such as that recovered by Poulsen (see Poulsen 1967, 1987) while smaller samples in the west, such as Nenumbo, retain a high level of diversity.

While some artefacts forms, such as *Trochus niloticus* fishhooks, become less common and finally drop out completely by the late Lapita phase, and some raw materials, such as *Turbo marmoratus* and *Nautilus* sp., also fall into disuse, other raw materials and techniques increase in importance with the move into Remote Oceania. Examples include the utilisation of *Pinctada* spp. and *Isognomon* spp. as raw materials, and the decoration of narrow *Conus* spp. rings through grooving or engraving.

In addition to these broad trends that see ideas about shell-working change across space and through time, local innovations can be observed within particular samples. The reuse ofdebitage generated in *Conus* spp. ring manufacture for the production of *Conus* spp. beads at St Maurice-Vatcha is
one such innovation. Unique artefacts in Conus spp. at Vao also attest to a culture of experimentation and innovation. While idiosyncratic traits observed within specific assemblages may not, at present, give major insights into relationships and culture change within the Lapita period, further detailed analysis of manufacturing techniques will allow us to achieve a degree of resolution that may highlight very particular spatio-temporal relationships and, with it, the networks and pathways of the movements of ideas.
6.1 Introduction

Shell artefacts – and those of *Tridacna* spp. in particular – have received consistent attention within the Philippine literature (e.g. see Fox 1970:64-5; Alba 1998; Ronquillo 1998). On the whole, this focus is due to the perceived importance of these artefacts for establishing an Austronesian migration, and thus antecedents for what is an important class of artefact in the Pacific. Despite this attention however, there is no cohesive picture of shell-working across the Island Southeast Asian region as a whole. While I certainly cannot synthesize neolithic and pre-neolithic shell working traditions across all of Island Southeast Asia here, I have attempted to select sites that offer the broadest possible cross-section of practices across space and through time. I have also explicitly incorporated assemblages that have featured prominently in the hypotheses of various scholars.

Arku Cave, Uattamdi, and Golo Cave have all been discussed and interpreted by Peter Bellwood; the former two within the framework of the Austronesian expansion hypothesis (e.g. Bellwood 1997:220-1, 229; Bellwood 1992). Material from all three sites has been incorporated into my analysis. Worked shell from Kamuunan Shelter has been used by Solheim to argue for a *Nusantao* trading network and an early horizon of shell-working across central Island Southeast Asia (Solheim 1984-5; Solheim *et al.* 1979), and this material has likewise been incorporated. The site of Duyong Cave in central Palawan,
the Philippines, has received considerable attention due to the presence of *Tridacna* spp. adzes (Fox 1970; Ronquillo 1998). Two adzes from this site have been analysed here along with a small sample of *Conus* spp. artefacts. Ille Cave and Shelter is a new site presently being excavated by the National Museum of the Philippines and the Archaeological Studies Program at the University of the Philippines under the directorship of Wilhelm Solheim. This is a complex cave and shelter site of considerable importance, and shell (worked and midden) from the first three seasons of excavation is presented here. The remaining sites are all located on Palawan Island in the southwestern Philippines. This area has long been recognised as a centre for shell-working by Philippine archaeologists, and artefacts from sites in this region form the main body of regional syntheses (e.g. Alba 1998).

While full shell data could be presented for most of the Lapita samples analysed, this was not achievable with the majority of samples from Island Southeast Asian sites. Midden was only available for analysis for Ille Cave and Shelter. For all other sites, either discussion of previous reports on midden material or a critical appraisal of the surrounding environs and potential mollusc-bearing niches has had to suffice. Furthermore, many sites covered within this section are burial sites, rather than the open habitation sites that characterised the Lapita samples. Thus, midden and working debris are often not present. Given this, the construction of *chaîne opératoire* for artefacts was impossible for many artefacts/samples. I have attempted to extract the maximum information from the material available to me, and in many instances, inferences regarding working derived from an analysis of the finished artefact was the only realistic option.
6.2 Arku Cave: Shell assemblage and artefacts

6.2.1 Background and context

Arku Cave is in a limestone area, and is situated between the Tuguegarao River (a tributary of the Cagayan River) and Sierra Madre ranges in northeastern Luzon Island, the Philippines (see Figure 6.1). Dr Barbara Thiel excavated the site as part of her doctoral research (Thiel 1980). The cave is 60m long and varies in width between 12 and 20 metres (Thiel 1980:57). Surface evidence of human use included earthenware sherds and human bones as well as material turned up from lower levels through the activities of ‘pot-hunters’ (Thiel 1980:58). In total, nine 2m x 2m squares were excavated by Thiel, with all material being screened through a 1.5mm mesh (Thiel 1980:58, 61) (see Figure 6.2). Excavation units followed the natural stratigraphy, but were subdivided arbitrarily when natural layers exceeded 15cm in depth (Thiel 1980:61).

No evidence of habitation was uncovered by Thiel. Rather, the cave was primarily used for burials, all of which Thiel interprets as secondary (Thiel 1980:63). While some were jar-burials, most of the human bone material was found scattered through the deposits. Some bones were observed to have a haematite coating (Thiel 1980:66-70).

Aside from human remains, quantities of earthenware were recovered in a range of finished and vessel forms. Large red-slipped pots were used for jar-burials, while stemmed ‘chalices’, bowls and jars also figured in the general assemblage (Thiel 1980:66-71). Grave goods in shell, stone, jade and fired clay were also recovered, most falling into classes associated with personal

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40 ‘Pot-’ or treasure-hunting is a widespread issue for archaeology in the Philippines, with many sites being disturbed and/or looted before, after, or even during excavation.
adornment such as beads, rings and lingling-o\textsuperscript{41} (Thiel 1980:71-3). Bone and
lithic artefacts, as well as spindle whorls, were also identified in small quantities
(Thiel 1980:73-5).

Six radiocarbon determinations were obtained on charcoal from various
contexts, and are summarized in Table 6.1. Despite the fact that all bar one of
the dates are from the regionally-infamous Gakushuin laboratory (see Spriggs
1989:604 for a commentary on the 'Gakushuin effect'), Spriggs considers that
more recent dates (post 7000 series) are not inherently problematic. Thiel's
(1980) dates fall into this category – albeit marginally. One date (GaK-7039)
was rejected by Thiel (1980:67, 76) due to an unacceptably large error caused
by a paucity of carbon in the sample. The remaining five dates fall comfortably
within a range from 1728 B.P. to 3479 B.P.

6.2.2 The total shell assemblage

Due, presumably, to its use as a burial cave, no shell midden was recovered
from the Arku Cave deposits. While the site is located close to freshwater
resources in the form of the Cagayan River and tributaries, it is presently over
50km from the sea. Thus, artefacts produced from shell – or at least the raw
materials – would have had to come from some distance away.

6.2.3 The worked shell component

Thiel (1980:71-3) lists shell artefacts recovered from Arku Cave, including
'bracelets'/rings, beads, 'earrings'/lingling-o, a shell disc and a shell pendant.
No details of raw materials are given in Thiel (1980), but the disc is identified as

\textsuperscript{41} 'Lingling-o' are distinctive circular ornaments with a split for attachment and carved or
moulded projections around the exterior. Occasionally they feature carved animal heads. The
same ornament type occurs in southern Dongson and Sa-huynh sites in present-day Vietnam
(Solheim 2002:170, 182).
Conus sp. in Thiel (1984-5:122). A sample of recovered ring fragments from Arku Cave was made available for study in Manila by the National Museum of the Philippines. The other artefacts mentioned by Thiel (1980) were not seen and will not be commented upon further here. Details of analysed artefacts are summarised in Appendix 3.1.

Thiel (1977:16) states that 145 fragments of shell rings were recovered from Arku Cave, which she describes as being “from white or grey shell”. Indeed, raw material identification for the ring fragments is not straightforward and the majority of specimens have no parallels within either this thesis or, to my knowledge, the published regional literature generally. Two distinct types of rings were recognised; a more robust grooved form manufactured from Tridacna spp. and a delicate narrow form manufactured from an unidentified gastropod. In all cases the shell is structurally altered – in most instances due to burning. Indeed, a number of small ring fragments have been burnt black. Others of the narrow specimens were coated in haematite.

The two fragments of Tridacna sp. ring may well come from the same specimen, although they do not refit. Both fragments come from a ring with an internal diameter of c. 6cm and both have a wide, shallow, abraded groove that extends over nearly the whole outer surface of the ring (see Figure 6.3a and b). The sides have been ground flat and the interior surface abraded to a slightly convex form.

The remaining rings are all seemingly manufactured from the same unidentified shell taxon and follow the same design template. One fragment is from the part of the ring where the body and second whorls overlap at the aperture (see Figure 6.3f), indicating that the raw material is a gastropod spire. When a number of pieces were refitted, however, the overall ring morphology
was oval rather than round. This indicates that the circular morphology of the spire was not followed during blank/preform creation. The rings are all small, with internal diameters ranging from 20mm to 40mm. They are also very narrow, with most rings being under 3mm wide. The sides have been ground, and the interior and exterior surfaces are smooth and rounded. All fragments are well polished though rather irregular upon close inspection. This is taken to indicate that the polish is a result of wear rather than grinding or abrasion during the manufacturing process.

6.2.4 Summary of results

While no manufacturing debris or unfinished specimens are present within the Arku Cave sample, some information can be gleaned from finished ring specimens present. To date, Tridacna spp., as a raw material for rings, has not been reported for Philippine Neolithic assemblages. The Arku Cave specimens demonstrate that it was used, though the actual origin of the specimens is uncertain. Whether Tridacna spp. shells were gathered/traded from the coast and brought inland, or whether the artefacts themselves represent networks linking inland and coastal populations cannot be adduced given the lack of reported manufacturing debris in the region. The same observation holds for the second ring type, which was certainly produced from marine shell.
6.3 Leta Leta Cave: Shell assemblage and artefacts

6.3.1 Background and context

The northern Palawan site of Leta Leta has received little attention in archaeological literature outside the Philippines\(^{42}\). Its importance, however, is well known to Filipino archaeologists and it is officially recognised as a ‘Site of National Importance’. The site was first recorded as ‘C-67’ by Carl Guthe who made a small collection of surface artefacts. These artefacts, still housed in the University of Michigan Museum, were incorporated in Solheim’s doctoral work (Solheim 1964). While Solheim originally believed Leta Leta to be an early site within the Metal Age ‘Bau’ ceramic series, later revisions (Solheim 2002:176) prompted agreement with the later findings of Fox (1970) that the ceramics were an early expression of the Neolithic ‘Tabon Pottery Complex’. More specifically, Solheim (2002:178) sees Leta Leta as possibly representing the earliest expression of the ‘Novaliches Pottery Complex’, distinctive for its high, ring-foot bowls with cut-out designs around the foot.

The site was completely excavated by Robert Fox and colleagues from the National Museum of the Philippines in 1965. Due to its location in northern rather than central Palawan (see Figure 6.4), the site was not included in Fox’s (1970) monograph on the Tabon Caves, however numerous references to Leta Leta are made throughout the volume. The absence of a report and/or Fox’s fieldnotes for the site makes the interpretation of stratigraphy and associations at Leta Leta challenging. The original artefact accession records have been made available for this study by the Records Department of the National Museum of the Philippines, and allow some discussion of artefactual and

\(^{42}\) Spriggs (1989:606) alludes to the site, but does not name it.
stratigraphic associations. These records are used here in association with a
short article on the site written for a popular volume (Fox 1977b) and comments
made in Fox (1970).

Leta Leta Cave is located on the eastern face of Langen Island in the
Baquit Archipelago on the west coast of northern Palawan. The site itself is
more a fissure than a cave set in the side of a sheer karst-limestone rock-face
that drops directly down to the sea. This locale makes it rather inaccessible.
The floor slopes sharply from the back of the fissure down to the opening. The
treacherous topography of the site, referred to as “difficult and dangerous” by
Fox (1977b:229), has been aggravated by recent sediment instability caused by
an earthquake in the early 1980s. This earthquake effectively destroyed what
remained of the site\(^\text{43}\).

As at Arku Cave, there is no evidence of habitation at Leta Leta and the
site was used primarily, if not exclusively, for burials. There are none of the jar
burials so typical of other burial sites in Palawan (Fox 1977b:230). Five burials
were excavated including four primary interments and one secondary ‘bundle’
burial where the bones had been gathered and placed together in a grave. One
of the primary burials had been interred in a mound of crushed hematite (Fox
1977b:230) which had coloured both the bones and surrounding grave goods.
As well as highly elaborate, and sometimes unique, ceramic forms a large
number of non-ceramic grave goods were uncovered. These included artefacts
in nephrite jade, shale, quartz, jasper, bone and shell.

\(^{43}\) While conducting fieldwork at Ille Cave on the opposite coast of Palawan I relocated Leta
Leta Cave using Fox’s (1970:plate 14) published photograph of the site. Indeed, it is highly
unstable with negligible cultural material present.
Leta Leta was not dated by Fox, although it appears that he did submit human bone collagen samples to an unknown laboratory\(^{44}\). Instead, he offered a relative age, based on perceived affinities with early Tabon assemblages such as Manunggul Chamber A and Ngipe’t Duldug which dated the bulk of the Leta Leta remains to 1000 -1500 B.C. (Fox 1970:65, 94, 105-7). He believed the haematite-stained burial to be earlier, based on the similarity of both the nature and placement of the grave goods to the single, primary burials unearthed at the central Palawan site of Duyong Cave. The date of 4630±250 b.p. on charcoal deemed to be associated with the Duyong burial (Fox 1970:17) has been called into question by Spriggs (1989:602). Discussion of Duyong Cave and dating difficulties is entered into below in section 6.8. Suffice it to say, there is presently no justification for assigning an earlier date to burial 2 at Leta Leta based on associations with Duyong Cave alone.

As part of my research, two radiocarbon dates were obtained from *Conus litteratus* or *Conus leopardus* shell ring or disc blanks. The dates are presented in Table 6.2. They are consistent and overlap at one standard deviation. They also accord well with Fox’s estimate based on pottery affiliations and constitute the earliest dates for the Palawan Neolithic if the Duyong Cave neolithic dates are rejected (see Spriggs 1989:606-7)\(^{45}\).

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\(^{44}\) This detail appears in the accession records with the samples deriving from the hematite-covered ‘burial 2’.

\(^{45}\) Leta Leta is consistently referred to as a ‘Late Neolithic’ site by Fox. Kress (1977:80) considers ‘Early Neolithic’ sites in Palawan to be Duyong Cave, Guri Cave and Sa’gung Shelter. The case of Duyong has already been mentioned and Sa’gung chronology is discussed later in this chapter. For all three sites, however, it is unclear what warrants their being termed ‘neolithic’, although Kress intimates that this is based on a more ‘diversified economy’ (Kress 1977:81) – namely the presence of shell. It is felt here that this in not enough to qualify a site as ‘neolithic’. 

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6.3.2 The total shell assemblage

As with Arku Cave, there is only worked shell and no shell midden recorded for Leta Leta. Unlike Arku Cave, however, Leta Leta Cave is situated in a coastal location set within the protected environs of Baquit Bay which opens out on to the biotically-rich South China Sea. Mollusc species recorded as raw materials within the Leta Leta deposits would certainly have been available within the surrounding environs.

6.3.3 The worked shell component

The Leta Leta deposits are rich in worked shell. Although a restricted number of artefact types and raw materials dominate, the site contains greater diversity as well as a greater sample of worked shell overall, than any other site in Palawan with the possible exception of Ille Cave and Shelter discussed in the next section (section 6.4). In his writings on the site, Fox (Fox 1970; Fox 1977b) mentions *Conus* spp. rings and discs, shell beads including “sequin-shaped shell discs” and modified *Cypraea* and *Nassarius*, ‘scoops’ of *Melo amphora* and *Turbo marmoratus*\(^\text{46}\) and *Nautilus*, rings in *Trochus* and *Patella* (limpet), and pendants of *Haliotis* (abalone), *Cypraea* and *Strombus*. In her survey of modified shell and bone artefacts from Philippine sites, Alba (1998:52) also mentions the presence of a number of pierced opercula of the small terrestrial prosobranch *Ophisthoporoides quadrasi\(^\text{47}\)*. This is a limestone cave-dwelling member of the regionally-common Cyclophoridae, and this species is apparently restricted to Palawan (Alba 1998:52).

\(^{46}\) Fox (1977b:233) names the species as *Trochus marmoratus*, with both the mistaken genus ascription and spelling error in the species name having been reproduced in later works by various authors.

\(^{47}\) I can find no information on this genus or species. It is possible that genus *Opisthostoma* is being referred to, though opercula of all species in this genus are typically only between 1mm and 0.5mm in diameter.
Chapter 6 – Shell-working: Island Southeast Asia

The National Museum of the Philippines made a sample of worked shell from Leta Leta Cave available for study as part of this thesis. The analysis was undertaken at the Museum in Manila. Worked shell taxa in the analysed sample included *Conus litteratus* and/or *Conus leopardus*, *Strombus* spp. and *Nassarius* spp. Taxa will be discussed in this order.

Forty-nine *Conus* spp. artefacts were analysed, and where condition and degree of working allowed species identification, it was apparent that all were manufactured from *Conus litteratus* and/or *Conus leopardus*. Two formal artefact types were present; perforated discs (n = 13) and both narrow (n = 2) and broad (n = 3) rings. In addition to finished artefacts, a number of blanks (n = 20) and preforms (n = 11) were also present. Specimens have been defined as ‘preforms’ where grinding has begun and ‘blanks’ where there is evidence of percussion but no grinding. The presence of blanks and preforms gives insights into production techniques. The blanks indicate that the body and spire of the shell were separated using direct percussion (see Figure 6.5a and b). After this, the body whorl edge was ground flat (see Figure 6.6a and b), and then the spire was ground flat (see Figure 6.6c). A perforation was then drilled near the aperture (see Figures 6.7a and 6.8a and b) or through the centre. Although the specimens in Figure 6.8a and b have central perforations, these have not been drilled. The central perforation in the specimen shown in Figure 6.8a has been produced by taphonomic deterioration, while that in Figure 6.8b is a consequence of grinding an elevated spire. The perforation of the specimen illustrated in 6.7b is distinct in having been 'scratched' rather than drilled or ground.

Specimens at different stages of working indicate that shells used as raw materials were sometimes collected post-mortem. The specimen shown in
Figure 6.8b has been water-rolled, producing a smooth surface that was then minimally ground on the outer spire face. The specimen shown in Figure 6.5c shows extensive damage by clionid sponges and it is likely that this too indicates post-mortem collection.

While the evidence for Conus spp. disc production at Leta Leta is regionally-rare and consequently illuminating, it is intriguing that this evidence is at Leta Leta at all. As stated above, the site is unstable, inaccessible, and contains no evidence of habitation. Given this, the presence of unfinished artefacts was unexpected. The lack of Conus spp. body fragments indicates that shell-working did not take place at the site. Rather, blanks and preforms appear to have been deposited as grave goods along with finished artefacts. A number of possible interpretations could be given for this – all of which would be highly speculative at present. Such potential interpretations include unfinished artefacts ‘standing in for’ finished ones, blanks and preforms indicating the significance of the production process, or perhaps the significance lies in the worked raw material (i.e. Conus litteratus and/or Conus leopardus) itself. Given the paucity of debitage and general evidence for production methods of Conus spp. artefacts within Island Southeast Asia, and the fact that Leta Leta presently stands alone in containing unfinished Conus spp. artefacts as grave goods, no particular interpretation can be favoured at present.

Five finished and complete Conus spp. rings from Leta Leta were analysed. Of the two narrow rings, one was apparently finished and worn, despite an irregularly-shaped internal surface owing to the fact that the second whorl remained un-abraded (see Figure 6.9a). The second was well abraded on all surfaces, finished and worn (see Figure 6.9b). All three broad rings analysed were recovered from a fore-arm of burial #1. All have been well-
ground on the spire surface, and two were also ground on the body whorl edge (Figures 6.10 and 6.12). The body whorl edge of the remaining specimen (see Figure 6.11) had been abraded rather than ground, and was smooth though sloping and irregular. This latter specimen was the only example with the second whorl removed while the interior surfaces of the other two specimens were smooth though irregular. All three specimens have a drilled perforation near the aperture. While perforations on *Conus* spp. artefacts in the Philippines are generally interpreted as being for suspension/attachment\(^{48}\), this seems not to be the case here given the positioning of the rings on the arm of the body. Rather, it seems that other items/artefacts were suspended from this hole as indicated by differential wear around the perimeter of the hole. No debitage or preforms obviously relating to ring manufacture were contained within the Leta Leta sample.

Broad *Conus* spp. rings are infrequent in Island Southeast Asian sites, with the only examples studied within this thesis deriving from Leta Leta Cave. Figure 6.13 graphs *Conus* spp. ring widths for all examples recovered from Philippine sites studied here. Estimated internal diameters of the same specimens are graphed in Figure 6.14. The rarity of broad *Conus* spp. rings across Island Southeast Asia, as well as their direct association with the dead, is argued here to accord with high value. This is especially so given the other rare, well-finished, and labour-intensive grave goods uncovered at Leta Leta, such as highly unusual ceramics (see Fox 1970:plate 16) and polished nephrite jade adzes.

\(^{48}\) *Conus* spp. discs with central perforations are referred to in the Philippine literature as 'earrings', while discs with perforations near the aperture called 'pendants' or 'chest ornaments'.

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Many hundreds of shell beads were recovered during the excavation of Leta Leta Cave. Fox (1977b:229-30) outlines how the many tiny beads that fell through the cracks of the platforms constructed for the excavation were later screened from sediments below. The beads made of pierced *Ophistophorus quadrasi* opercula mentioned by Alba (1998:52), as well as the small *Cypraea* spp. beads mentioned by Fox (1977b:233) were not part of the analysed sample. Of the remaining bead types cited for Leta Leta, 558 of the "round, thin, and flat shell discs" mentioned by Fox (1977b:233) were individually analysed, and a reconstructed strand of *Nassarius* spp. beads (n = 208) from the public display gallery of the National Museum was also viewed, though not un-strung.

Although disc beads are generally regarded to be manufactured from small *Conus* spp. spires (Alba 1998:52-3), the raw material at Leta Leta Cave has been identified here as *Strombus* spp. The evidence for the manufacture of these beads, present at nearby Ille Cave (discussed in section 6.4), indicates that spires of *Strombus canarium* and probably *Strombus luhuanus* were utilised in manufacture. All the Leta Leta examples have been ground on both faces, with the perimeter most often left in a natural state. The perforation was formed in the process of grinding the conical spire rather than being drilled. Five examples are illustrated in Figure 6.15a-e. Figure 6.15c shows clearly the ground perforation, where, due to uneven grinding of the preform, the hole is at the apex of the spire rather than the centre of the bead. A chaîne opératoire for the manufacture of these beads has been elaborated from evidence at Ille Cave, and will be discussed below (section 6.4.3).

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49 Alba (1998:52) cites *Conus musicus* and *Conus sponsalis* as the raw materials for ground, disc beads. It is not stated, however, to which assemblage(s) she is referring.
Species of the Nassariidae chosen for bead manufacture include *Nassarius arcularius* and *Nassarius pullus*. The dorsum of each shell has been removed by percussion to enable threading/attachment. Specimens are unground.

**6.3.4 Summary of results**

Letla Leta is well known in the Philippine archaeological literature as a unique and important site, and the worked shell certainly follows the pattern of the other material culture classes present. This is not only the sole Island Southeast Asia sample analysed here that has broad *Conus* spp. ring forms, but production evidence for *Conus* spp. discs is also present – despite the fact that they were not manufactured on site. Raw material choice within the Conidae is consistent with only *Conus litteratus* and/or *Conus leopardus* being identified. Shell beads are ubiquitous and group in well with other sites in the region discussed below.

**6.4 Ille Cave and Rockshelter: Shell assemblage and artefacts**

**6.4.1 Background and context**

Ille Cave and Rockshelter is located about five kilometres inland from the eastern coast of northern Palawan (see Figure 6.16). The geology of all of Palawan Island can be characterised as karst limestone, and the Ille site is situated in the base of a tower karst set on the floodplain of the meandering Dewil River. The site was first recorded during a National Museum survey of the El Nido area conducted in 1998. A test excavation conducted by the Archaeological Studies Program at the University of the Philippines, led by Professor Wilhelm Solheim, was undertaken later in 1998. The results of this
testing have prompted a series of small scale excavations at the site incorporating researchers from both the National Museum and University of the Philippines (see Figure 61.7).

At the invitation of Professor Solheim, the midden and worked shell samples from Ille were incorporated into this thesis. Excavated shell, as at May 2002, was studied in Manila. In addition, I participated in the excavation of the 'eastern trench' (Squares N5W3, N6W3 and N7W3) in early 2002. This trench, and associated radiocarbon determinations, form the basis of my discussion of stratigraphy and chronology. It is presently unclear how the stratigraphy in the eastern trench relates to other parts of the site. The same basic layers appear to be in accordance across excavated areas of the site (personal observation) however deposition/accumulation rates vary, meaning that there are major differences in thicknesses of various strata. It is clear that depth alone provides no reliable indicator of association between east and west portions of the site.

Excavation strategies have been varied, though excavation has generally proceeded in 10cm arbitrary spits with most material being screened through small non-standard mesh. The eastern trench was excavated in 5cm arbitrary spits, with all material being dry-screened through 3mm archaeological screens. Additionally, a twelve litre sediment sample from each spit in Square N5W3 was wet-screened with botanical material being extracted by basic flotation.

Excavation methods and results have been presented in more detail elsewhere (Szabó, Swete Kelly and Peñalosa In press).

The uppermost layer across the site is associated with the Philippine Metal Age, with an assemblage including trade ceramics and varied styles of earthenware, glass beads, and metal objects including some gold. A number of primary, extended burials have been excavated from this layer, including two in
the eastern trench. Indeed, nearly every area opened for excavation thus far has produced primary Metal Age burials. The grave digging process means that cultural material from lower layers has been redeposited upwards into Metal Age layers complicating both the radiocarbon chronology (see below) and material culture associations. Underlying the mixed Metal Age burial layer is a dense shell midden comprised largely of freshwater species. This is the lowest level for earthenware and, in the eastern trench, contained only one glass bead. It is considered to represent downward displacement. Below the shell midden layer was a silty-clay layer containing animal bones, shell and lithic artefacts. Cultural material decreased while clay and decaying limestone content increased until solid rock was reached. It is unclear whether this layer represents bedrock or flowstone.

A series of radiocarbon dates were obtained from Square N5W3 and are listed in Table 6.3. The one date from the Metal Age burial layer was rejected as being clearly too old and probably representing grave fill derived from older deposits within the cave. A basal date was also rejected as being too recent and thus not accurately dating the deposits at this depth. The large standard errors on all of the dates obviate the usefulness of any date by itself. Taken collectively, however, there is broad consistency between dates within and between layers, and they can be considered as a general chronological guide. The lack of any dates that would signal a neolithic occupation/use of the cave is somewhat misleading, as direct AMS dates on shell artefacts (presented in section 6.4.5) fall squarely within a neolithic timeframe. I suggest that the proximity of neolithic material to the Metal Age burials above has resulted in

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50 More recent excavations have uncovered deeper cultural layers (Solheim, pers. comm. 2004, Paz, pers. comm. 2004), suggesting this is flowstone or localised cave topography.
extreme mixing of deposits and the masking of a clear neolithic level(s). Such a level may well be present in other areas within the site.

6.4.2 The total shell assemblage

Midden shell was present in varying concentrations throughout the Ille deposits. All midden shell up to, but not including, the April 2002 excavations was analysed as part of this thesis.

Seventy-seven species were identified, with the sample being dominated by fresh and brackish water molluscs. Species represented by twenty or more individuals are graphed in Figure 6.18. The turriculate gastropods show the classic meat extraction pattern for shells of this morphology, with the shell being snapped in half. The only obviously intrusive shells are the terrestrial snails, which occur in low frequencies throughout the deposits. Figure 6.19 graphs the relative contribution of different mollusc-bearing niches evidenced within the Ille shell assemblage. Freshwater and mudflat/mangrove-associated species dominate\textsuperscript{51}, with the nearby Dewil River and its delta being the probable collection source. Terrestrial and clean sand niches are also represented, but contribute less than 1% each. Despite the presence of seventy-seven species overall, this is a rather small total when compared with other large midden samples (e.g. Kamgot, discussed in Chapter 5). On the one hand, this is likely to be a reflection of the restricted range of species available in freshwater environments. On the other, there seems to be a genuine focusing of collecting activities seen most prominently in the mangrove/mudflat sample where larger (e.g. Telescopium telescopium and Isognomon isognomon), more conspicuous

\textsuperscript{51} Faylona (2003) reached similar conclusions based on species identifications and environmental information determined as part of the research presented here.
(e.g. mangrove neritids and larger mangrove-dwelling members of the
Ellobiidae) and colonial (e.g. Gafraarium tumidum) species dominate.

6.4.3 The worked shell component

As a habitation as well as burial site, Ille is exceptional in the region. A wide
range of shell artefacts has been uncovered at the site as well as evidence for
the production of some types. What rather confounds analysis, however, is the
obvious mixing of the upper layers of the site and associated chronological
ambiguities. Given the lack of clear stratigraphic and chronological
understandings both within and between different areas within the site, there is
an issue in separating neolithic from Metal Age and pre-neolithic artefacts and
working debris. In a first effort to get around this, shell artefacts that were likely
to have been manufactured with metal tools were separated out. Three of the
major bead types were then dated directly using AMS techniques. The results
(presented below) have so far confirmed this initial seriation.

Species identified as raw material for artefacts within the Ille deposits are
presented in Table 6.4. All worked shell analysed is summarised in Appendix
3.3. In order, I will discuss the Cypraeidae, Strombidae, Nassariidae, Volutidae,
Columbellidae and Conidae. Remaining taxa will then be discussed together.

6.4.3.1 The Cypraeidae

Four Cypraea annulus specimens with the dorsum removed were identified
within the Ille worked shell assemblage (see Figure 6.20). There is no evidence
of cutting or grinding meaning the dorsa were probably removed by a
percussive technique. If these specimens had been identified within a Lapita
assemblage, where reef-flat shells were well represented in the midden, they
would probably not have been categorised as worked due to the coincidence of

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the breakage pattern with natural fracture and meat extraction patterns. The dominance of freshwater and mangrove-associated species at Ille, however, makes these specimens clear outliers. Their presence at other sites in Palawan such as Leta Leta (discussed above), and Manunggul Chamber B (see Fox 1970:118), in the apparent absence of midden in both cases, strengthens the claim that these specimens are indeed artefactual.

Dorsa of *Cypraea annulus* were not recovered at the site. While this may indicate manufacture elsewhere, shell recovery during excavation oscillated between total recovery and a focus upon large and whole specimens (Solheim n.d.-a Also Kress pers. comm. 2002). Given this, fragments of small cowrie may have been overlooked.

6.4.3.2 The Strombidae

Small, flat disc beads are frequently mentioned in archaeological literature pertaining to Palawan (e.g. Solheim n.d.-a:for Ille and Palawan generally; Fox 1970:107 for Leta Leta and Ngipe't Duldug, 115 and 118 for Manunggul Chambers A and B). Species identifications and anything other than cursory descriptions, however, are rare. The disc beads from Leta Leta Cave were identified as having been made from a member of the Strombidae, and the same type of disc bead, along with manufacturing debris, is present at Ille Cave.

Modified strombids within the Ille deposits belong to two species; *Strombus canarium* and *Strombus luhanus*. The weedy-sand habitat of *Strombus luhanus* has been outlined in Chapter 5, and, given the contents of the midden, would not have been available within usual gatherings environments. *Strombus canarium* prefers a muddy-sand bottom in shallow water (Abbot 1991:35) and may well have been available in the environments of
the Dewil River delta. Six *Strombus canarium* shells were identified within the total sample and all had been modified in the same way. A sharp point had been inserted at the suture line between the second and third whorl. Once the insertion had been made, half the spire was hewn along suture lines. A single blow with a long pointed tool was then delivered to the suture opposite the hewn portion, and the spire came away. The remaining body portion is left whole, except for the hole at the apical whorls and a puncture mark through the inner shell whorls corresponding to the blow delivered for final removal. One such example is shown in Figure 6.21a. The finished beads (n = 29) are manufactured from the apical whorls of the shell. Both faces are ground and, given the naturally elevated spire morphology, a perforation is formed through grinding. The outer perimeter is not ground, though is sometimes lightly abraded (e.g. Figure 6.22b). Given that the perforation is ground rather than drilled (contra Chazine n.d.), size and morphology are variable and dependent upon degree of grinding and original spire morphology. Figure 6.22a and b show three examples of finished *Strombus* spp. beads.

A single *Strombus luhuanus* also had the apical whorls removed in the same manner as *Strombus canarium* specimens, but only after reduction of the body through successive percussive blows around the circumference of the shell (see Figure 6.21b). Such modified *Strombus luhuanus* have been identified from other Palawan sites (Alba 1998:49 and Figure 1), although they are generally categorized as beads in their own right. Chazine (n.d.) pictures modified *Strombus luhuanus* from ‘Upper Duyong’ close to the original Duyong site (Fox 1970 and discussed below) as well as numerous *Strombus*

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52 Identified as *Conus* spp. in the original report. A mix of *Conus* spp. (discs) and *Strombus luhuanus* (beads and reduced shells) is apparent from the photographs.
spp. beads which he has grouped typologically according to perforation
diameter.

It is unclear whether the modified *Strombus luhuanus* is related to bead
production, or whether this working is linked with the production of another type
of unidentified artefact. Only one of the finished beads from Ille is certainly
manufactured from a *Strombus luhuanus*. Dr Susan O’Connor (pers. comm.)
has seen and photographed *Strombus luhuanus* modified in the same manner
being used as spindle whorls in East Timor. This possibility is currently being
investigated by Southeast Asian textile expert Dr Judith Cameron (pers.
comm.).

These flat, disc beads are commonly stated to be a marker of the neolithic
(Fox 1970:115, 118; Solheim n.d.-a). While they are generally associated with
neolithic deposits (though they have been recorded in Metal Age deposits, see
Fox 1970:118 for Manunggul Chamber B), these beads have never been dated
directly. A *Strombus* sp. disc bead was one of three bead types dated directly,
using AMS techniques, as part of this thesis. X-ray diffraction analysis
conducted on all three beads before dating confirmed no detectable levels of
calcite and thus no recrystallization. Dates for the three beads are presented in
Table 6.5. The date for the *Strombus* bead coincides with the earliest date for
Leta Leta, and thus, the earliest firm neolithic date for Palawan. Furthermore,
together with the *Nassarius arcularius* bead it confirms the presence of neolithic
material culture at Ille.

6.4.3.3 The Nassariidae

Four species of nassarid were identified as being modified within the Ille
deposits; *Nassarius arcularius, Nassarius globosus, Nassarius albescens* and
*Nassarius pullus*. All nassarids are nocturnal scavengers that lie buried just beneath the surface in coral, weedy or muddy sand during the day (Cernohorsky 1972:145). There is no reason to suspect that the species present at Ille would not have been encountered during collecting forays to the mudflats.

As with the modified *Cypraea annulus*, there is no evidence of cutting or grinding, with the dorsa having been removed through percussion. Many of the specimens show signs of wear from threading/attachment, which strengthens the case that these specimens are artefactual rather than representing taphonomic or accidental breakage. Thinned and rounded areas of the perforated edge indicating wear are typically situated either in the siphonal canal area (see Figure 6.23b) or towards the suture line of the body and second whorls (see Figure 6.23a).

In all, thirty-one specimens of modified *Nassarius* spp. were identified within the Ille deposits. *Nassarius* spp. modified in apparently the same way have been recovered from other sites in Palawan, including Leta Leta (see above), Ngipe’t Duldug (Fox 1970:107) and Pagayona Cave (Fox 1970:147) – in the latter case associated with iron and bronze. A direct AMS date on a modified *Nassarius arcularius* specimen is presented in Table 6.5. At roughly 2,500 b.p., this form falls comfortably within the late neolithic.

6.4.3.4 The Volutidae

Genus *Melo* takes in most of the largest members of the Volutidae. *Melo* spp. have large, inflated body whorls constructed of thin, brittle shell. All volutids are carnivorous and/or scavengers and are found on sandy or muddy substrates intertidally and sub-tidally (De Bruyne 2003:192). *Melo* spp. may
well have been available in environments regularly exploited by the occupants/utilisers of Ille Cave, however they would not have been common.

‘Scoops’, or fashioned sections of the convex body whorl of *Melo* spp., are a consistent and ubiquitous presence in neolithic Palawan archaeological sites. Several were uncovered at Leta Leta, one apparently serving as a container for powdered hematite. Further examples from neolithic contexts have been reported from Ngipe’t Duldug (Fox 1970:107) and Sa’gung shelter (Kress 2000:305) with Metal Age contexts including Batu Puti (Fox 1970:75) and Tadyaw Cave (Fox 1970:153).

All *Melo* spp. artefacts reported to date from Palawan are apparently finished specimens. As well as finished examples, the Ille deposits contained evidence of *Melo* spp. working. Two finished specimens are present at Ille Cave, with one taking in a quarter of the body whorl and the other about half. The edges have been cut. A further three specimens have a single cut edge, with the other edges having been roughly snapped. An additional four fragments have snapped edges with no evidence of cutting. While the sample is too small to outline a *chaîne opératoire*, the current evidence suggests that the preform was roughly snapped in the first instance, and then tidied by cutting clean edges. Both the overall morphology and thin, brittle nature of the shell mitigate against successful reduction though direct percussion. There is no evidence that snapped edges were initially scored to guide fracture.

### 6.4.3.5 The Columbellidae

The Columbellidae comprise numerous small species that are highly variable both in terms of morphology and coloration (Cernohorsky 1972:132; Fiene-Severns *et al.* 1998:36). The two species represented at Ille are the black and
white patterned *Pictocolumbella ocellata* and the highly variable, multi-coloured *Pyrene scripta*. Columbellids are nocturnal and are found both intertidally and subtidally on clean and weedy sand and among rocks (Cernohorsky 1972:132; Fiene-Severns *et al.* 1998:36). It is unlikely that columbellids would have been encountered on collecting forays to the regularly exploited environments indicated by the midden analysis. This implies that the shells derive from a source further afield.

Five modified specimens of columbellid were identified within the Ille worked shell sample; two of *Pyrene scripta* and three of *Pictocolumbella ocellata*. Modification is minimal, with either one or two perforations being pierced in the body whorl of the shell with a sharp point. Where there is a single perforation, it is on the dorsal shell surface (see Figure 6.24c), while double perforations include one hole in the dorsal surface, and one in the ventral (see Figure 6.24a and b). All perforations are rough and irregular, and have not been drilled.

Pierced columbellids have been reported for ‘Upper Duyong’ by Chazine (n.d.: no page numbers). Although identified as ‘micro-strombus’ in this report, the photograph indicates that they are members of the Columbellidae. A *Pyrene* sp. with a perforation in the dorsal surface is also illustrated within the ‘Bead Type’ inventory constructed from recovered beads of all materials found in archaeological sites throughout the Philippines, although provenance is not given (Santiago 2003:Plate A(1)).

6.4.3.6 The Conidae

The Conidae are represented by two formal artefacts within the Ille worked shell assemblage; ground, perforated spires, and rings. Species identification of any
of the *Conus* spp. artefacts was not possible due to the degree of working in the discs, and the taphonomic condition of the ring fragments. Suffice it to say, that the freshwater and mangrove/mudflat environments exploited for subsistence purposes would not have yielded *Conus* spp. specimens and the raw materials must have been sourced elsewhere.

The ground spires are variable in size with two being manufactured from large species of *Conus*, and one from a medium-sized specimen or smaller species (see Figure 6.26). Both faces have been well ground in all three cases, with light abrasion of the perimeter. Of the larger specimens, one has a drilled hole near the aperture, while the other has a punched hole through the apex where grinding has substantially thinned the shell. The smaller specimen has a drilled, central perforation (see Figure 6.25).

Two ring fragments from the eastern trench are highly eroded. Both have an internal diameter of c. 6cm and may derive from the same artefact. One fragment is so deteriorated that comment upon grinding and cross-section is not possible. The other has a square cross-section with the sides being well ground and the outer surface abraded.

Only two further *Conus* sp. specimens were identified from within the Ille deposits. The first is a water-worn spire with a naturally-formed perforation at the apex. It is not culturally modified, although it may have been purposely collected or used artefactually. The second is a highly eroded anterior section of a large *Conus* sp. shell. Its condition precludes further analysis. The lack of debitage, and evidence of the presence of *Conus* spp. generally, indicates that conids were not worked at the site.
6.4.3.7 Worked shell of other taxa

This discussion of worked shell belonging to taxa not already discussed will be cover three separate categories; worked shell of identified taxa, worked shell of unidentified taxa, and exotic identified taxa present but displaying no evidence of working.

Worked shell where the raw material could be identified encompassed four taxa; Charonia tritonis, Isognomon sp., Spondylus sp. and Vepricardium multispinosum. A single Charonia tritonis, or ‘triton’s trumpet’, was found under a boulder in square N2W12. A small perforation has been knocked or roughly hewn in the second whorl at the suture with the body whorl, as is the common pattern with shell trumpets (personal observation of ethnographic specimens from Papua New Guinea). Abrasion around the edges of this hole indicates wear. Charonia tritonis can be found in shallow water around coral reefs (De Bruyne 2003:140) and thus is not found in a habitat regularly exploited by those who frequented Ille. One other shell trumpet has been recorded archaeologically in the Philippines. This specimen was found at Sa’gung Shelter in central Palawan (Kress 2000:305). The Sa’gung deposits contain a sequence that is argued to span the Holocene with Ming tradewares in the upper portion and the association of the trumpet is not detailed. It has been identified as ‘Muricidae sp.’ (Kress 2000:305), which seems unlikely given the maximum size of even large muricids. If it is not manufactured from Charonia tritonis, as is typical, it may be Tutula bubo in the Bursidae which has ‘muricid-like’ features.

One small valve of a juvenile Isognomon sp. as well as a right valve of a Vepricardium multispinosum have single perforations. In the case of the Isognomon sp. valve, a hole has been drilled through the centre of the valve.
The *Vepricardium multispinosum* has a pierced hole near the umbo that shows abrasion through wear. A single large disc bead, manufactured from a species of *Spondylus* was recovered from the upper mixed Metal Age layer. The preform has been hewn and edges subsequently abraded. Both faces have been ground and the central perforation is drilled.

There is a number of artefacts where species identification has not been possible. These are all associated with the mixed Metal Age deposit and are all formal bead types with the exception of a single shell 'lingling-o'. The bead types, both morphologically and technologically, appear to be of later (Metal Age) manufacture with drilling being done by metal points (see Figures 6.28 to 6.30). They also appear to be of specialised manufacture, with great consistency in form and finishing. One of the common annular disc type (*n* = 180) (see Figure 6.28) was directly dated using AMS techniques. The date (presented in Table 6.5) of post 1000 B.P. indeed indicates a fairly late Metal Age association. As the concern of this thesis is primarily palaeolithic and neolithic shell-working, these late bead forms will not be discussed here. They form the basis of my on-going research focusing on morphological and technological relationships with Metal Age trade beads and associated lapidary techniques.

The shell lingling-o (see Figure 6.27), although undated, may be of neolithic age. No lingling-o in jade or shell have been recovered from clear neolithic contexts in Palawan (see Fox 1970:127), however the Arku Cave data presented above (section 6.2) suggest a probable neolithic occurrence. Early Metal Age examples are most commonly worked in jade, however examples in shell have been recovered from Metal Age deposits at Rito-Fabian Cave (Fox 1970:123), Duyong Cave (Fox 1970:127), Uyaw Cave (Fox 1970:127), Guri
Cave (Alba 1995) and Sa’gung Shelter (Kress pers. comm. in Solheim n.d.-b:31). Fox (1970:164) considers the jade specimens to be of non-Philippine manufacture and the shell examples to be local duplications. Whether of neolithic or Metal Age association, the highly eroded condition of the Ille example precludes comment upon manufacturing techniques.

Fragments with no obvious signs of working, but from non-local taxa frequently identified with shell artefact manufacture, were identified within the Ille shell assemblage. Most notably these include fragments of Trochus niloticus (n = 2), Turbo marmoratus (n = 6), Hippopus hippopus (n = 2) and Tridacna gigas (n = 1). While these fragments are probably related to artefact manufacture, no finished/unfinished artefacts of these species have identified and none of the fragments display clear evidence of having been worked.

6.4.4 Summary of results

The shell assemblage from Ille Cave and Shelter arguably contains a wider range of raw materials and artefact forms than any other site in Palawan. Along with Leta Leta, it is also one of the few that contains evidence for the working of some (though certainly not all) forms and shell species. Interestingly, the two taxa displaying clear evidence of having been worked on-site – Strombus canarium and Melo spp. – were likely to have been locally available, while other taxa would generally have had to come from more distant niches. Whether this reflects mobility of people or artefacts is unclear, although the presence of fragments of non-local Trochus niloticus, Turbo marmoratus, Hippopus hippopus and Tridacna gigas would indicate that more than solely finished artefacts were being moved around.
In contrast to statements made by those such as Francis (2002:202-3) that shell artefacts declined to negligible importance with the Metal Age, the presence of distinctly Metal Age forms at Ille, not so far recorded at other sites in the region, argues for the continuing importance and value of shell. There is no evidence of these later artefacts being produced on site and their source is unclear. The AMS determinations on *Strombus* and *Nassarius* bead forms confirm their neolithic association. As noted by Fox (1970:118, 147), however, their use (and manufacture?) continued into the Metal Age.

The mixing of neolithic and Metal Age deposits at Ille clearly presents chronological and typological problems. Hopefully, further excavation and radiocarbon determinations will clarify some of the present ambiguities.

### 6.5 Paredes Shelter: Shell assemblage and artefacts

#### 6.5.1 Background and context

The Paredes site is situated, along with Leta Leta Cave, on Langen Island near El Nido, northern Palawan (see Figure 6.31). Its location on the island is not stated in known reports and publications. Paredes shelter was located and excavated by Fox in the same field season as Leta Leta (Fox 1966a). Unlike Leta Leta, however, the site had not been previously recorded by Beyer. The Paredes site includes a small, stratified shelter and three nearby ‘grottos’. The grottos were unstratified and all contained material dating to the 17th or 18th centuries (Fox 1970:176). The stratified shelter was excavated by Fox, and was found to contain evidence of three separate periods of use. The uppermost/surface layer of the shelter was comprised of three shroud-wrapped burials with associated material dated tentatively by Fox to the 18th century (Fox
1970:176). A jar burial assemblage was found below this. The presence of a bronze axe and jade indicated a Metal Age deposition (Fox 1970:177). A third layer below this revealed three, primary neolithic burials with associated artefacts of Conus spp. and a Tridacna sp. adze (Fox 1970:177). Fox (1970:177) considered these shell artefact types to indicate a cultural association with neolithic levels at Duyong Cave and thus dated the lower layer to the 'early neolithic'. No radiocarbon determinations were ever obtained for the site.

6.4.2 The total shell assemblage

As with Arku and Leta Leta caves, the main usage of Paredes Shelter was as a burial site. There is no indication of shell midden from Fox's writings or the accession records for the site. My own experience of the El Nido area, however, can testify to the presence of live coral reefs and scattered low-impact sandy bays. Mudflats and mangal are not features of the immediate area.

6.4.3 The worked shell component

Most of the worked shell recovered from Paredes Shelter – as deduced from the accession records – was made available for study as part of this thesis. This included six ground and perforated Conus spp. spires with an additional unperforated example. A modified Melo broderipii was also included.

While Fox (1970:177) suggests that shell artefacts were only found in association with the lowermost neolithic layer, the accession records in Fox's own hand are hazier on this point. Fox (1966a:20) states that the neolithic burial layer began at about 80cm below the surface. The accession records indicate, however, that only three ground and perforated Conus spp. spires
were found at/below this depth in association with the *Tridacna* sp. adze\(^{53}\). These deeper *Conus* spp. spires are illustrated in Figures 6.32a and 6.33c. The third specimen was either not seen as part of this study or is one of the examples without a visible accession number (Figure 6.32b or c, or Figure 6.33a). The two specimens listed as ‘subsurface’ in the accession records, but clearly above a depth of 50cm are shown in Figure 6.33b and 6.34a. These two ‘upper’ specimens have the smallest, neatest central perforations seen and may well indicate the use of a metal drill. All specimens have been ground flat on both faces, though differing degrees of wear mean that some examples have slightly convex surfaces along with a sharply-angled periphery.

The accession records note only the presence of two distinct cultural assemblages corresponding to the two upper layers of the site. All the shell artefacts, then, are linked with ‘Jar burial assemblage 2’. What seems likely is that Fox separated the middle and lower assemblages retrospectively, and associated material culture was assigned to assemblages on the basis of a combination of depth and typology. Given this, as well as evidence from other Palawan sites, some of the shell artefacts may well be associated with the middle layer/jar burial assemblage.

Two modified *Melo* spp. shells were noted by Fox in the accession records, with the two being found together and bearing the same accession number. They were both recovered at a level above 50cm in depth, and therefore have a possible Metal Age association. One of these specimens was analysed here, and is illustrated in Figure 6.34b. While Fox calls this artefact a ‘scoop’ in the accession records, I would argue that the specimen represents an unfinished artefact or ‘reduced shell’. Unlike finished examples of *Melo*

\(^{53}\) This artefact was not seen/analysed for this study.
artefacts elsewhere, none of the edges have been cut or abraded. The inner
whorls have been removed by a process of chipping and snapping leaving only
the body whorl and the spire. Such techniques employed in initial stages of
working have been noted for Ille Cave and Shelter (above). If this indeed
represents an unfinished artefact utilised as a grave good, it groups well with
Conus spp. blanks and preforms recovered from nearby Leta Leta.

6.5.4 Summary of results
There is no evidence of artefact production at Paredes Shelter, however the
presence of a probable unfinished artefact as a grave good is an indication that
the pattern noted at Leta Leta is not confined to that site (or Conus spp.) alone.
Conflicting statements made in the extant reports and accession records make
chronological commentary difficult, however the lowest cultural level seems to
be neolithic. That it is 'early neolithic', on the basis of comparisons with the
single neolithic burial at Duyong Cave, would require confirmation by
radiocarbon dates. The paucity of recovered Tridacna spp. adzes, coupled with
generally uncertain or contentious contexts (see Spriggs 1989), means that they
are presently of little use as a chronological marker. The remaining Conus spp.
and Melo spp. artefacts do not, by themselves, firmly indicate a neolithic date let
alone an early one.

6.6 Sa’gung Shelter: Shell assemblage and artefacts

6.6.1 Background and context
Sa’gung Shelter was originally located by Fox during surveys of the areas
around Lipuun Point and the Tabon Cave complex (Fox 1966b:6). A quick test
excavation confirmed to Fox that Sa’gung Shelter was "without question the most important site next to Tabon Cave itself found in the Quezon area" (Fox 1966b:6). The site was excavated in the late 1960s by then graduate student Jonathan Kress (Fox 1970:50) and papers containing information about various aspects of the excavation have been published (e.g. Kress 1977; Kress 1980; Kress 2000). A diagrammatic plan of Kress’ excavation is shown in Figure 6.36.

Sa’gung is a 33m by 5-6m shelter formed by an ancient collapse of a section of limestone cliff in the Quezon area of central Palawan (Kress 2000:290) (see Figure 6.35). At least three major cultural layers are present. The lack of remains of the mouse deer (Tragulus nigricans), which went extinct on the Palawan mainland near the end of the Pleistocene, indicate a Holocene sequence for Sa’gung. On lithic typological grounds, Kress (2000:290) favours an early Holocene date for the lowest cultural layer and, in earlier publications, has linked the lithic assemblage of this lower layer with the Asian mainland Hoabinhian (Kress 1977:81). Doubts regarding this interpretation have been expressed by later authors (Pawlik and Ronquillo 2003:84). Two radiocarbon dates have been reported for the upper two cultural layers of the site, and these are presented in Table 6.6. Three flexed burials were excavated from the layer ascribed by Kress (1977:81) to the early neolithic, with two further flexed burials being excavated from the pre-neolithic layer. The label of ‘neolithic’, as with Paredes Shelter, has been attributed by the excavator on the basis of the presence of edge-ground tools and a more diverse array of faunal remains.

6.6.2 The total shell assemblage

Kress (1977:80) refers to Sa’gung as a ‘shell midden site’, and indeed much in the way of shell midden was recovered. No midden was seen/analysed as part
of the research presented here, but Kress (2000) contains species
identifications and quantitative data for column samples of shell (50cm²) taken
from two locales within the site (square 16F and a non-extraction portion at the
juncture of squares 8E and 9F – see Figure 6.36). The column samples were
analysed in arbitrary 10cm units.

In total, sixty-five species argued to be related to subsistence were
identified from the Sa’gung deposits (Kress 2000:309). Despite this diversity,
the assemblage was dominated by a small group of species – most prominently
Placuna placenta, Geloina coxans and Anadara granosa. Frequencies of
these and other species are not constant throughout the three identified cultural
layers. Generally speaking, Placuna placenta and Anadara granosa dominate
the shell assemblage in the lower two units and decline in the upper unit, while
Geloina coxans shows the inverse pattern (see Kress 2000:320). Kress
interprets these data as representing the steady expansion of mangrove
environments at the expense of estuarine and lacustrine habitats (Kress

6.6.3 The worked shell component

Kress (2000:305) briefly mentions some of the shell artefacts recovered from
excavations at Sa’gung Shelter. These include artefact(s) in Melo diadema, a
‘Muricidae’ shell trumpet alluded to in the section on Ille Cave and Shelter
above, and “almost a dozen” Conus moreletti shells “strung into a necklace”
(Kress 2000:305). The sample made available for study here by the National
Museum of the Philippines did not include any of the artefacts listed by Kress.
Shell artefacts studied here include ground and perforated Conus spp. spires,
Conus spp. rings, abraded and perforated discs/beads of Conus sp. and an
unidentified bivalve, and three modified shells with hewn holes. These artefacts are itemised in Appendix 3.5.

The ubiquitous ground and perforated *Conus* spp. spire is represented by five specimens in the analysed sample. All have drilled perforations near the aperture (see Figures 5.37a-b and 6.38a-c). One example also has a central perforation (see Figure 6.38c) which appears to be the product of abrasion/thinning of the apex as a part of the grinding process rather than drilling. The larger specimens have been ground flat on both faces, while the smaller specimens have been ground flat on the inner spire face only with the outer face convex but abraded smooth. In the absence of accession records for this site, it is unclear how the depths at which the artefacts were found relate to the three cultural layers outlined by Kress, and thus little comment can be made regarding chronology or temporal associations.

A complete *Conus* sp. ring and two further ring fragments were present in the analysed sample. The two ring fragments show evidence of having been ground flat on both edges with the outer and inner surfaces abraded (see Figure 6.39a and b). Cross sections are roughly plano-convex. The complete ring may be unfinished (see Figure 6.39c). Certainly, abrasion is not as extensive as seen in the fragments. All edges are sharp, and the inner surface still shows traces of the second whorl around the entire inner perimeter. The widths and inner diameters of all three specimens have been plotted, together with other *Conus* spp. ring fragments from Palawan, in Figures 6.13 and 6.14 respectively.

One further artefact manufactured from a species of *Conus* was present in the analysed sample. A small disc/bead taking in the apical whorls of the spire was ground on the outer spire face (see Figure 6.40c). This grinding had produced a central perforation. The outer edges are rough, and it is clear that
the specimen is broken. Whether this is a smaller artefact worked using the same techniques as applied to larger ground *Conus* spp. spires, or whether it is the centre of a larger, broken artefact is difficult to determine.

As with Ille Cave, the results of the midden analysis indicate that *Conus* spp. would not have been encountered on regular collecting forays. Mobility of artefacts, people, or raw materials is suggested instead.

The analysed sample contained four further artefacts utilising three taxa. A hewn, ground and perforated disc manufactured from an unidentified bivalve is illustrated in Figure 6.40b. The central perforation is drilled. The remaining three specimens are all bivalves with hewn holes. Two specimens are of the estuarine bivalve *Geloina coaxans* (see Figure 6.40d). The holes have been formed through a combination of chipping and rough cutting with all working initiated from the outer surface of the shells. The third specimen is a modified valve of *Placuna placenta* (see Figure 6.40a). The longest edge has been cut, while a notched area has been cut more roughly. All other edges have been snapped. A hole has been hewn through the valve using a combination of chipping and rough cutting. All working has proceeded from the inner surface of the valve. Both *Placuna placenta* and *Geloina coaxans* are common within the midden suggesting they would have been commonly available in the surrounding area. *Placuna placenta* frequencies within the midden are variable and Kress (2000:322) suggests that the species may have been collected for reasons other than or in addition to its nutritional value. Indeed, one of the graves was lined with shells of *Placuna placenta* (Kress 2000:322).
6.6.4 Summary of results

There would seem to be two distinct strands of shell-working/shell artefact use and deposition taking place at Sa’gung Shelter, as evidenced by the small sample studied here. On the one hand, there is the presence of Conus spp. artefacts in forms seen commonly throughout Palawan. Conus spp. are scarce within the midden, and indeed the midden analysis indicates that Conus spp. were probably not locally available. This means that the artefacts or raw materials were sourced from further afield. Secondly, there is evidence of species collected locally being modified in less standard ways. This may or may not represent reworking of midden material.

The Sa’gung evidence might suggest that the skew of neolithic sites on Palawan towards burial rather than habitation contexts is distorting our view of early shell-working, i.e. it is possible that ‘everyday’ shell-working differs markedly from artefact production for grave contexts. On the other hand, evidence for shell artefact production at Ille Cave accords well with artefacts commonly found in burials, and modified ‘midden’ species are rare. The location and excavation of further habitation sites on Palawan may shed further light on this issue.

6.7 Batu Puti: Shell assemblage and artefacts

6.7.1 Background and context

Batu Puti Cave is one of the many caves that honeycomb Lipuun Point, also the location of the famous Tabon Cave, in central Palawan. It was excavated by Robert Fox and staff of the National Museum of the Philippines as part of the wider Palawan prehistory project of the 1960s. In his 1970 monograph on the
excavations, Fox barely mentions the site, while I have found no references to the site at all in unpublished material held by the National Museum of the Philippines. From scattered comments in *The Tabon Caves*, it is apparent that the site contained both primary and jar burials (Fox 1970:9). Fox (1970:118) links the jar burials with the ‘developed’ Metal Age. This designation is based on the noted similarity in material culture with that present in Manunggul Chamber B, which Fox reports to have a radiocarbon determination of 190 BC (Fox 1970:118-9). The primary burial(s) are apparently neolithic, with ground stone and *Tridacna* spp. adzes being recovered (Fox 1970:9, 62). Fox notes that the assemblage was “badly disturbed” (Fox 1970:62).

### 6.7.2 The total shell assemblage

There is no mention in Fox’s writings of recovery of shell midden from Batu Puti Cave. Despite this, the accession records make clear that shell was found through the Batu Puti deposits. Unfortunately, there are few clues as to which species were present, although *Lambis lambis, Strombus* sp., *Arca* (*Anadara* sp.) and ‘oyster’ are mentioned by name. Fox (1970) talks briefly about the terrestrial and marine environments in the vicinity of Lipuun Point. As is the case with Palawan generally, the Lipuun Point/Quezon area is a karst limestone landscape. There are a number of rivers (see Figure 6.41) that Fox states “teem with aquatic life” (Fox 1970:11). Of the littoral environment, Fox (1970:13) comments upon the “large shallow bays protected from the waves of the open China sea by a series of fringing reefs and islands”. Nearby mangrove and reef habitats are detailed by Fox in his map of the area (see Fox 1970:Figure 5 and this thesis Figure 6.41). It would appear that mollusc-
bearing habitats were both close and diverse from at least the neolithic period onward.

6.7.3 The worked shell component

The accession records list several hundred shell artefacts; mainly shell 'ornaments', beads, spoons, and rings. Fox (1970:62, 118, 146) mentions a few of these including *Tridacna* sp. adzes, *Anadara* sp. 'lime containers', *Nautilus* sp. spoons, generic 'shell beads' and a scoop manufactured from *Cassis cornuta*. A sample of five artefacts from Batu Puti was made available for study by the National Museum of the Philippines. Although this sample is small, it contains examples of artefacts and raw materials not seen in other samples in addition to the more familiar *Conus* spp. artefacts.

Three *Conus* spp. artefacts were present in the analysed sample including two ground and perforated spires (Figure 6.42a and b) and one complete ring. The perforated spires have both been well ground on both surfaces. One example (see Figure 6.42a) has a small perforation that has probably been drilled with a metal point. The accession records indicate that this artefact was found in association with iron and glass in an area that Fox has determined 'undisturbed'. The other example (see Figure 6.42b) has a central perforation that has been drilled from both faces with an obtuse bit. This artefact was likewise associated with iron and glass. The ring is probably the most carefully-finished example seen within the Palawan assemblages analysed as part of this thesis (see Figure 6.43a). The inner and outer surfaces have been well-abraded and the final cross-section is semi-circular. This artefact was recovered from a ledge where it had been placed with other shell artefacts and earthenware vessels. Its age it therefore uncertain.
While fragments of the large 'green snail' *Turbo marmoratus* were recovered from Ille Cave, Batu Puti Cave contains the only unequivocal evidence of the working of this species in the form of a broken 'spoon'. The handle is missing, but most of the concave portion remains (see Figure 6.43b). The outer edge has been cut and then abraded. The outer prismatic surface of the shell is not present, and it is unclear whether its removal was a part of the working process or a result of taphonomic processes. Bautista (1996) has noted the presence of *Turbo marmoratus* spoons from the nearby Manunggul Cave (Chamber B) as well as the Mataas site in Albay Province. The two specimens analysed by Bautista were manufactured from the keel/shoulder region of the inflated body whorl of the shell (Bautista 1996:Figure 1) and the same region of the shell was used in the manufacture of the Batu Puti specimen. Again, this artefact was found in association with iron and glass.

The final artefact in the Batu Puti sample is the only artefact within the Philippine samples manufactured from *Trochus niloticus*. Four fragments of a ring preform were able to be reconstructed to form a near-complete example (see Figure 6.44). The preform has been constructed from the widest part of the shell where the ventral surface and body whorl meet. The inner architecture of the shell has been chipped away with a sharp point. The body whorl edge has been ground, and it is uncertain whether this edge was originally cut or chipped. The ventral surface has been ground flat. The aperture area of the body/ring is not present, so it is unclear if or how the ring connected to form a complete circle. The preform is not directly associated with iron or glass, however a black and white glass 'eye bead' was recovered from five centimetres above in the same square.
6.7.4 Summary of results

It is probable that all of the artefacts analysed from Batu Puti date to the Metal Age rather than the neolithic. If this is the case, the persistence of the use of the Conus spp. as a raw material as well as the working techniques and finished artefacts is again apparent. Spoons seem to have an antiquity stretching back to the neolithic, with an example being reported from Leta Leta Cave in association with a primary burial (information from accession records). While Fox (e.g. 1970:146) suggests that the raw material for spoons in general is Nautilus pompilius, all spoons subsequently reanalysed have been redesignated as Turbo marmoratus (Bautista 1996 and this thesis). The presence of these artefacts in Metal Age layers at Manunggul Cave Chamber B, Duyong Cave and Batu Puti suggests local continuity over the neolithic/Metal Age transition. Spoons are the only artefacts consistently manufactured from Turbo marmoratus.

Trochus niloticus, either as a raw material generally or one associated specifically with ring manufacture, has not been recorded for other Philippine sites. Its occurrence at Batu Puti is thus of considerable interest.

6.8 Duyong Cave: Shell assemblage and artefacts

6.8.1 Background and context

Along with Tabon and Leta Leta caves, Duyong Cave is one of the most consistently-mentioned and important sites within the Philippine archaeological literature. The neolithic lenses within the site served as Fox's type-assemblage for the 'early neolithic', and the associated shell artefacts are widely regarded as the precursors of Pacific shell-working traditions (Peralta 1977:273; Alba
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1998:64; Fox 1970:64-5; Ronquillo 1998:73-4). Within the non-Filipino literature, Duyong Cave has been rather more of a chameleon, with the neolithic layer moving seamlessly between interpretation as an Austronesian occupation (Bellwood 1978:208), and a non-Austronesian occupation where occupants had contact with Austronesian populations (Bellwood 1997:222; Bellwood 1985:224-5), and where the shell adzes represent part of an early, widespread manufacturing tradition (Bellwood 1997:222). Both the wide-ranging claims of cultural relationships and the on-going confusion vis-à-vis the same can be broadly attributed to two aspects of the assemblage: the shell artefacts and the associated radiocarbon dates.

Duyong Cave is a small limestone cave situated very close to the present beach (see Figures 6.45 and 6.46). Upon discovery, the surface of the cave was covered in large sherds of burial jars and associated Metal Age material culture along with over 5,000 bones identified as Sirenia sp. or the sea cow/duyong/dugong. It is this feature that has lent its name to the cave (Fox 1970:54). The site was totally excavated by Robert Fox and staff of the National Museum of the Philippines, and recent surveys (Chazine n.d.) indicate that little undisturbed original deposit remains.

Fox identified three major cultural layers: an upper layer containing Metal Age jar burials, a middle neolithic layer containing a single primary burial and 'hearth-like' features, and a lower “small flake-and-blade” assemblage (Fox 1970:54)(see Figure 6.47). Three radiocarbon dates were obtained from the lower two layers, and these are presented in Table 6.7. These dates have subsequently served to anchor chronological understanding of the prehistory of Palawan and elsewhere in the Philippines through relative artefactual associations (e.g. Paredes Shelter and Leta Leta discussed above).
Spriggs (1989:602) has applied the principles of ‘chronometric hygiene’
towards the Duyong Cave radiocarbon determinations, and finds the
stratigraphic/cultural associations of the two ‘neolithic’ dates questionable. The
charcoal sample argued to date the burial derives from grave fill, which is
notoriously and understandably unreliable for dating the burial itself. The
uppermost date from Ille Cave and Shelter (discussed above) is an excellent
case in point. Spriggs (1989:602) notes that Fox himself had reservations
regarding context and association, and was only convinced upon receiving the
radiocarbon date itself. The neolithic hearths, which Fox treats as representing
the same broad occupational phase as the burial, in fact constitute a separate
layer which he had originally believed to be associated with the Metal Age
deposits above (Fox 1970:62; Spriggs 1989:602). Again, the date itself was
used as retrospective justification for stratigraphic reinterpretation. Given these
difficulties regarding the relationship between stratigraphy and radiocarbon
determinations, I must concur with Spriggs in rejecting claimed associations.

6.8.2 The total shell assemblage

Fox (1970:56) notes a concentration of shell midden at the front of the cave
associated with the small flake-and-blade assemblage (see Figure 6.47). The
accession records confirm that shell was not found throughout the deposit, but
was spatially (and temporally?) restricted. A sample of 2543 shells was
analysed by Fernando Dayrit – then conchologist at the National Museum of the
Philippines – and a summary of results is presented in Fox (1970) table 5. The
dominant taxon was freshwater gastropods of the genus *Thiara*, followed by the
upper intertidal zone marine species *Planaxis sulcatus*. *Cerithium ornit*a

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54 This is probably the river-mouth species *Cerithidea ornata.*
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*Neritina gagates*, with terrestrial snails of the genus *Helicostyla* also being well represented. While terrestrial snails are frequently discounted as being intrusive into cave deposits, helicostylids are arboreal snails that rarely come to ground. This feature of ecology, as well as the lack of other reported terrestrial genera, suggests a human vector - either related directly to subsistence, or the bringing in of foliage with which these snails entered incidentally.

As a whole, the midden indicates the exploitation of a number of environments, including freshwater, river-side vegetation, silty sand, and upper shore rocks/reef platform. Interestingly, the majority of species connected with reef/rock intertidal environments are typically only present high in the intertidal zone. Such species include *Planaxis sulcatus*, *Nerita plicata* and *Acmaea saccharina*. Without a good understanding of the local coastline and associated eustatic and topographic history, it is impossible to say whether this indicates the presence of upper-shore rocks and the absence of a developed reef during the period of gathering/deposition, a particularly restricted gathering pattern, or a different local topography meaning that these gastropods inhabited areas close to the cave mouth as a part of their natural habitat range.

6.8.3 The worked shell component

Shell artefacts were recovered at Duyong associated with both the neolithic burial, and the thin charcoal-bearing layer through which it was cut (Fox 1970:62). These included *Tridacna* spp. adzes associated with the burial, and a gouge of the same material in the layer immediately above. *Conus* spp. ground and perforated spires were found in both layers. Accession records indicate shell artefacts were likewise found as a component of the upper, Metal Age jar burial assemblage.
Five shell artefacts from Duyong Cave were made available for this study by the National Museum of the Philippines, including three artefacts in *Conus* spp. and two of the *Tridacna* spp. adzes found in association with the primary burial (see Appendix 3.7 for an inventory). The three *Conus* sp. artefacts are all ground spires with central, drilled perforations (see Figure 6.48a-c). They are all manufactured from *Conus litteratus* and/or *Conus leopardus*. All are in extremely good condition with the perforations having been drilled with metal points. This, together with information regarding associations indicated by the accession records, suggest that they should be grouped with the upper Metal Age jar burial assemblage. Ground and perforated *Conus* spp. spires were thus recovered from all cultural layers at Duyong above the flake-and-blade assemblage.

There is no reported evidence for the manufacture of *Conus* spp. artefacts at Duyong, and the accession records further confirm that this is the case. The results of the midden analysis further suggest that the clean, weedy sand environments preferred by *Conus litteratus* and *Conus leopardus* were not being exploited by the occupants/utilisers of Duyong Cave, and were probably not a feature of the local littoral landscape.

The two *Tridacna* sp. adzes were held in the public display cases of the National Museum rather than in the stores. The specimens are clearly not manufactured from fresh shell, though questions as to whether these specimens are replicas received mixed responses. If the adzes studied are indeed the original specimens (as reported to Bellwood, 2003), then they can only be of fully-fossilised shell. The midden analysis indicates that environments capable of supporting *Tridacna* spp. populations were almost certainly not present in the surrounding area.
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The two adzes studied here both derive from extremely large shells that are undoubtedly *Tridacna gigas*. Both are also made from the robust, hinge portion of valve. It is assumed that both were originally detached from the body of the valve through direct percussion. This edge, on both specimens, has been well abraded through working and all that remains to indicate this process is a slightly irregular edge.

The specimen illustrated in Figure 6.49 has been well abraded on the dorsal surface, with only a small patch of the original outer shell sculpture being visible. There are no grinding facets evident, and if the dorsal surface was originally ground on a grinding stone, the evidence of this has been removed by subsequent abrasion. The ventral surface has been minimally worked, with the bevel having been ground on a single facet and the central, lateral and cardinal tooth area ground smooth and flat.

The specimen illustrated in Figure 6.50 (see also Fox 1970:Figure 19a) is made from the right valve of a *Tridacna gigas*, rather than the left valve utilised in the previous specimen. The dorsal surface is similarly well abraded, though the original sculpture of the shell is clearly evident. The ventral surface has been minimally worked with evidence of grinding confined to the bevel and a small patch at the poll end. The ventral surface is rather irregular overall, largely due to the incorporation of part of the adductor muscle scar into the artefact.

Fox (1970:Figure 19b and Figure 42e) illustrates two of the three remaining *Tridacna* spp. artefacts recovered from the central cultural layer at Duyong. The first, found in association with the primary burial, follows the same pattern as described for the two analysed examples, though apparently it is in poorer condition. The same portion of the shell has been used with the dorsal
surface abraded and the ventral surface has been minimally ground. The specimen illustrated in Fox's (1970) Figure 42e is somewhat different and seems to be the 'gouge' associated with the charcoal-bearing 'habitation' layer rather than the primary burial. It is not manufactured from the hinge region of the shell, but rather from a section of one of the large valve folds. Consequently, the profile in cross-section and cutting edge are curved. The edges indicate that the blank had been separated from the rest of the valve through direct percussion, and the ventral surface at least is unground.

6.8.4 Summary of results

Duyong Cave is clearly an important site and it is unfortunate that issues surrounding the association of the radiocarbon determinations frustrate interpretation. The dates themselves are not inherently unreasonable, but require confirmation. This would be achieved most effectively through direct AMS dating of associated Conus spp. artefacts. Whether the central, cultural layers represent a 'neolithic' is a separate issue, and one that has already been alluded to with reference to Sa’gung Shelter. The presumed appearance of shell artefacts with the neolithic, and the consequent assumption that the presence of shell artefacts signals neolithic horizons within sites, is not exclusive to the Philippines (e.g. Glover 1986:97; also see discussion in Szabó and O’Connor In press). Indeed, recent direct AMS dating of shell artefacts excavated from East Timor has produced unexpected and thought-provoking results in this regard (O’Connor and Veth In press; Szabó and O’Connor In press).
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The relationship between the *Tridacna* spp. adzes from Duyong, and other examples from both Island Southeast Asia and Oceania will be further discussed in Chapter 8.

6.9 Kamuanan Cave: Shell assemblage and artefacts

6.9.1 Background and context

The Kamuanan Cave site, located on Talikod Island in the Gulf of Davao (see Figure 6.51), southern Mindanao in the Philippines, has been mentioned many times in print (e.g. Solheim *et al.* 1979:111, 116; Cleghorn 1977; Spriggs 1989:602; Ronquillo 1998:68-72). Little detailed information, however, has ever appeared. The site was test-excavated by Wilhelm Solheim and Jaime Neri in 1972, but, due to time constraints, only two 1x1m test-pits were opened and the maximum depth reached was apparently 18 inches\(^{55}\). The material was transported back to Hawai‘i for further analysis, resulting in Cleghorn’s (1977)(discussed below) published work on experimental *Tridacna* spp. flaking. Kamuanan was further excavated by Legaspi, however nothing regarding these excavations has appeared in print (Solheim *et al.* 1979:116). Neither the midden shell nor other assemblage components have thus far been reported upon. The sample is still held at the University of Hawai‘i and was studied there with the permission of the National University of the Philippines and the University of Hawai‘i.

Talikod is a low limestone island with dramatic uplift episodes evidenced by a series of upraised reefs, the highest of which was over fifteen metres

\(^{55}\) This depth was the deepest as recorded on bag labels during analysis, however Solheim *et al.* (1979:111) report a maximum depth of 20cm.
above sea level (Solheim et al. 1979:111). The elevation of the cave is not stated and no plan of the site or its setting in the landscape has been published. Upon discovery of the site, three teenagers were living there while attending school (Solheim et al. 1979:111), thus some modern material and surface disturbance are to be expected.

The excavated deposits were composed primarily of shell with the addition of a few small, stone artefacts (Solheim et al. 1979:111). No pottery or metal was observed (Solheim et al. 1979:111). Solheim’s suspicion that some of the shell had been worked or ‘flaked’ prompted the direct radiocarbon dating of a fragment of Tridacna spp. (Solheim, pers. comm.). Two dates were run on the single specimen (see Table 6.8), and although the resulting dates were not overtly untoward, Solheim (Solheim et al. 1979:117) suspected some recrystallization of the shell. Specifically, he noted that “several of the possibly worked or used shells from the Talikod sites seemed to me to be somewhat fossilised”, and wondered whether such specimens were deliberately selected for working (Solheim et al. 1979:117).

Artefacts manufactured from subfossil shell have been noted elsewhere in the region (Solheim et al. 1979:117 and see discussion on Golo Cave artefacts below), and for this reason two midden shells (Pleuropaca filamentososa and a fragment of Turbo marmoratus operculum) and two fragments of species in the Tridacnai (a valve of a juvenile Hippopus hippopus and a fragment of Tridacna sp.) were submitted for dating as part of this thesis. It was considered that a gross difference between the ages of the midden shell fragments and the Tridacnai specimens would strengthen the case for the exploitation of subfossil deposits for shell-working material. All six dates for the site are presented in Table 6.8.
The radiocarbon determinations confirm that the *Tridacna* sp. and *Hippopus hippopus* specimens are considerably older than the dated midden shell. While this is suggestive evidence for sub-fossil members of the Tridacnidae being purposely collected for working, there are issues to do with site formation processes at Kamuanan that complicate findings. Since these issues were observed during the analysis of the midden, they will be discussed within that context.

### 6.9.2 The total shell assemblage

The total shell sample (including worked pieces) comprises 408 estimated individual shells and 950 total fragments. Fifty-five species are represented as well as the aggregate category of Polyplacophora (chitons). This is a remarkable degree of diversity given the size of the sample, and the first clue that all is not well with the Kamuanan shell midden. Species represented by more than five fragments are graphed in Figure 6.52 and the relative importance of mollusc-bearing niches is graphed in Figure 6.53. These graphs clearly show the dominance of supra-littoral and upper-intertidal zone species (e.g. *Nerita undata*, *Nerita plicata* and *Tectarius grandinatus*). Furthermore, very many of the fragments within the sample, together with spines of the urchin *Heterocentrotus mammillatus* and one fragment of volcanic sand-tempered earthenware, showed signs of having been extensively beach-rolled. This said, meat extraction patterns – particular visible for turriculate gastropods – indicate that midden shell is also present.

While the one published photograph of the site – taken from the cave mouth looking out – indicates that the site is presently several metres above sea level, both the taphonomic and compositional evidence suggest that this
was not the case in the past. It seems likely that the cave was situated in a back-beach location and that the majority of the shell sample represents deposition through storm surges. The supra-littoral gastropods would have lived, died and accumulated around the immediate cave-mouth area. While I can find no information regarding uplift rates and chronology for the Talikod Island/Gulf of Davao region, geological work in the region makes it clear that this area is tectonically-active, with Talikod Island being situated between two of the major Mindanao faultlines (the Philippine Fault and the Cotabato Fault) as well as major subduction zones (e.g. see Pubellier, Bader, Rangin, Defontaine and Quebral 1999). The ‘midden’, thus, is here argued to be a time-averaged subfossil deposit.

Despite this, there is clear evidence of non-modern human presence at Kamuanan. Chert cores and flakes were found at all levels in both squares, and show no evidence of water-rolling. Chert is not local to the island, but the basement geology of much of southern Mindanao is a complex of cherts, gneisses and schists (Wernstedt and Spencer 1967:figure 13) suggesting nearby mainland sources. The lithic artefacts (n=11) were not analysed, however three distinct colour categories (dark red, purple and beige-brown) were recognised for basic recording purposes. Whether these colour differences relate to weathering or source is uncertain. Faunal remains exclusive of the shell included pig teeth (n=4) and goat teeth (n=3), as well as unidentifiable long-bone fragments – one of which showed evidence of burning. Domestic animals are commonly tethered in caves in the Philippines (personal observation) and there is little to justify a pre-modern attribution.

Shell ‘flaking’ recognised during excavation (Solheim et al. 1979), and later confirmed by Cleghorn (1977), also clearly represents human agency in
the formation of deposits at Kamuanan. The reanalysis of the worked shell, as well as identification of further examples, is presented here.

6.9.3 The worked shell component

Cleghorn's (1977) analysis of the Kamuanan shell, and his efforts at replication, were strongly influenced by then-current research on lithic technology (e.g. Crabtree 1972). The exclusive focus on freehand direct percussion as a reduction technique, coupled with a search for formal flaked artefact types, led him to comment that the "artefact forms are varied and in general crude and uninspired" (Cleghorn 1977:241). This may certainly appear to be the case if the purpose of reducing of the shell was to generate pseudo-lithic artefacts, however results of analysis throughout this thesis have demonstrated that direct freehand percussion is most frequently an initial form of reduction before working using different techniques ensues, and that formal artefacts generated in shell do not generally coincide with formal lithic types.\textsuperscript{56}

While some of the shell fragments displayed features indicative of direct percussion, the most common working technique noted during this analysis was indirect percussion and/or pressure flaking. The list of raw materials utilised at Kamuanan was also expanded to include Trochus niloticus, Tectus pyramidis and Turbo marmoratus, along with the worked Tridacna spp. and Conus spp. noted by Cleghorn (1977). No formal artefact types are present, and working techniques including grinding, abrading, cutting and drilling are not evident. Two of the fragments isolated by Cleghorn (1977) have been incorporated into the worked shell sample here, while all other examples have been classified as unclear (U) or rejected. All identified worked shell is itemised in Appendix 3.8.

\textsuperscript{56} Production of ground stone artefacts, such as adzes and beads, is the exception here.
Six examples of worked *Trochus niloticus* were identified. Five fragments, derived from the anterior portion of the shell, had notches indicating the use of either an indirect percussion or pressure flaking technique (e.g. see Figure 6.54). The remaining worked piece is a reduced whole shell with evidence of both freehand direct percussion and secondary percussion/pressure flaking (see Figure 6.55). It is uncertain whether direct percussion represents an initial stage in *Trochus niloticus* working, or whether the specimen shown in Figure 6.55 represents another goal altogether. Given the ecological picture presented by the results of analysis of the total shell assemblage, there is no reason to suspect that *Trochus niloticus* was not found in the local littoral environment.

The slightly smaller trochid, *Tectus pyramis*, was also identified as having been worked. The same notching observed on fragments of *Trochus niloticus* was also observed on two fragments of *Tectus pyramis* (e.g. see Figure 6.56a). In addition, one example of a *Tectus pyramis* reduced right back to the columella was noted. This specimen has deep notches indicating working with a sharp point (see Figure 6.56b). A single worked fragment of *Turbo marmoratus* also displays the same notches - initiated from both the outer and inner shell surfaces (see Figure 6.57). One *Conus litteratus* or *Conus leopardus* fragment has two notches at the suture line between the body and second whorls of the spire.

At least three species of tridacnid exhibit evidence of having been worked; *Tridacna gigas*, *Tridacna squamosa* and *Tridacna crocea*. Two different working techniques were practised with tridacnids, the first of which is fracture initiated by ‘wedging’, with the second being the use of direct percussion noted by Cleghorn (1977) and Solheim (Solheim *et al.* 1979). Seven fragments of *Tridacna* spp. were noted to have one, deep notch at the initiation point of a
fracture. The fracture itself then follows natural growth planes within the shell. This pattern seems to indicate the forceful insertion of a sharp point, probably using an indirect percussion technique, which serves to force splitting of the valve/fragment along natural lines. Given this, there are no diagnostic features indicating working along the length of the fractures themselves. Three examples of this ‘wedging and splitting’ method of reduction are shown in Figure 6.58a and b and Figure 6.59a. A further three definite and two possible Tridacna spp. pieces are true ‘flakes’, exhibiting evidence of a Hertzian initiation and either a hinge or feature termination (e.g. see Figure 6.59b). Flakes typically include very little, if any, of the natural outer and inner surfaces of the shell. While the Tridacna spp. sample is too small for conclusive statements as to the relationship between these two techniques, the evidence thus far suggests that ‘wedging and splitting’ is employed for primary reduction of valves and large fragments, whereas direct percussion ‘flaking’ is used either for trimming or generating flakes that were intended as artefacts in their own right.

6.9.4 Summary of results

Since its entry into the regional archaeological literature (Solheim et al. 1979), Kamuanan Cave has been an enduring enigma. This is due to both fleeting descriptions of the site and contents, and questions over chronology. Results of analysis of the total shell assemblage, with particular attention being given to composition and taphonomy and four new radiocarbon dates, form the basis of a reinterpretation of the Kamuanan deposits given here. Rather than representing dense shell midden, I have argued that the shell is more likely to represent a subfossil deposit accumulated when the cave was situated closer to the shoreline. That subsistence refuse has been mixed in with the subfossil
material is possible, or indeed likely. Probable evidence of prehistoric occupation is confined to worked shell and chert, and the chert artefacts themselves are potentially related to shell working.

Given that only the upper 20-25cm of the deposits were excavated it is difficult to say anything conclusive about the site. The possibility is offered here, however, that Kamuanan may have been a collection point for subfossil shell utilised for working – in effect, the equivalent of a quarry site. Basic, and probably initial stages of working are represented, but in the absence of any evidence suggesting habitation. Needless to say, only further excavation is likely to make more sense of the site as a whole.

Despite the lack of clarity regarding chronology and site formation processes, the worked shell assemblage from Kamuanan Cave is important for two major reasons. Firstly, it provides evidence for the working of members of the Trochidae and Turbinidae. Scant evidence for the utilisation of these taxa as raw materials has been recorded for Island Southeast Asian sites to date. Secondly, there is evidence for a primary reduction technique for members of the Tridacninae that indicates methods other than freehand direct percussion were practiced in initial reduction. Given the morphology and microstructure of members of the Tridacninae, the ‘wedging and splitting’ technique would allow for greater control of fracture than is the case with direct percussion. Indeed the unpredictable nature of fracture of Tridacna spp. when reduced using direct percussion was noted by Cleghorn (1977:243). The recognition of the wedging and splitting technique also lends support to the observation that notions of reduction associated with lithic technology are not always appropriate when the material under consideration is shell.
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6.10 Golo Cave: Shell assemblage and artefacts

6.10.1 Background and context

Golo Cave is located on Gebe Island in the northern Moluccas, Indonesia (see Figure 6.60). It is situated about 60m inland from the beach, set into a limestone cliff, with the current cave floor being about 8m above the high water mark (Bellwood, Nitihaminoto, Irwin, Gunadi, Waluyo and Tanudirjo 1998:249). It was excavated over two seasons (1994 and 1995-6) by Professor Peter Bellwood and a team of Indonesian archaeologists as part of a larger project with Professor Geoffrey Irwin focused upon the prehistoric and early historic periods in the northern Moluccas, Indonesia. Two trenches were excavated at Golo, with the larger one (4.8m²)\(^{57}\) revealing a deep sequence (Bellwood et al. 1998:249). Two major cultural layers were identified as well as a complete extended burial of unclear association (Bellwood et al. 1998:251). Despite the visibility of only two stratigraphic layers, the radiocarbon determinations indicate that the deposits built up over a considerable span of time, with basal dates indicating frequention prior to 30,000 B.P. and earthenware sherds being present at the very top of the sequence (Irwin et al. 1999:366). Published radiocarbon dates for the site are reproduced in Table 6.9.

While the dates derived from the midden shell and charcoal are largely in sequence, recent direct AMS determinations on three of the shell artefacts (Bellwood, unpublished data) have caused some interpretative problems. A piece of *Tridacna gigas* from the lowest part of the sequence has returned a date of c. 32,000 B.P. and is rejected as representing subfossil shell (Bellwood pers. comm. in Tanudirjo 2001:112). It does, however, accord with two dates

\(^{57}\) Reported as 5.8m² by Irwin et al. (1999:366)
on unspecified midden shell (refer to Table 6.9) which have been accepted as accurate (Irwin et al. 1999:366). Despite this, the gap in the sequence from c. 30,000 b.p. to c. 14,000 b.p. is rather striking. An AMS date on a *Hippopus hippopus* adze/gouge, found in a level (145-150cm) associated with a date of c. 13,000 B.P. (calibrated) returned a date of c. 7000 b.p. Bellwood has offered an interpretation of caching to explain the relationship between the date and the stratigraphy (Bellwood pers. comm. in Golson in press), however Golson (Golson in press) points out that current dates and stratigraphic interpretation would mean the burial of the adze at least 85cm below its chronologically-associated level.

Irwin et al. (1999:366) comment that "the site ages rather abruptly at the very bottom" and this can be clearly seen in Table 6.9. Since the shell midden was not brought back from Indonesia and results of on-site identification and quantification cannot be located, little comment can be made regarding potential availability and exploitation of different niches. A restricted range of taxa with a focus on upper-intertidal and supralittoral species would accord well with shell midden results from other similarly-located sites of equivalent age (e.g. Matenkupkum, see Gosden and Robertson 1991 and Kili Cave, see next chapter). For these early dates to be truly convincing, other methods of dating need to be attempted (Irwin et al. 1999:366) so that a potential subfossil shell problem can be ruled out, or a solid environmental/geomorphologic case made.

6.10.2 The total shell assemblage

Shell midden was found throughout the Golo deposits (Bellwood et al. 1998:Table 5) but, as just stated, the midden was not brought back from the
field and the results of on-site quantification and identification could not be located. No comment can therefore be made on the total shell assemblage.

6.10.3 The worked shell component

Shell adzes are the only recognised formal shell artefact type from the Golo Cave deposits, and different forms occur in *Tridacna* spp., *Hippopus hippopus* and *Cassis comuta*. Not mentioned in the published literature are a number of worked pieces of both the shell and operculum of *Turbo marmoratus* as well as pearl oyster (*Pinctada* spp.). Identified worked shell artefacts are summarised in Appendix 3.9.

Adzes utilising the thickened lip of a *Cassis comuta* were restricted to the upper part of the sequence at Golo (70cm and above), and were also recovered from the upper levels of nearby Wetef Cave (Bellwood et al. 1998:Table 5; Irwin et al. 1999:Table 1). Fourteen specimens are listed by Bellwood et al. (1998:Table 5), however only twelve were in the analysed sample with the missing examples being associated with a depth of 30-40cm. While Irwin et al. (1999:370) state that all the *Cassis comuta* adzes, including those from Wetef, are "of identical style and size", two distinct forms are recognised in this analysis, with one likely being a curated form of the other.

The preforms have been generated by simply knocking the heavy lip away from the thinner shell body using direct percussion. This was done from the dorsal face of the lip, with a bevel then being formed through abrasion to the anterior end of the ventral lip face. During analysis, two 'forms' were recognised with the first being smaller and having a greater degree of abrasion on the ventral lip surface (e.g. Figure 6.61a and b), while the latter was larger with minimal abrasion to the extreme anterior only. The relationship between
the two forms is plotted in Figure 6.63 and the two forms clearly separate out with a single intermediate example (see Figure 6.62). Given that the larger examples show signs of use-wear, they are regarded as finished. Interpretation here is that the smaller form represents a curated version of the larger form.

A direct AMS date on a Cassis cornuta adze specimen produced a very early date not in keeping with its position in the stratigraphy (see Table 6.9). Bellwood (pers. comm.) suggests that ‘old’ or subfossil shell has been used in the manufacture of the artefact, and this would appear to be the case.

Six adzes or gouges within the analysed sample were produced from members of the Tridacninae: two of Hippopus hippopus, two of Tridacna gigas, and two of an unidentified species of Tridacna. While form and finishing is quite variable, all have been manufactured from a central single valve fold. The Hippopus hippopus artefacts are smaller and less robust than the Tridacna spp. examples, and have not been greatly modified. In both cases, the fold has been chipped away from the main body of the shell with a sharp point. There is no evidence for direct freehand percussion in the reduction process. One example (see Figure 6.63) has been lightly abraded down the chipped edges. The natural dorsal margin of the shell forms the bevel, and there is scant evidence for abrasion in this region in either specimen. Final morphology and cross-section of the Tridacna spp. adzes seems dependent upon the original size and morphology of the valve. The degree of working in all specimens is again minimal with reduction and abrasion following the same pattern just outlined for Hippopus hippopus with the exception that the dorsal margin of the shell is not incorporated into the Tridacna spp. specimens (e.g. see Figure 6.64).
Cut fragments of nacreous shell are found in small numbers from a depth of 100cm to the surface, with the only exception being a single piece of cut *Pinctada margaritifera* recovered from a depth of 180-185cm. The majority of specimens derive from the body whorl of *Turbo marmoratus* (n=8) while a further two utilise *Pinctada* spp. All but two specimens have multiple cut edges. Aside from the cutting, there is no further evidence of working or the application of different techniques.

What is probably the most remarkable finding of the worked shell analysis was the identification of flaked *Turbo marmoratus* operculum throughout the deepest levels of the Golo deposits. True ‘flakes’ as well as operculum ‘cores’ and shatter fragments were identified at depths largely restricted to 200cm and below. Flake initiation is invariably bending – a feature which may very well be linked to the curved morphology of the dorsal surface of the operculum. All flakes bar one were initiated from the dorsal surface. Four flakes show a 90° change in the direction of energy, and have been termed ‘plunging flakes’ (e.g. See Figure 6.65c-f). This pattern is interpreted to be a consequence of the application of excessive force, causing the energy to turn upon reaching the ventral face, and dissipate back in towards the centre of the operculum. Termination, as well as general flake morphology is strongly influenced by both the microstructure and internal operculum features.

As stated in Chapter 4, there is no available literature relating to the microstructure of *Turbo* spp. opercula, but visual inspection indicates that it is prismatic. *Turbo* spp. opercula are paucispiral, meaning that shell is laid down as a loose, continuous spiral. As the operculum is enlarged to keep pace with

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58 During analysis, it was noted that the excellent condition of this fragment defied its depth association when compared with other material.
the growing aperture of the shell, earlier whorls/surfaces are covered and partially reabsorbed. When the operculum is broken, however, these older surfaces are still clearly evident and play a substantial part in directing fracture (e.g. see Figure 6.65a,b,e and f). This feature of *Turbo* spp. opercular structure can be seen to have influenced both flake termination and morphology in a number of the Golo examples.

Two large, reduced opercula were identified within the Golo worked shell assemblage, with both showing a combination of flake scars and shatter surfaces along fractured portions (e.g. see Figure 6.66). A number of fragments not displaying evidence of having been flaked were also identified, and may represent spall/shatter (e.g. see Figure 6.67). These were likewise restricted to the lower reaches of the deposits.

**6.10.4 Summary of results**

Despite the lack of a clearly-visible stratigraphy, it is clear that deposition patterns at Golo are complex, and that deposits were accumulated over a substantial period. With regard to shell artefacts, there are three distinct approaches to working which seem to be associated with different nodes in time. The uppermost layers contain primarily adzes/gouges produced through minimal working of the lip of large, and evidently subfossil, *Cassis cornuta*. The middle reaches of the deposit, dating to the terminal Pleistocene and Early Holocene contain solely adzes/gouges produced from members of the Tridacninae. The examples are all minimally-worked and standard in manufacture – although final form is influenced strongly by the morphology of the selected valve. Worked shell from the lowermost deposits at Golo presents the only clear evidence for direct percussion flaking, with *Turbo marmoratus*
opercula being the consistently selected raw material. Technologically, the shell-working evidenced in the basal deposits separates out clearly from that seen in upper spits. The associated pre-30,000 b.p. dates require confirmation.

There is little evidence for sustained habitation of the cave below c. 120cm, and the presence of ‘cookstones’ (Bellwood et al. 1998:Table 5) seems anomalous in the absence of bone. Clearly, however, the cave was being frequented by humans as evidenced by both shell and lithic flaked artefacts.

6.11 Uattamdi: Shell assemblage and artefacts

6.11.1 Background and context

Uattamdi was excavated as part of the same project that saw the excavation of Golo. Located on Kayoa Island, off the west coast of Halmahera (see Figure 6.68), Uattamdi is a rockshelter set into a limestone cliff c. 60m back from the modern beach (Bellwood et al. 1998:253, 257). A total of 16m² was excavated and two cultural layers were recognised in deposits that extended to c. 1.20m in depth (Bellwood 1992:54; Bellwood et al. 1998:257). The lower cultural layer, encompassing units ‘C’ and ‘D’, had earthenware throughout and is of neolithic association while the upper layer, including units ‘A’ and ‘B’, is associated with the widespread Metal Age jar burial tradition (Bellwood 1992:54; Bellwood et al. 1998:257). The lower layer is argued to be closely related to material associated with the Lapita cultural complex (Bellwood 1992; Bellwood et al. 1998:262-3). Bellwood (1992:54) states that the two layers were separated by a layer of pumice and beach sand.
Radiocarbon determinations for Uattamdi are presented in Table 6.10. The upper cultural layer clearly dates to the Southeast Asian Metal Age with one intrusive date in unit B rejected by the excavators (Bellwood et al. 1998:Table 1). The dates for cultural layer 2 span one thousand years from about 2500 to 3500 BP. The lowest date for this layer overlaps with a one derived from a water-rolled shell (ANU-9321) associated with sterile beach deposits below.

6.11.2 The total shell assemblage

Shell midden was found throughout the Uattamdi deposits in varying concentrations. The shell material was sorted and quantified in the field with voucher specimens being retained for later identification. Ken Heffernan identified the voucher specimens, and used the quantitative data generated in the field to produce a report (Heffernan 1993). Heffernan (1993:1) states that the quantification method employed by Bellwood was a minimum number of individuals (MNI) rather than fragment (NISP) count.

The dominant species in the Uattamdi total shell assemblage derive from both sandy and hard reef-flat intertidal zones. These include species such as Donax sp., Hippopus hippopus, Anadara antiqua and Cardium sp. in the former category, and Turbo spp. and Nerita spp. in the latter. Strombus luhuanus is common in the lower cultural layer, while the littoral vegetation-dwelling Pythia scarabaeus is common in the upper layer. An unidentified member of the Pteriidae (pearl oysters) is common throughout the lower layer with only one occurrence in the upper layer. The greatest density of shell is in the unit C of the lower layer with negligible amounts of shell being recovered from the base of both cultural units. From the available data, it appears that
coral sand intertidal environments were most regularly exploited by the occupants/utilisers of Uattamdi. While hard reef-flat species are present (most prominently Turbo spp.), the lack of diversity in species representing this niche is notable – especially considering this is one of the most speciose niches for marine shell in the tropics. This would appear to reflect highly selective gathering in a niche that was perhaps not immediately local.

6.11.3 The worked shell component

Published reports (Bellwood 1992; Bellwood et al. 1998; Irwin et al. 1999) cite shell artefacts as present being beads, armbands/rings, a Tridacna sp. adze, scrapers, knives and worked pearleshell possibly related to fishhook manufacture. Bellwood et al. (1998:Table 7) associate worked shell exclusively with the lower cultural unit.

Within the analysed sample, worked pieces and formal artefacts of Trochus niloticus, Cypraea tigris, Conus sp., Isognomon isognomon, Pinctada spp., Hippopus hippopus and Nautilus sp. were recorded. Cassis cornuta is a tentative addition to this list. Formal artefacts are all evidenced by finished specimens, and, in the absence of the midden, it is unclear whether anything other than expedient artefacts were being produced on-site. All identified worked shell is itemised in Appendix 3.10.

Trochus niloticus is represented by three fragments of what is possibly the same ring (see Figure 6.69a-c). Certainly the measurements accord well enough for this to be the case. All three specimens have been ground flat on both sides with the outer surface having been lightly abraded to produce a domed plano-convex cross-section. Heffernan (1993:Appendix 1 table 3b) records low levels of Trochus niloticus as being present within the midden
deposit throughout the C unit, from which all three ring fragments derive. Whether or not these specimens are linked in any way to shell working is unknown, however their presence demonstrates that *Trochus niloticus* was available for collection and use.

Modified cowries were noted by the excavators (Bellwood *et al.* 1998:Table 7), although Bellwood (pers. comm.) was uncertain as to whether these related to meat extraction or working. From a sample of seven *Cypraea tigris* dorsa, two were isolated as being modified beyond that necessary for meat extraction. A *Cypraea tigris* dorsum with two perforations (see Figure 6.70b) was found unfortunately in the spoil making its cultural association unclear. A second specimen, recovered from the lowest ‘D’ unit, had been ground flat along the fractured edge (see Figure 6.70a). A patch of crushing at one end indicates that the dorsum was detached from the ventral portion of the shell through direct percussion.

Two beads were present within the sample, both tentatively identified as having been produced from *Cassis cornuta*. The first is a broken specimen that can best be described as a disc bead (See Figure 6.71a). Both faces are ground, but at an angle which resulted in a wedge-shaped profile. The central perforation is drilled and the outer perimeter has been abraded. The second is a squat barrel bead drilled end-to-end (see Figure 6.71b). Both the beads are shaped from solid blocks of shell, rather than utilising the naturally-round morphology of a gastropod spire. The outer surface has been abraded on four facets of varying sizes producing an irregular profile. Evidence of *Conus* spp. working is confined to a single fragment of a narrow ring (see Figure 6.71c).

The modified pearl oyster referred to in publications (e.g. Bellwood 1992:57) is represented by six modified fragments derived from both the
Isognomonidae and Pteriidae (e.g. Figure 6.71d). Techniques applied are various, including shaping with a sharp point (n=1), cutting (n=3) and abrading (n=2). As pointed out by Bellwood (1992:57), there is no good case to relate these fragments to fishhook production. A cut piece of an inner septal wall of a *Nautilus* sp. was also identified within the sample (see Figure 6.72b). The natural siphonal hole present in this region of the shell is incorporated into the artefact.

The presence of a *Tridacna* sp. adze has been mentioned in publications (Bellwood *et al.* 1998:257; Irwin *et al.* 1999:372), and this specimen was present in the analysed sample (see Figure 6.72a). There is clear evidence of direct percussion, with blows being administered around the edge of the artefact and to its surface. The latter actions have caused the outermost sculptural layer of shell to come away and stress fractures are evident across the dorsal surface. The artefact is not manufactured from either a fold or the hinge region of the valve, but rather an area of the valve near the hinge running at an angle (c. 10°) to the folds. If it is an adze, it is certainly incomplete and of a unique form. That it is worked is certain.

**6.11.4 Summary of results**

The Uattamdi worked shell sample is diverse in terms of both raw materials and working techniques evidenced, although the analysed sample provides little evidence for the manufacture of formal types at the site. The results of the midden analysis suggest that species utilised for working would have been accessible to the occupants of Uattamdi, if not immediately local. What is perhaps the outstanding feature of the Uattamdi formal shell artefacts is their singularity regarding form, raw materials and manufacturing techniques. The
beads and adze are unparalleled elsewhere. This issue will be further taken up in Chapter 8.

6.12. Summary of Island Southeast Asian shell-working practices

Summarising shell-working practices in Island Southeast Asia is a difficult task for a number of reasons. Firstly, the prevalence of samples derived from burial sites means that questions arise about the representativeness of samples. It further means that there is frequently little direct evidence of shell-working procedures. Secondly, on-going chronological issues make it difficult to relate sites, layers, assemblages and artefacts to one another with any great degree of certainty. Thirdly, the diversity of worked shell assemblages in composition, space, and time make for a particularly complex picture.

In the following sections, I will present a broad overview of attitudes towards raw material selection and collection, shell working techniques and protocols, and the spatio-temporal distribution of formal shell artefact types, to draw out common themes and elements of diversity in Island Southeast Asian shell-working practices.

6.12.1 Raw material selection and collection

There are both temporal and spatial dimensions to visible patterning in raw material selection and collection protocols with regards to Island Southeast Asian worked shell assemblages. There is an emerging pattern of subfossil shell use in early Island Southeast Asia shell-working, with either fossil or subfossil *Tridacna* spp. being selected for artefact manufacture at Golo, Kamuanan, and probably Duyong. Specimens of *Cassis cornuta* utilised for
adze manufacture in the upper layers of Golo Cave also appear to have been produced from subfossil specimens. The possibility that subfossil *Turbo marmoratus* opercula were selected for the flaking observed in the lowermost deposits at Golo is possible and currently being investigated. The sourcing of subfossil/fossil shell is a completely different task to gathering live shellfish. Sources are less predictable – dependent as they are on local geological processes and taphonomic effects. They are also likely to occur in locations that are not immediately coastal, particularly if the area is tectonically active. Thus, a detailed local environmental knowledge is required in order to locate and collect specimens deemed suitable for working.

From the few samples available that give insights into early shell-working in Island Southeast Asia, only a small group of taxa emerge as being consistently selected for working. These include *Turbo marmoratus*, present in both the Kamuanan and Golo samples, and various members of the Tridacninae. Notably, these taxa along with *Trochus niloticus* are also present in unworked form, though apparently brought into the site from some distance, at Ille Cave. *Trochus niloticus*, *Tectus pyramidis* and *Conus* spp. are also recorded for Kamuanan.

The selection and collection of shells in firmly neolithic contexts presents a different picture – both in terms of shells used and the locations from which they derive. *Conus* spp. emerges as the dominant raw material choice across Palawan, and appears at sites through the region regardless of whether it was available locally. *Strombus* spp., *Nassarius* spp., *Melo* spp. and *Cypraea* spp. also occur with the advent of the neolithic in Palawan sites. The use of *Tridacna* spp. continues, though whether subfossil or fresh sources are being exploited is currently unclear. *Tridacna* spp. use is also seen at Arku Cave,
where its presence 50km inland clearly indicates a non-local source for either shell or artefact.

What is clear throughout the sequence is that certain shell taxa are being actively selected for working, regardless of whether sources are local, non-local, or subfossil contexts.

6.12.2 Shell working techniques and protocols

As stated above, burial contexts for many of the Philippine assemblages combined with the unavailability of midden for the northern Moluccan samples, have meant that finished artefacts themselves have frequently been the source of information on shell-working techniques and protocols. While this is less than ideal, a considerable amount can still surmised and clear patterns have emerged.

The lowermost assemblage at Golo Cave is presently the earliest worked shell assemblage in Island Southeast Asia by about 20,000 years. Its assemblage of flaked *Turbo marmoratus* opercula is presently unique, although worked pieces of the actual shell itself have been identified for mid-Holocene deposits at Kamuanan and Metal Age deposits at Batu Puti. In all cases, the working protocols are different. The *Turbo marmoratus* opercula artefacts present at Golo were worked through simple direct freehand percussion. There is no evidence of the application of other techniques. *Turbo marmoratus* shell at Kamuanan, however, has been worked by chipping at the edges with a sharp point. The ‘chipping’ technique is seen only infrequently in Island Southeast Asian worked shell assemblages, with the *Trochus niloticus* ring preform recovered from Batu Puti being the only other convincing example. The *Turbo*
marmoratus spoon recovered from Batu Puti shows a combination of techniques including cutting and abrading. The 'wedging and splitting' of Tridacna spp. at Kamuanan is so far unique in the region.

Apart from some light abrasion of Tridacna and Hippopus adzes from mid-Holocene levels at Golo, the techniques of grinding, abrading, cutting and drilling do not make a widespread appearance until the neolithic period. On current evidence, techniques utilised for the production of Conus spp. perforated discs, Conus spp. rings, Strombus spp. beads, and Melo spp. scoops appear homogenous across Palawan.

Uattamdi appears as an outlier in many respects with regards to shell-working protocols. Although Tridacna spp. is being worked through direct percussion, the area of the shell selected for working presently has no parallels among other sites. The shell beads are also unique, being hewn out of a solid block of shell, rather than utilising the natural morphology of a species of gastropod as is seen at all other sites. This technique of bead making would seem to have more in common with typical stone bead production rather than shell. The utilisation and cutting of Nautilus spp. is also unique to Uattamdi in Island Southeast Asia.

6.12.3 Shell-working communities of practice in Island Southeast Asia

Shell-working practices across time and space in Island Southeast Asia display characteristics of both union and disjuncture. While some of this is no doubt due to the temporal gaps present between earlier and later samples, there are also distinct shell-working approaches and techniques being practiced contemporaneously.
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The samples deriving from archaeological sites in Palawan are repeatedly linked through raw material choice, working techniques and finished artefact forms. Furthermore, there are clear continuities from neolithic-period traditions into the Metal Age, with metal tools being used to perform tasks such as drilling perforated Conus spp. discs without alteration to the broad chaîne opératoire, choice of raw material, or final artefact form. There are clear and consistent linkages between certain raw materials and particular artefact forms, with the use of Tridacna spp. being confined to adzes, Melo spp. being used for scoops, Turbo marmoratus being modified into spoons, Conus spp. shells being used for ring and perforated disc production, and Strombus spp., Pyrene scripta, Pictocolumella ocellata, Nassarius spp. and Cypraea spp. being worked into beads. The practice of depositing shell artefact blanks and preforms in burial sites is also, at present, only recorded in Palawan at the sites of Leta Leta and Paredes Shelter.

The late and unique usage of Trochus niloticus for ring production at Batu Puti, using chipping and grinding techniques, is argued here to represent the Metal Age intrusion of technological ideas stemming out of the older Trochus niloticus ring tradition present further east. In current thinking, this represents a ‘backwards’ movement of cultural influence and ideas.

The small sample from Arku Cave, with its fragments of grooved, narrow Tridacna spp. rings, is presently unique. Given the geographic location of Arku Cave c.50 km from the sea, the raw materials or artefacts themselves necessarily derive from elsewhere. The lack of similar artefacts, and indeed the dearth of shell artefacts from northern Luzon altogether, do not help us in contextualising the finds at Arku.
Kamuanan is presently a more difficult site to understand in regional context, due both to chronological issues and the fact that no finished artefacts, blanks or preforms are present. The working of *Tridacna* spp. has parallels both east and west of Mindanao, while the working of *Trochus niloticus* has pre-Metal age links to the east at Uattamdi. The use of *Turbo marmoratus* does not have any direct neolithic parallels, only becoming common in spoon manufacture in later neolithic and Metal Age deposits. The presence of non-local unworked *Tridacna* spp., *Trochus niloticus* and *Turbo marmoratus* in neolithic and/or pre-Neolithic layers at Ille Cave, however, may mean that there is very much more to be learnt about the history of the working of these taxa in Island Southeast Asia.

Golo Cave spans a considerably longer period of time than any of the other sites studied. The lower assemblage of flaked *Turbo marmoratus* opercula and the upper assemblage of *Cassis cornuta* lip adzes, have no regional parallels. Some affinities, however, can be observed between the *Tridacna* and *Hippopus* adze assemblage present at Golo, and the adzes recovered from Duyong Cave. The issue of relationships and affinities between *Tridacna* spp. adzes is further discussed in Chapter 8.

Uattamdi, like Arku Cave, currently appears as an outlier sample. While *Tridacna* spp. adzes and shell beads are found elsewhere in the region, there are distinct technological differences in the production of these artefacts at Uattamdi. The process of hewing, polishing and drilling beads from solid blocks of shell has no equivalent in the region until the Metal Age, but even such later beads – as seen for example in the upper levels at Ille Cave – are quite different in form and manufacture. The Uattamdi *Tridacna gigas* adze blank does not utilise sections of the shell consistently used elsewhere in Island Southeast
Asia, meaning the resulting morphology is unique. The fragments of *Trochus niloticus* ring(s), as well as the single narrow *Conus* sp. ring fragment, do have parallels in Palawan, although, as mentioned above, the single *Trochus niloticus* ring recovered from Batu Puti is associated with Metal Age materials. The shaping of *Nautilus* sp. or *Pinctada* spp. through cutting and/or abrasion has no parallels within the other Island Southeast Asian samples.

What emerges, then, is a clear neolithic community of practice centred on Palawan. Both Uattamdi and Arku Cave appear as outliers, with possible links expressed in *Trochus niloticus* ring manufacture in the case of Arku and Batu Puti. The Kamuanan and Ille samples indicate that the use of *Trochus niloticus* and *Turbo marmoratus* have longer histories as raw materials than is currently apparent from the available evidence. Both regional linkages and the relationships of Island Southeast Asian shell-working practices to those seen in the western Pacific are further investigated in Chapter 8.
Chapter 7: Approaches to shell-working - Pre-Lapita Near Oceania

7.1 Introduction

Sites in Near Oceania containing pre-Lapita evidence for shell artefact production have only been located and investigated since the Lapita Homeland Project of the 1980s. The analyses by Anita Smith (e.g. Smith 1991; Smith and Allen 1999) have resulted in claims for pre-Lapita working of *Trochus niloticus*, *Turbo* spp. and *Tridacna* spp., and while some interpretations are controversial (see Green 2000), the fact that shell was utilised as a raw material for the production of artefacts in the pre-Lapita Bismarck/Solomons region is undisputed. Further finds of pre-Lapita shell artefacts on Buka and Manus Islands in Papua New Guinea (see Wickler 1990; Wickler 2001; Fredericksen, Spriggs and Ambrose 1993; Fredericksen 1994), and Guadalcanal Island in the Solomon Islands (Roe 1993) further indicate that shell working was widespread, if not especially common.

The choice of samples for inclusion in this section of the analysis was controlled more by sample accessibility and security issues than the nature of samples themselves. Many of the sites excavated as part of the Lapita Homeland Project have been repatriated to the National Museum and Gallery in Port Moresby, Papua New Guinea. Security concerns precluded analysis of this material. A planned trip to Honiara, Solomon Islands to study Roe’s (Roe 1993) material from Vatuluma Posovi and Vatuluma Tavuro likewise had to be cancelled due to a government travel warning. The pre-Lapita material
excavated by Stephen Wickler (Wickler 2001) as part of his doctoral research is held jointly between the Australian National University and the University of Hawai‘i, and could feasibly be analysed. Similarly, material from the site of Pamwak on Manus Island is held at the Australian National University, thereby presenting no problems of access. Thus, assemblages forming the basis of this investigation into pre-Lapita shell-working in Near Oceania include Kilo Cave and Palandraku Cave on Buka Island, and Pamwak Shelter on Manus Island.

7.2 Kilo Cave: Shell assemblage and artefacts

7.2.1 Background and context

Kilo is a solution cave, with a large, dry main chamber and a smaller, wet inner chamber, located on the southeast coast of Buka Island, North Solomons Province, Papua New Guinea (Wickler 2001:31)(see Figure 7.1). Presently, Kilo is c. 8m above sea level and 65m back from a sandy coastal strip and reef flat (Wickler 2001:31). The site was located and excavated by Dr Stephen Wickler as part of his doctoral thesis research.

A three by one metre trench was excavated down to an average depth of 2.2m, at which point the limestone bedrock was encountered. Wickler (2001:33) comments that the deposits “consisted of homogeneous structureless silts”, and excavation thus proceeded in10cm arbitrary levels. Some differentiation of deposits based on sediment colour and texture could be made resulting in the definition of two major layers and a number of sublayers. The upper major level (layer I) is associated with Holocene dates and has been broken into three sub-units (a-c) on the basis of sediment colour. The lower major layer (II) has yielded three shell dates indicating Pleistocene occupation,
and has been divided into five sublayers. Radiocarbon dates obtained by Wickler for Kili are presented in Table 7.1. As at Golo Cave, a robust sequence of charcoal dates signal human cave use through the Mid- to Early Holocene, while a cluster of marine shell dates represent an abrupt increase in the age of deposits. Wickler attributes the lack of intervening deposits to the stability of the cave environment and the resulting minimal accumulation of sediments in the absence of human presence (Wickler 2001:33).

While the published radiocarbon sequence presents a picture of minimal disturbance, recent direct AMS dates on shell artefacts found within the Kili deposits complicate interpretations of stratigraphic integrity. These data have yet to be published in full, but following Spriggs (2001), median dates will be used below in the discussion of the worked shell. In summary, some artefacts were found to be in situ, while others were either younger or older than the surrounding dated deposits (Spriggs 2001:370-1). Rather than reflecting disturbance solely in the contexts of Kili and Palandraku, these results are indicative of the level of often-undetected subtleties and complexities in cave sequences generally.

Shell and bone are present throughout all levels of the deposit. Shell, however is dominant in layer II and the base of layer I, while bone is found in greater densities in level I (Wickler 2001:37). Flaked lithic artefacts utilising quartz, calcite, chert and volcanic rock are largely restricted to layer II (Wickler 2001:39). Charcoal was confined to layer I, with only three pieces being recorded for the uppermost spit of layer II (Wickler 2001:Tables 3.10 to 3.12).
7.2.2 The total shell assemblage

All shell recovered was screened through 6.4mm (1/4") and 3.2mm (1/8") mesh screens, with only the material recovered from the larger screen size being analysed due to time constraints (Wickler 2001:217). Shell material from all squares/units was weighed, and a single testpit was selected for the outlining of species composition and relative proportions (Wickler 2001:218). The upper-intertidal gastropods *Nerita undata* and *Nerita plicata* dominate throughout the deposits, with relatively consistent levels of patellid limpets, *Tectarius* spp. and various species of chiton rounding out the major taxa for layer II. These more minor taxa are likewise upper-intertidal zone dwellers. The presence of *Turbo* spp., being a reef-flat dweller, presents another ecological picture. While it features among the dominant species just listed, the quantification method (weights) has undoubtedly skewed its importance. Certainly its presence suggests that reef resources were available, and indeed, other reef taxa such as *Cypraea* spp. and various muricids are present in low levels (see Wickler 2001:Appendix C.8). The species list and quantitative data for layer I indicate increasing availability/exploitation of estuarine niches. This is specifically indicated by the presence of species such as *Terebralia sulcata*, *Anadara granosa* and *Polymesoda coxans* (see Wickler 2001:Appendix C.7). Reef species are less consistently represented in layer I.

7.2.3 The worked shell component

At present, the Kilu worked shell assemblage is split between the Department of Anthropology at the University of Hawai‘i and the Department of Archaeology and Anthropology at the Australian National University. Material at both locations was studied as part of this thesis. Worked shell from Kilu includes
modified pieces of *Trochus niloticus*, *Turbo marmoratus*, *Terebralia palustris*, *Conus* sp., *Tridacna squamosa*, *Tridacna maxima* and *Nautilus* sp. A full inventory of worked shell identified here is presented in Appendix 4.1. All identified worked shell was recovered from the upper Holocene layers of the site, rather than the lower Pleistocene deposits.

Two pieces of modified *Trochus niloticus* recognised within the analysed sample had previously been categorised as ring fragments. The first (see Figure 7.2a and b) is burnt and structurally-altered with much of the original surface having come away, but it shows clear signs of working that coincide with ring production. It is not clear whether the preform was created through cutting or chipping, as these surfaces have been ground back (e.g. see Figure 7.2a). The second specimen (see Figure 7.2c) is clearly worked, but relates more strongly to fishhook than ring production. The edge at the body whorl (left edge in Figure 7.2c) has been ground down, while the ventral surface edge (right edge in Figure 7.2c) has been carefully abraded, but not reduced back to the body whorl as would be expected with ring production. While the evidence is too equivocal to support an argument for pre-Lapita *Trochus niloticus* fishhook manufacture, it is suggestive.

A number of fragments of *Turbo marmoratus* were present within the Kilu sample, with some being more clearly worked than others. Four fragments of the thickened keel that runs around the shoulder of the body whorl were identified (see Figure 7.3). These fragments show no direct evidence of working, but their removal – possibly through direct percussion – would have made more accessible the shoulder area of the body whorl, fragments of which do show evidence of working. One such body whorl fragment is shown in Figure 7.4. The outer prismatic layer of shell has come away completely,
though whether this is the product of working or taphonomic processes is unclear. A series of notches around all edges indicates chipping with a sharp point to reduce the fragment. There are no finished artefacts or clear preforms utilising *Turbo marmoratus*, so it is uncertain what the intended outcome was likely to be.

The presence of ground gastropods is discussed by Wickler (2001:197-8), who suggests that these artefacts may have functioned as chisels, in the same manner as later *Terebra* sp. and *Mitra* sp. artefacts, rather than abraders. While there is considerable variation, these artefacts are turriculate gastropod spires ground on either one or two opposing faces. At Kilu, examples are invariably modified examples of the mud-dwelling *Terebralia palustris* though examples from other of the Buka sites include species in the Cerithiidae such as *Rhinoclavus vertagus* and *Pseudovertagus aluco* (Wickler 2001:197).

Eighteen *Terebralia palustris* spires were present in the analysed sample, with nine showing clear signs of human modification. These specimens were abraded on either one, or two opposing, faces. Abraded facets are curved rather than flat, indicating abrasion against a rounded surface. Examples are shown in Figure 7.5a-d. Of the remaining specimens, four were regarded as unworked, one was water-rolled, and the final four probably represent coenobitid hermit crab damage. As discussed in Chapter 4 (section 4.5.2), tree-climbing species in the Coenobitidae preferentially select slender tall-spired shells, including *Terebralia palustris* in the Potamididae. Due to the fact that apertures are not represented in the analysed sample, levels of typical hermit crab modification of this region cannot be assessed. Four apices do, however, show classic coenobitid damage. While humanly-modified specimens are abraded along a single (or two), curved facet(s), these hermit-crabbed
specimens display less concentrated and regular abrasion, consistent with being consistently dragged along the ground.

What emerges from the analysis of abraded *Terebralia palustris* specimens is a picture of some complexity. Along with being one of the major species represented in the midden deposit, there are clear examples of this species entering the site by other means (hermit crabs) or post-mortem (water-rolled). Without viewing the midden-associated *Terebralia palustris* specimens with these complications in mind, it is difficult to apportion relative importance to these various processes in the accumulation of this species at Kilu.

Four further modified shells comprise the Kilu worked shell assemblage. The first is a ground fragment of a *Conus* sp. spire (see Figure 7.6). The spire has been ground on the outer shell face with the inner face remaining unmodified. The outer/body whorl of the shell is not present, and rather than representing a ‘pendant’ (sensu Spriggs 2001:371), the fragment coincides with debitage produced during *Conus* spp. ring manufacture. A similar piece recovered from the spit above was AMS-dated to 7580 B.P. (Spriggs 2001:371), however in the greater scheme of *Conus* sp. working this is a very early date, and requires confirmation. Certainly, the specimen analysed here was burnt and structurally-altered, rendering it less than ideal material for dating.

The second of the three final modified shells is a section of the dorsal margin of a *Tridacna maxima* with grinding facets near the margin (see Figure 7.7). The rest of the fragment shows roughly fractured edges with the edge furthest from the margin being burnt. The third specimen is a single, detached flute of a *Tridacna squamosa*, which has a single, large notch produced by chipping with a sharp point. The final artefact is a cut piece of a *Nautilus* sp. shell (see Figure 7.8) which derives from one of the internal septal walls rather
than the main body chamber of the shell. The perforation is the natural siphonal hole.

7.2.4 Summary of results

While the worked shell assemblage from Kilu is small, a variety of raw materials and working techniques are evidenced. *Turbo marmoratus* and *Trochus niloticus* are clearly being modified, and in the case of *Trochus niloticus*, formal artefact types are present. Modification of *Terebralia palustris* is complex and a number of processes, both natural and cultural, appear to be at work here. The range of techniques seen at Kilu is broad, however drilling\(^{59}\) and cutting are confined to the uppermost spits of the deposit.

7.2 Palandraku Cave: Shell assemblage and artefacts

7.3.1 Background and context

Palandraku is a coastal cave located 200m north of Kilu, 50m back from the present beach and 5m above present sea level (Wickler 2001:40)(see Figure 7.1). Unlike Kilu, it is a wet cave that receives little natural light. The site was initially recorded by Specht in 1967, who began an excavation that could not be completed due to illness. It was later excavated by Wickler as part of his doctoral research (Wickler 2001; Wickler 1990). Wickler opened a three by one metre trench in what he describes as a relatively dry and undisturbed area (Wickler 2001:40). As with Kilu, stratigraphy was unclear, and excavation

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\(^{59}\) No drilled artefacts were analysed here, but a single ground and drilled bead of *Spondylus* sp. or *Chama* sp. was recovered from testpit 3, layer 1A, spit 3, and destroyed during the process of AMS dating. The median date returned was 2210 BP (Spriggs 2001:370) placing it in the post-Lapita period.
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proceeded in 10cm arbitrary levels with bedrock being reached at maximum depth of c. 180cm (Wickler 2001:41-2).

Three distinct temporal units were identified, which could be further broken down into eleven stratigraphic units within eight layers (Wickler 2001:42). The top two temporal units are associated with post-Lapita ceramic phases, and will not be further discussed here. The lowest unit (layers V-VIII) is preceramic, and associated radiocarbon dates are reproduced in Table 7.2. Densities of material evidence for preceramic human occupation are low, but shell, bone, charcoal and volcanic and coral rock are found throughout (Wickler 2001:45, Table 3.14).

7.3.2 The total shell assemblage

The results of shell midden analysis for Palandraku are presented in Wickler (2001:231-33) and sampling and quantification protocols follow those outlined above for Kilu. While change in relative frequencies of taxa was noted between preceramic and upper ceramic-associated deposits, I will only consider the preceramic material here. The dominant taxa in the lower temporal unit are *Turbo* spp., *Turbo marmoratus*, *Nerita* spp., *Drupa* spp., *Cypraea* spp. and *Polymesoda* cf. *coaxans*. Without species identifications it is difficult to be specific, but the major and minor species together indicate a collecting focus on the intertidal reef-flat, with a smaller contribution from a river mouth/estuary source (see Wickler 2001:Appendix C.9). There is little doubt, however, that the reliance on weights for quantification will tend to skew favourably to the larger and more robust reef species. The development of weedy sand environments is clear in the upper cultural levels.

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60 It is not stated whether this total includes worked *Turbo marmoratus*. 320
7.3.3 The worked shell component

Most of the worked shell recovered from Palandraku was confined to the upper ceramic-associated deposits, however a small number of pieces of worked shell were recovered from the aceramic deposits beneath. After the removal of some worked shell for direct dating (see Spriggs 2001) five pieces comprised the sample studied here. These artefacts are itemised in Appendix 4.2.

One piece of *Turbo marmoratus* displayed probable signs of working (see Figure 7.9), but the edges are very worn and the notches on one side proved, upon closer inspection, to be fresh. A further piece (see Figure 7.10) showed clear signs of working, having been cut around most of the circumference. Two pieces of *Nautilus* sp. shell also have cut edges (see Figure 7.11b-d), with cuts initiated from both the inner and outer surfaces of the shell. The final specimen is a whole *Oliva cf. carneola* with the spire removed (see Figure 7.11a). This had been achieved through chipping with a sharp point as evidenced by notches at the whorl sutures. A near identical specimen was recorded for the lower ceramic level, and it is unclear whether this represents continuity of practice or downward movement.

7.3.4 Summary of results

The worked shell sample from the aceramic levels at Palandraku is small, however raw materials including *Turbo marmoratus* and *Nautilus* sp., accord well with findings at Kilu. A further three artefacts removed for AMS dating, including two *Trochus niloticus* ring fragments and a bead of *Spondylus* sp. or *Chama* sp., also accord well. Direct dates on the *Trochus niloticus* artefacts returned pre-Lapita dates of 4810 B.P. and 5260 B.P., while the bead also returned a probable pre-Lapita median date of 3780 B.P. (Spriggs 2001:370).
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The pre-Lapita association of the modified *Oliva cf. carneola* requires confirmation, but a number of examples have been recovered recently from early Holocene contexts in East Timor (Sue O'Connor pers. comm.; personal observation), adding weight to an early occurrence in the general region.

7.4 Pamwak Rockshelter: Shell assemblage and artefacts

7.4.1 Background and context

Pamwak Rockshelter is located on Manus Island in the Admiralty Islands, Papua New Guinea (see Figure 7.12). Presently, it is four kilometres inland, though is believed have been six to ten kilometres from the coast during the Pleistocene and Early Holocene (Marlow *et al.* 1988 in Schmidt 1996). The site was first located and excavated during 1989 and 1990 as part of the Lapita Homeland Project by Wallace Ambrose, Matthew Spriggs and Clayton Fredericksen. Four 1x1m squares were opened over the course of the two field seasons with bedrock being reached in one quadrant of a single square at a depth of nearly 4m (Fredericksen *et al.* 1993:144). Excavation proceeded in 10cm spits during the first season and 5cm spits during the second, with all material being wet-screened through 1.4mm mesh throughout both (Fredericksen 1994:56).

The main published report for the site (Fredericksen *et al.* 1993) outlines seven layers defined on the basis of visible differences in sediment composition, texture and colour. These layers are described in Table 7.4. Fredericksen (1994:57) points out that these layers are probably the result of pedogenic processes, and as such, should not be regarded as directly translating to discrete periods of use/habitation. The exception to this
observation is the shell midden comprising layer 2. Fredericksen (1994:57) felt that paying greater attention to spits rather than layers would give a finer degree of resolution in analysis.

To date, thirty-five radiocarbon determinations have appeared for the site. These are reproduced and re-calibrated in Table 7.3. While there are a number of inconsistencies and inversions – particularly noted at the upper and lower interfaces of the shell midden (Fredericksen 1994:59-60) – the basic structure and sequence of archaeological deposits at Pamwak can be inferred. Fredericksen considers the dense shell midden (layer 2) to have been deposited 5000 -7200 BP (Fredericksen 1994:59). This estimate was obtained by discounting the two earliest dates for the layer, which are seen as anomalous, and pooling the other ages to determine a combined probability (Fredericksen 1994:59-60). Of this layer, Fredericksen comments that a number of lenses and bands of differing compactness indicate distinct depositional phases (Fredericksen 1994:60). Spriggs (1997:49) assigns a 6000 B.P. lower limit to the midden deposits, but as pointed out by Golson (Golson in press) the reasoning behind this choice is not clear.

Radiocarbon determinations for layer 3 present a rather more complex picture with disturbance evidenced by stratigraphic inversions (Fredericksen 1994:59). Fredericksen et al. (1993:146) suggest that it is a mixed deposit that possibly represents intermittent use between the major periods evidenced in layers 2 and 4. Later reports have consistently suggested a terminal Pleistocene association for layer 3 (Fredericksen 1994:57; Schmidt 1996:58-9). Layer 4 certainly does date consistently to the terminal Pleistocene, while dates below this are currently problematic.
7.4.2 The total shell assemblage

As can be seen in Figure 7.13, Pamwak is presently in close proximity to a number of mollusc-bearing niches, including reef intertidal, sandy intertidal, mangrove and freshwater zones. Results of the midden analysis (Schmidt 1996) indicate that this was also the case at the time of midden deposition.

The shell midden from Pamwak was sampled and analysed in the course of BA(hons) research by Lyn Schmidt (see Schmidt 1996). The northeast and northwest quadrants of squares 3 and 4 were selected for quantitative analysis. The estuarine bivalve Polymesoda coxans dominated throughout, and indeed soft-shore bivalves generally were most abundant throughout the sample. Such ancillary species include Anadara antiquata and Gafarium tumidum, in association with muddy-sand/mangrove dwelling gastropods such as Cerithidea anticipata, Terebralia sulcata and Terebralia palustris. Freshwater thiarids and neritids, as well as terrestrial snails occur most frequently in the upper portion of the midden (Schmidt 1996:37-8). Coral reef species are notable by their absence.

Although reef habitats are found reasonably close to the site (see Figure 7.13), it is evident that the residents/occupants of Pamwak were not utilising this zone as a mollusc-gathering niche. For part of the sequence at least, the reef may not have been as developed/extensive as seen now. It is also unclear, given the number and size of rivers draining into the sea along this coast, how much of the reef shown on maps could be characterised as 'clean reef' rather than sediment-covered. In any event, if clean reef habitats were locally present, they were not being utilised by the frequenters of Pamwak.
Chapter 7 – Shell-working: Pre-Lapita Near Oceania

7.4.3 The worked shell component

Pamwak is most well known within the region for its assemblage of Tridacna gigas adzes. Also reported have been Trochus niloticus fishhook blanks and rings — though the latter are restricted to pottery-bearing post-Lapita deposits (Schmidt 1996:59). Debate continues as to the chrono-stratigraphic association of the adzes, and the details of this will be covered in more detail below.

The Pamwak worked shell assemblage is held at the Australian National University, and was studied there with the permission of Wallace Ambrose and Matthew Spriggs. While the inventory largely coincided with published statements, seventeen rather than the stated sixteen (e.g. Fredericksen 1994:63) or fifteen (Spriggs 1997:59)) adzes were present. Additional worked shell not previously mentioned in publications was also incorporated into the analysis. Material studied for this thesis is listed and described in Appendix 4.3.

Three fragments of Trochus niloticus shell were present in the analysed assemblage, but they showed no definite signs of working. Their presence, given the ecology of Trochus niloticus and the ecological picture presented by the midden, is anomalous. In this respect, they are probably associated with working, though are certainly not definite fishhook blanks. The worked shell not previously mentioned includes two fragments of cut Nautilus sp. shell, and a cut piece of what is probably a species of oyster. The two Nautilus sp. pieces both derive from the main body chamber of the shell. The specimen illustrated in Figure 7.14a has two cut edges, with both cuts being initiated from the outer surface. The other piece (not shown) is burnt, and has one cut edge. The artefact tentatively identified as having been made from an oyster valve (Ostreidae sp.)(see Figure 7.14b and c) is manufactured from the same material as that used for the unique hewn and perforated disc at the Lapita site of
Kamgot (see Figure 5.28c). The edges are thin and frangible, but there is clear evidence of cutting around the acute-angled end.

Despite frequent allusions in the literature to the *Tridacna gigas* adzes from Pamwak, they have never been fully presented or illustrated. Fredericksen *et al.* (1993:148) describe the adzes as “edge-ground”, with all examples bar one being made from the dorsal region of the shell and being variants of Kirch and Yen’s (1982) Type 3\(^6\). The remaining example is described as a hinge-section adze equating to a Kirch and Yen (1982) Type 7. The seventeen adzes analysed as part of my research are shown in Figures 7.15 to 7.31. The sample includes the hinge-section adze described by Fredericksen *et al.* (1993:148)(see Figure 7.25).

*Contra* Fredericksen *et al.* (1993:148), and excepting the hinge-region adze which will be discussed further below, I would rather not attempt to place the Pamwak examples into the Kirch and Yen (1982) typology. While the adzes are indeed made from the main body of the valve (dorsal region), the alignment of the blank is quite unlike all adzes covered by Kirch and Yen’s scheme. Rather than the blank being positioned at an angle to the natural folds of the shell (as is seen in examples from Kamgot, Nenumbo, and Lapita sites generally – see Chapter 5), the Pamwak adzes are all manufactured from a single massive fold. Consequently, all cutting edges are curved, as would be expected to be the case given the natural morphology of this part of the shell.

The only physical description of the adzes to appear in print is restricted to the observation that they are “edge-ground” (Fredericksen *et al.* 1993). My analysis suggests that working was considerably more extensive than is

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\(^6\) Spriggs (1997:59) reports, in error, that all *Tridacna* spp. adzes excepting one were constructed from the hinge section of the shell.
Chapter 7 – Shell-working: Pre-Lapita Near Oceania

suggested by the use of this description. Bevel areas are most often worked from both the inner and outer surfaces of the shell (or ventral and dorsal surfaces of the adze). While the bevels may be described as 'ground', I favour the term 'abraded' here. There is little evidence of grinding facets per se, and working appears to be with a freehand abrading implement. In addition to abrasion of the bevel area, there is evidence for abrasion of the lateral and medial edges in five specimens, and abrasion of the dorsal/outer shell surface in eight specimens. There is some evidence of the use of direct percussion to detach the fold from the main body of the valve, but in most cases such evidence has been obscured by subsequent abrasion and/or wear and/or deterioration. A number of specimens also show notches/depressions created on the inner shell/ventral surface through direct percussion that may relate to hafting (e.g. see Figures 7.15, 7.16, 7.17, 7.19 and 7.20).

From surface and structural assessments it appears that some specimens at least were manufactured from subfossil shell. Three examples have been burnt, leading to structural weakness and disintegration (e.g. see Figure 7.22 and 7.31). A further example, shown in Figure 7.23, has a life history that appears to be more complex than the other specimens. This adze is clearly water-rolled and has been severely attacked and weakened on all surfaces by clionid sponges and other bio-eroding organisms. This damage has apparently occurred after the fashioning of the adze and would necessarily have had to occur under water. Clionid damage this severe indicates a period underwater of several years (see experiments and results in Lescinsky, Edinger and Risk 2002). All traces of working have been obliterated by these natural processes. In effect, it is identified as an adze on gross morphology and context alone.
As mentioned above, a single example of a *Tridacna gigas* hinge section adze was recovered from Pamwak. Traces of flake scars in some regions of the lateral and medial edges indicate that the preform was shaped using direct percussion. Most traces of this initial working have been obscured by subsequent and extensive grinding of the dorsal and ventral surfaces. The cross-section is irregular, but best described as lenticular.

While *Tridacna gigas* is undoubtedly found in lagoons around the Manus Island coast, the results of the midden analysis make clear that these habitats were not being exploited by those who frequented Pamwak. Moreover, there is no evidence for the working of *Tridacna* spp. at all within the Pamwak deposits indicating that the adzes were not produced on-site (Schmidt 1996:59). The adzes were recovered from contexts that have been associated with both terminal Pleistocene and Early- to Mid-Holocene dates, prompting a protracted debate as to their age (Fredericksen *et al.* 1993:149; Fredericksen 1994:63-4; Schmidt 1996:57-9). Figure 7.32 presents information as to adze provenances and associated radiocarbon dates and makes clear how complex this picture is. Rather than entering the fray by arguing either for or against disturbance, I think the complex chronological and stratigraphic picture for Pamwak merits the direct dating of artefacts, and arguments from the standpoint of stratigraphic association seem unlikely to provide solid answers. It is worth stating, however, that the potential use of subfossil shell as a raw material could further complicate chronological interpretation if direct dating were undertaken.

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62 *Tridacna* spp. adzes were the most common type of adze reported at contact on Manus Island (Moseley 1879 in Schmidt 1996:56).
7.4.4 Summary of results

Even if a terminal Pleistocene association for some of the *Tridacna gigas* adzes is questioned, Pamwak still provides the earliest evidence for the manufacture of these artefacts in the Asia-Pacific area. The fact that all examples bar one fall outside of Kirch and Yen’s (1982) typology is significant with respect to comparisons with later adze types. A more detailed consideration of the Pamwak adzes in relation to those from other sites follows in the next chapter. While reported *Trochus niloticus* fishhooks blanks were not in evidence, working of both *Nautilus* sp. and Ostreidae sp. indicate that there is more to worked shell artefacts at Pamwak than adzes.

Chronology and an understanding of site formation and transformational processes at Pamwak complicates interpretation, and hopefully direct dating and/or further excavation can help clarify these issues.

7.5 Summary of pre-Lapita Near Oceanic shell-working practices

While fewer assemblages deriving from pre-Lapita Near Oceanic contexts were available for analysis, and samples tend to be smaller than all Lapita and many Island Southeast Asian sites, some distinctive patterns in shell working have emerged. These relate to the selection and collection of raw materials, and the nature of the relationships between particular taxa and working techniques.

7.5.1 Raw material selection and collection

The range of raw materials utilised for the production of shell artefacts in pre-Lapita Near Oceanic sites is both limited and consistent. Worked pieces of
Nautilus spp., Trochus niloticus, and Turbo marmoratus are present in all three sites. Other worked taxa include Tridacna gigas, Spondylus sp./Chama sp., Terebralia palustris, Conus sp. and Ostreidae sp. Epibiont damage seen on Tridacna gigas valves utilised in the manufacture of adzes at Pamwak indicates that at least some specimens of this species were collected post-mortem. Post-mortem collection is also necessarily the case with individuals of Nautilus sp.

That the gathering of shell specimens intended for working did not overlap with the collection of shellfish for subsistence purposes is demonstrated at Pamwak by a general ecological disparity between midden contents and the worked shell assemblage. This, together with the recurrent status of major shells selected for working across sites, implies that particular species were actively sought as raw materials.

7.5.2 Shell working techniques and protocols

Green (2000: 380) has pointed out that shell artefacts deriving from pre-Lapita Near Oceanic contexts more frequently fall into the category of unmodified utilised shell than the category of formal artefacts. While formal artefacts are indeed uncommon in such deposits, there are consistencies in raw material selection and associated working protocols that indicate clear commonalities in shell-working practices between sites. This is especially noticeable when the observations of Anita Smith (Smith 1991, 2001; Smith and Allen 1999) are incorporated. While it remains unclear exactly what formal artefact types (if any) were being produced from Trochus niloticus, there is a consistent pattern of reduction through chipping of the shell with a sharp point. This same technique has been observed at Kilu Cave in the working of Turbo marmoratus. A cutting technique was uniformly applied to Nautilus spp. at Pamwak,
Palandraku, and Kili, and cut *Turbo marmoratus* is further recorded for Palandraku.

Thus, while small sample sizes are small, observations about raw material selection and working protocols indicate strongly that approaches to shell-working are shared between populations in Near Oceania – either through ancestral links or group contact.
Chapter 8: Discussion and Conclusion - Shell-working and communities of practice

In the western Pacific, Austronesian colonists between 1500 and 1000 BC left an extremely clear-cut trail of pioneer archaeological sites across about 6,500 kilometres of ocean.... Lapita, therefore, can provide an excellent insight into its logical antecedents, which lie somewhere in the eastern regions of Indonesia or the Philippines... (Bellwood 1997:234)

It is the ‘cultural complex’, not the pottery, which develops in the Bismarcks (and probably the Solomons) over millennia; it is the pottery which, being suddenly included within the complex, becomes the ‘barium meal’ that allows us to see its extent. (Allen and White 1989:142)

8.1 Distributions: raw material, techniques and practices

8.1.1 Introduction

There has been considerable detail given in the presentation of results over the last three chapters for the nineteen assemblages analysed in this thesis. While much could be said, and these data pulled together in various ways, here I will focus upon spatial and temporal patterning in raw materials, artefact types and working techniques in their various combinations. I will focus on each major family consistently associated with artefact manufacture identified within this thesis in turn, including the Trochidae, the Turbinidae, the Tridacninae, the Conidae, the Pteriidae and Isognomonidae, the Nautilidae, the Cypraeidae, the Nassariidae and the Strombidae.

8.1.2 The Trochidae

Trochus niloticus is one of the species that has been used to argue for continuity of shell working traditions through time in the Bismarck Archipelago (e.g. Smith 2001). The presence of Trochus niloticus rings in pre-Lapita
deposits has been confirmed through the recovery of finished and broken examples from sites such as Kilu and Palandraku Caves on Buka Island (Spriggs 2001), Guadalcanal in the Solomon Islands (Roe 1993) and Lolmo Cave in the Arawe Islands (Gosden, Webb, Marshall and Summerhayes 1994). Claims for the presence of *Trochus niloticus* fishhooks in pre-Lapita deposits have met with more resistance (Green 2000). However, a complete and a broken example, recently excavated from Lene Hara Cave in East Timor, have returned early and mid Holocene dates respectively (O'Connor and Veth In press; Szabó and O'Connor In press), so the proposition is not implausible. In addition, for Kilu Cave I have also argued that a piece of worked *Trochus niloticus*, previously identified as a ring, matches more closely the working expected for fishhooks.

The geographic and temporal distribution of *Trochus niloticus* working identified within this thesis is presented in Figure 8.1. The two consistent formal artefact types manufactured from *Trochus niloticus* are rings and fishhooks; both of which have a presence in Island Southeast Asia if the East Timor examples are incorporated.

The earliest evidence for *Trochus niloticus* ring manufacture is clearly in the Bismarck Archipelago area (see Figures 8.1 and 8.2). The earliest evidence for *Trochus niloticus* rings in Island Southeast Asia is provided by Uattamdi, however its unit C association does not indicate a pre-Lapita age (see Figure 8.1). The sole remaining *Trochus niloticus* ring – in this case a preform – is associated with Metal Age jar burial deposits at Batu Puti in Palawan. Traces of working visible on this preform indicate that production methods, on current evidence, coincide with production methods seen in Near Oceania.
Chapter 8 – Discussion and Conclusion

*Trochus niloticus* rings are a consistent presence in Lapita worked shell assemblages (see Figure 8.2), although numbers are always low and evidence of production sparse. Of the Lapita samples analysed within this thesis, only Nenumbo contained no evidence of *Trochus niloticus* working. The evidence from Naigani is equivocal. Where *Trochus niloticus* rings do appear in deposits (Kamgot, Vao, 13A, St Maurice-Vatcha), *Trochus niloticus* fishhooks are generally also recovered. Vao is the only exception here, however it is worth noting that the Vao sample is very much smaller than samples from either Kamgot or the New Caledonian sites.

Unambiguous *Trochus niloticus* one-piece, jabbing fishhooks are confined in Oceania to Lapita deposits, however an equivocal example was identified within the Kilu deposits (see above). Evidence for a Near Oceanic pre-Lapita ancestry for this artefact type has been, to date, tantalising without being completely convincing. The new examples from East Timor (mentioned above) indeed confirm a more ancient record for these artefacts than their consistent Lapita association would suggest. No shell fishhooks have ever been recovered from Philippine deposits, with the exception of a single example from Itbayat Island in the northerly Batanes Islands (Bellwood, pers. comm.; personal observation). This example, however, is not in *Trochus niloticus* and does not follow the strong patterning seen in both form and manufacture further south. As a tentative assessment, it would appear to link more closely to specimens excavated from nearby Taiwan (e.g. O-Luan-Pi, see Li 1983).

Probable pre-ceramic working of *Trochus niloticus* has been identified at Kamuanan Shelter in the southern Philippines. Formal artefacts, blanks or

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63 This specimen has subsequently been lost, however, from seeing it after initial recovery, I identified the raw material as *Turbo* sp. and probably *Turbo marmoratus*. Given its association, it is also unlikely to pre-date (or perhaps even be contemporaneous with) the Lapita period.
Chapter 8 – Discussion and Conclusion

preforms are not present, and it is unclear what (if any) formal artefact was to be produced. What can be said, however, is that the method of chipping at the margins of the fragment with a sharp point coincides with techniques applied to both ring and fishhook manufacture elsewhere. There is at least some linkage in terms of practical dispositions to the working of *Trochus niloticus* – and indeed the choice to work *Trochus niloticus* at all – regardless of potential final outcomes. Little can be said about *Trochus niloticus* in relation to Ille Cave and Shelter. Its presence within the freshwater/estuarine dominated midden is anomalous but there is no indication of working *per se*. I feel that its presence - along with *Turbo marmoratus* and *Tridacna* spp. - is significant, as these species stand apart ecologically from the rest of the shell assemblage. It is clear that they have been deliberately chosen and sourced from further afield. That these species coincide with species showing evidence of working at Kamuinan is, I think, no coincidence.

The available evidence to date suggests that *Trochus niloticus* ring manufacture was a mid-Holocene Near Oceanic innovation with the technology being transferred through time to Lapita peoples and west into Island Southeast Asia. Although evidence for all regions and periods until post-Lapita is limited, there is nothing to suggest that production techniques differed. *Trochus niloticus* fishhooks are dominantly associated with Lapita deposits, and particularly far western and southern Lapita sites. This concentration may have more to do with chronology than geography, with deposits containing *Trochus niloticus* fishhooks usually being earlier in the Lapita phase than deposits from which they are absent. Smith (2001:151) notes that *Trochus niloticus* fishhooks are absent from the regional material inventory in the post-Lapita period. The analysis presented here suggests that this ‘loss’ may have occurred within the
Lapita period itself rather than being a feature of the Lapita/post-Lapita transition.

*Trochus niloticus* as a general working material clearly has a pre-Austronesian association in both Island Southeast Asia and Near Oceania. The type of working noted for *Trochus niloticus* fragments by Smith and Allen (1999) for Pleistocene through to mid-Holocene deposits at the New Ireland sites of Matenbek and Matenkupkum coincides with that noted here for both Kili Cave and Kamuanan Shelter\(^{64}\). This includes not only notched body fragments but also a whole *Tectus pyramis* shell reduced by secondary percussion and/or pressure flaking right back to the columella\(^{65}\) (see Figure 6.56). The purpose/intent of this working is unclear, but its presence makes it worthy of attention in its own right.

Both the Mindanao and East Timor evidence suggest that positing continuity of *Trochus niloticus* working in the Bismarck/Solomon area alone is overly restrictive. Indeed, the evidence presented here indicates that the working of *Trochus niloticus* was linked over a wide area prior to the assumed Austronesian dispersal. Notably, however, there is currently no evidence for its use in the central or northern Philippines – or Taiwan to my knowledge - at any point.

### 8.1.3 The Turbinidae

Worked *Turbo argyrostromus* and *Turbo setosus*\(^{66}\) have been identified for Pleistocene through to mid-Holocene deposits at the New Ireland sites of

\(^{64}\) Although the ‘drillholes’ noted by Smith and Allen (1999) have been interpreted in this thesis as chipped notches that are morphologically distinct from drill-holes seen in later shell artefacts. On the basis of photographs in Smith and Allen (1999), I would offer a similar interpretation for the Matenbek and Matenkupkum material.

\(^{65}\) Or the ‘spine’ of Smith and Allen (1999).

\(^{66}\) Only *Turbo argyrostromus* is cited in text and captions, however the specimen on the right in Smith and Allen (1999), figure 4, appears to be a *Turbo setosus*. 

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Matenbek and Matenkupkum (Smith and Allen 1999). From available photographs, I am not convinced that these shells are ‘drilled’, as the notches appear too irregular in both morphology and profile to indicate sustained rotary motion. The photographed shells do, however, appear to be worked — at least with a sharp point. In the assemblages I have studied as a part of this research, there was no evidence of the utilisation of *Turbo argyrostomus* or *Turbo setosus* as raw materials. Where modified specimens of these taxa were encountered, there was no evidence to suggest they were related to working rather than meat extraction. Of the Turbinidae, the only species that was identified as having been worked in the samples discussed here was *Turbo marmoratus* (see Figure 8.3 and 8.4).

*Turbo marmoratus* opercula, reduced by direct percussion, are almost totally restricted to the lowest layers of Golo Cave, and are not present at any other site. There are few sites in the region that contain deposits as old as these (c. 32,000 b.p.), so this situation is unsurprising. What is notable is that the technique applied — direct freehand percussion — is an unusual technique to see applied to shell *in isolation*. While direct percussion has frequently been noted across various taxa as a method of primary reduction, it is not associated with the latter stages of the production of formal artefacts. Furthermore, the aim, generally, was not to produce flakes in any sort of controlled manner, but simply to force breakage and generate manageable pieces and/or blanks for further working. In this, direct percussion as a working technique has a markedly different status in shell-working as compared to its utilisation in the manufacture of lithic artefacts. In contrast, the true ‘flaking’ of *Turbo marmoratus* opercula at

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67 An equivocal and very eroded example is present in the upper part of the Kamgot deposits. In this instance, it cannot be ruled out that the slight evidence of chipping around the edges is the product of taphonomic ‘wear and tear’.
Golo suggests the direct transferral of lithic technologies to shell. This is something not seen in any of the later deposits studied and could well provide a valuable insight into the first shell-working technologies of the region.

Before leaving the subject of worked *Turbo marmoratus* opercula, the presence of partially-reduced examples at the southern Taiwanese site of O-luan-pi should be mentioned. A number of opercula with chipping around the edges are shown in Li (1983) and these are apparently associated with all phases (OLPI-IV), thereby spanning the period from c.5000-2500 b.p. These examples show minimal evidence of flaking, with only between one and three flakes being removed from each specimen. Thus, rather than acting as ‘cores’ as is the case at Golo, these probably represent functional artefacts in their own right. Indeed, examples from the southern Taiwanese site K’en-ting are termed ‘scrapers’ (Li 1982). There is little to suggest that Taiwanese examples are not an independent innovation.

Working of the body whorl of *Turbo marmoratus* has a wider spatial and temporal distribution, with occurrences in both Island Southeast Asia and Near Oceania (see Figure 8.3 and 8.4). In all instances, worked fragments derive from the shoulder area of the inflated body whorl. The only identified formal artefacts utilising *Turbo marmoratus* as a raw material are one-piece rotating fishhooks at Kamgot. Evidence for the production of these fishhooks at Kamgot indicates that preforms were created through a combination of cutting and indirect percussion/pressure flaking with a sharp point. Earlier worked fragments from Kilu, Palandraku and Kamuanan show that both these techniques have a prior Holocene history in the region, though only a single worked fragment from Palandraku shows the use of the two techniques together (see Figure 7.10). The cut edge on the Palandraku piece is curved, which
contrasts with illustrated examples from Kamgot (see Figure 5.12) where cut edges are straight. Curved cuts are, however, present within the Kamgot sample. Curved cuts were presumably produced by working with the sharp edge of the cutting implement perpendicular to the surface of the shell, while straight edges were worked with the sharp edge parallel. Given the morphology and production techniques seen for *Turbo marmoratus* fishhooks at Kamgot, it is likely that the Palandraku example represents a rotating fishhook preform.

The intent associated with *Turbo marmoratus* working within the Kilu and Kamuanan samples is unclear. It is also worth noting the presence of cut *Turbo marmoratus* and a clear fishhook preform from aceramic levels of Lebang Halika on Nissan Island (Spriggs 1991).

The *Turbo marmoratus* spoon identified at Batu Puti is but one example of a tradition that, from an assessment of the literature, clearly spans from Palawan up to the Ryukyu Islands in southern Japan (e.g. see Takemoto and Asato 1993). Other examples recovered from sites in Palawan are discussed in Chapter 6. The site of O-luan-pi in southern Taiwan has produced at least one example, associated with deposits dated to c.3000 b.p. A neolithic occurrence is suggested by the recorded presence of an example at Leta Leta, but most Philippine examples are associated with Metal Age (post 2300 B.P.) deposits.

The presence of *Turbo marmoratus* is noted for Ille Cave at an approximate date of 7000-6000 B.P. As with *Trochus niloticus*, there is no sign of working, but in the same manner, its presence within the shell sample is anomalous.

There appear to be at least three separate strands of *Turbo marmoratus* working evident across the study region through time. The earliest working practices focus upon the operculum rather than the shell itself, and direct
percussion flaking is associated. This may represent a direct transferral of lithic technologies. The evidence for this, present in the lowest deposits at Golo Cave, is at present unique. Early to mid-Holocene *Turbo marmoratus* working, evidenced from Mindanao in the west to Buka in the east, utilises the inflated body whorl of the shell around the shoulder area. Both cutting and working with a sharp point are employed. Where preforms and finished artefacts are present, fishhook production is confirmed (Kamgot) or indicated (Palandraku, Lebang Halika).

Kamgot is the only Lapita site studied as a part of this thesis to contain evidence of *Turbo marmoratus* fishhook production – or indeed any sort of utilisation of this species at all. Abundant evidence of its use in the production of fishhooks in a very similar manner to that seen at Kamgot is seen in early Kiki phase deposits (c. 2850 B.P.) as well as later phases on Tikopia (Kirch and Yen 1982). As Kirch and Yen note (1982:239) however, evidence for the use of *Turbo marmoratus* is more patchy on a regional scale. While Kirch and Yen (1982:239) suggest that local availability may be the critical variable, this would not seem to explain all – or even the majority – of cases. While *Turbo marmoratus* does not occur in New Caledonia, it occurs across the rest of Melanesia (see Chapter 4). Even if it is not immediately local, evidence from sites such as 13A (see Chapter 5) and Natunuku (Szabó 2001) suggest that if a desired raw material is not found locally, then efforts are made to acquire it from further afield.

I suggest here that the selection and working of *Turbo marmoratus* into fishhooks represents a continuity of practice from earlier traditions in the region. While this tradition appears to have fallen largely by the wayside as Lapita peoples expanded eastward, it is perfectly feasible that it was retained by
certain peoples/in certain areas. Tikopia may very well represent one such place.

The third distinct strand of *Turbo marmoratus* working relates to the production of spoons in Island Southeast Asia. This is associated with late neolithic/Metal Age sites, and appears to be restricted to an axis running from Palawan up to southern Japan. The (relatively) complex morphology of these artefacts, and the consistency in expression between various areas, indicate at least cultural contact, if not technological transfer and a close and sustained relationship.

### 8.1.4 The Tridacninae

The working of giant clam has a long history and evidence of its use as a working material spans the study area. The two major formal artefacts produced are adzes and rings, with both occurring in a variety of forms. Double-perforated units make an appearance in the middle/late Lapita period.

Assertions as to the significance of *Tridacna* spp. adzes in particular have been a feature of the regional literature for decades (e.g. Ronquillo 1998; Fox 1970). Spriggs (1996b:341) considers *Tridacna* spp. adzes to be rather unhelpful in untangling the 'Lapita origins' question, due to their widespread occurrence – although stylistic differences are alluded to (Spriggs 1996b:340). While Spriggs is perhaps correct in his assessment, *Tridacna* spp. adzes do have more of a story to tell.

The traditional high-level distinction in the description of *Tridacna* spp. adzes in the Pacific is whether the hinge or the 'dorsal' region of the shell is utilised in manufacture (e.g. see Kirch and Yen 1982). As mentioned in the presentation of results from Pamwak, this division may work very well for adzes
associated with Lapita and post-Lapita deposits, but does not (and no doubt was not intended to) work when applied to pre-Lapita adzes recovered from contexts in Near Oceania and Island Southeast Asia. The use of a single valve fold is characteristic of such earlier adzes, with only four unfinished specimens from the early TK-4 site on Tikopia representing a later occurrence in (late) Lapita period Oceania (Kirch and Yen 1982:210).

In the study region, pre-Lapita age adzes made from the Tridacna fold-region dominate in Wallacea and eastern assemblages (Near Oceania), while hinge section adzes dominate in the Philippines. The only convincing hinge-section adze recovered in a pre-Lapita context from the Near Oceanic region studied as a part of this thesis derives from Pamwak (see Figure 7.25). It would appear to have a mid-Holocene association (refer to Figure 7.32). This specimen shows far more evidence of grinding/abrasion than other Pamwak specimens, and is perhaps the only pre-Lapita specimen that shows any close relationship to later Lapita hinge-section forms.

The only other pre-Lapita Near Oceanic hinge-section adze to have been recovered is a spot find from the Sepik region of the north New Guinea coast (Swadling 1994:134). A direct radiocarbon date on this specimen returned a determination of 4,980±90 b.p. (Swadling 1994:134). Both Swadling (1994:134) and Golson (in press) raise the possibility that the adze was manufactured on old shell, thereby returning a date not coincident with artefact production, but this is rejected by Swadling, and less emphatically by Golson, on the basis of extra-areal parallels, contemporaneous regional transformations and the position of the Sepik-Ramu inland sea at this time. In terms of working, the degree of grinding is much less than is seen on the Pamwak specimen, and the original hinge morphology is clearly visible. In this, as well as overall
morphology and size, it is much more like the two specimens analysed from Duyong Cave in the Philippines (see Chapter 6).

As mentioned above, hinge-section adzes dominate in the Philippines. The only exception I have come across is the *Tridacna* spp. 'gouge' referred to by Fox as occurring in neolithic deposits (although not in association with the burial) at Duyong Cave, and illustrated in *The Tabon Caves* (Fox 1970:Figure 42e). In the separation of *Tridacna* spp. implements into 'adzes' (hinge section) and 'gouges' (fold section), Fox may have hit upon the critical variable between the two forms: function. While all the hinge-section adzes analysed as a part of my research have had straight cutting edges, the fold-section adzes invariably have curved cutting edges. This may very well translate to a difference in function. Given the patchy distribution of pre-Lapita *Tridacna* spp. adzes, and the fact that the two forms do not separate cleanly on geographic lines, I suggest that the Philippine, eastern Indonesian and Near Oceanic adzes represent a cluster of related technological practices rather than independent innovations along east/west lines. The single well-ground hinge-section adze from Pamwak is a likely transitional example to the Lapita period.

The 'type 4' Lapita adze (Kirch and Yen 1982), constructed from the dorsal region of the valve at an angle to the folds, has long been recognised as a Lapita innovation, and there is nothing in this current analysis to contradict this interpretation. The association of this adze type with *Tridacna maxima* can also be viewed as a Lapita innovation, with *Tridacna gigas* dominating as a raw material in pre-Lapita times.

*Tridacna* spp. rings were recovered from the Lapita sites of Kamgot, Vao, and St Maurice-Vatcha. In Island Southeast Asia, their presence is restricted to the uppermost spit at Arku Cave. The two Arku fragments are potentially from
the same ring, which is narrow in width with a wide, abraded central groove.
The same general morphology and finishing is seen in a single example at
Kamgot. Neither site contains manufacturing debris or blanks/preforms
associated with this form, so it is difficult to comment upon similarity or
difference in manufacture. Given the stratigraphic position of the Arku
fragments and the radiocarbon determinations for the site (Table 6.1) it seems
unlikely that they would pre-date the Kamgot example. The remaining Lapita
examples are all more robust, with a particularly large specimen from Kamgot.
No clear manufacturing debris or unfinished examples were recovered from any
of the samples analysed, making further comment difficult. What can be stated
is that there was clearly a range of different sizes and morphologies produced.

Worked fragments of *Tridacna* spp. and *Hippopus hippopus* have been
recovered from a greater range of sites. From these pieces, two major primary
reduction methods have been defined: ‘wedging and splitting’ seen at
Kamuanan, and direct percussion in order to break up valves at Vao. The
distributions and temporal spans of these techniques are presently unknown.
Conchoidal flakes of *Tridacna* spp. are so infrequent that it seems unlikely a
controlled and systematic ‘flaking’ technique was used with any regularity.
Rather, direct percussion as applied to *Tridacna* spp. appears to be more of a
‘rough and ready’ technique. Cutting is likewise an uncommon technique,
represented by a lone hinge fragment at Naigani (see Figure 5.105a).

Despite the fact that more attention has been focussed upon the
understanding of *Tridacna* spp. than any other shell taxa utilised as a raw
material (e.g. Moir 1990; Smith 1991) both small sample sizes and its
complexity as a working material mean that it remains, by and large, intractable.
Further experimental work coupled with lateral thinking and a solid understanding of ethnographically-recorded techniques is needed.

**8.1.5 The Conidae**

Species in the Conidae, and *Conus litteratus/Conus leopardus* in particular, are by far the dominant shells selected for working within Lapita sites. *Conus* spp. artefacts are identified for all Lapita samples analysed within this thesis, with a range of formal artefact types being found at all of these sites (see Figures 8.7 and 8.8).

Given that there are approximately four hundred morphologically-similar species of *Conus* inhabiting Indo-Pacific waters, I think it is notable that only a few are selected for working – and most of these consistently so. While an argument could be made for the selection of *Conus litteratus/Conus leopardus* based on size (these are the largest species of *Conus* inhabiting the Indo-Pacific) and intended function (rings), I believe this feature is secondary in the selection of particular species of *Conus*. Of the nine species that show evidence of working identified within the studied Lapita samples, five are patterned with dark rows of spots on a white background (*Conus litteratus, Conus leopardus, Conus eburneus, Conus ebraeus* and *Conus stercusmuscarum*), with one (*Conus marmoreus*) being patterned with white ‘tent-shaped’ markings on a black background. A glance at any glossy guide to shells of the Indo-Pacific will demonstrate the variability in patterning and coloration in the Conidae, thereby reinforcing the highly selective nature of Lapita raw material selection. Thus, rather than selecting *Conus* sp. specimens based on the sizes of final artefacts, I suggest that coloration and patterning
was the first-order selection criteria. These specimens were then subdivided into working/artefact categories based on size.

The lack of a first-order focus on size is perhaps reflected in the homogeneous *Conus* spp. working techniques across most associated artefact types. There is little difference in the chaînes opératoire established, or working techniques isolated, for rings, ‘mini-rings’, perforated discs and beads. This relationship is even closer at St Maurice-Vatcha, where beads and rings are seemingly produced from the same shell with overlapping production sequences.

The only major technological division seen in *Conus* spp. working relates to reduction through cutting versus reduction through direct percussion. As suggested in Chapter 5, I believe that a cutting technique is most often associated with the production of broad rings. Interestingly, however, cutting of the smaller species *Conus eburneus* – surely not destined for ring manufacture – is recorded for St Maurice-Vatcha. I have argued that cutting, as a reduction strategy, is less risky though more labour intensive than direct percussion. This increased labour translates to a ‘higher value’ which is reinforced by the fact that, when broken, broad rings are curated and reworked into new forms whereas their narrow counterparts are not.

Lapita *Conus* spp. working is both consistent and ubiquitous across its spatial and temporal range, with the only deviations noted in the samples analysed here being the ‘recycling’ of ring debitage to generate beads at St Maurice-Vatcha, and two unique artefacts at Vao. The relationship of Lapita *Conus* spp. working to the equally distinctive *Conus* spp. artefacts recorded for Island Southeast Asia and the sparse evidence for pre-Lapita Near Oceania is more complex.
Conus spp. working in Island Southeast Asia is concentrated in Palawan. While it could be argued that this represents differential sampling, the apparent dearth of shell artefacts as compared to the amount of work undertaken in Luzon suggests that this pattern holds. Ground and perforated Conus spp. spires dominate in earlier deposits (e.g. Duyong and Ille), while rings seem to occur slightly later (Leta Leta). Both forms continue through into the Metal Age, and are recorded elsewhere in the Philippines at this time (e.g. Solheim 2002:passim).

Ground and perforated Conus spp. spires do occur in Lapita deposits, however they are never common\(^{68}\) and are consistently much smaller in size than examples from Palawan. There is also some ambiguity as to whether many (or even most) ground and perforated spires associated with Lapita deposits represent artefacts in their own right or unfinished pre-forms of small rings. There is no such ambiguity with the Palawan examples. If there is any relationship between specimens from Palawan and those associated with Lapita deposits, it seems remote. The clear importance of ground and perforated Conus spp. spires in Palawan, signified not only by their frequency but also by their recurrent association with burials, further suggests that these artefacts had a different and altogether more significant role in everyday practice.

Conus spp. rings have a slightly different spatial and temporal distribution in Island Southeast Asia, with examples appearing outside of Palawan at the northern Moluccan sites of Uattamdi (Chapter 6) and Buwawans\(^{69}\). Single examples of narrow rings were recovered from both sites, though both post-date the emergence of Lapita-associated rings to the east. Conus spp. rings in

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\(^{68}\) I have noticed that many Lapita examples are water-rolled rather than ground/abraded with no evidence for cultural modification.

\(^{69}\) An inspection of the Buwawansi specimen reveals that it is of unique morphology and manufacture potentially representing the diffusion of an idea, but not technological transfer.
Palawan (and elsewhere in the Philippines) tend also to be associated with late/post-Lapita dates. At Ille Cave, two ring fragments are found in the uppermost spits only.

The only secure pre-Metal Age association for Conus spp. rings in Palawan is at Leta Leta cave, where there is evidence for both broad and narrow ring forms. As reported in Chapter 5, two radiocarbon dates obtained for Leta Leta for this thesis suggest that the cave was frequented around 3500 – 3200 B.P., thereby overlapping with early Lapita sites. While there is no reason to suspect that the Leta Leta dates are not robust, I remain wary of inferring chronology at burial sites in the absence of a detailed stratigraphic understanding. Lapita occupations, on the whole, appear as short-term one-off occupations thus providing a relatively tight chronology, but the same cannot be said of caves utilised for burials. There are no Metal Age deposits at Leta Leta, but this recognition should not be used to infer neolithic homogeneity. In short, we presently have no idea how long Leta Leta was in use and whether the dates obtained fairly reflect the temporal status of the deposits in general, let alone particular artefact forms.

Technologically, there is little in the Leta Leta sample to suggest that Conus spp. rings were produced in a significantly different manner to Lapita examples. This is stated, though, without the benefit of debitage and unfinished artefacts. The drilling of perforations near the apertures of the broad rings is so far unique to this site and a feature not seen in Lapita-associated examples.

The three rather lonely Conus spp. artefacts reported for pre-Lapita deposits in Near Oceania are all ground spires; one from Lolmo Cave in the Arawe Islands (Gosden et al. 1994) and two from Kilu Cave. A direct AMS determination with a median date of 7580 b.p. has been reported by Spriggs
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(2001:371) for one of the Kilu examples, and while this seems inordinately early, this date accords with its stratigraphic position. While this evidence confirms pre-Lapita Conus spp. working, it is a stretch to argue for continuity through to Lapita.

On present evidence, Lapita Conus spp. working practices seem to be most closely related to the Leta Leta assemblage in northern Palawan. This is the only site outside of the Lapita spatio-temporal range itself where broad rings have been reported, and the consistent selection of Conus litteratus and/or Conus leopardus is certainly another commonality. Despite this, the large ground and perforated spire assemblage has no genuine parallel in Lapita, and details of broad ring finishing differ. On the other hand, Leta-Leta lacks the diversity seen so consistently in Lapita samples and cannot truly be called ‘older’ on the basis of current radiocarbon determinations. The intermediate geographical position of the northern Moluccas does not really assist interpretation, as radiocarbon dates or material evidence give no insights as to directionality of influence.

While synthesis of Conus spp. working across the region is difficult, I propose here that early links between Lapita and Island Southeast Asian practices are not close, although ground spires may have a longer pan-regional history. Both the status and many of the artefact forms associated with Lapita Conus spp. working to a large degree represent Lapita innovations. While this may seem bold given the amount and diversity of Lapita Conus spp. artefacts, the interchangeability of the chaînes opératoire between bead, ring, and perforated disc manufacture means this may not be such a great leap. This ‘technological transfer’ between various sizes of Conus spp. to produce various
sorts of artefacts is further bound together by the noted aesthetic consistency of the raw material.

Whether the practice of cutting Conus as a primary reduction technique was likewise linked with the production of broad rings at Leta Leta is unknown. Cut Conus spp. shells do, however, occur in southern Taiwanese sites. I do not wish to go into detail regarding Taiwanese evidence; it is taken here that evidence for the movements of techniques out of Taiwan and through Island Southeast Asia should leave a detectable signature in the Philippines and eastern Indonesia. Despite this, it is worthy of note that cut Conus spp. shells occur in cultural units III and IV at O-luan-pi (Li 1983) as well as the nearby site of K’en-ting (Li 1982). At O-luan-pi they do not predate either Leta Leta or early Lapita (Li 1983:80-1). A single radiocarbon determination from K’en-ting on marine shell artefacts (pooled?) has returned a date of c. 3600-4300 B.P. (2 sigma range) (Li 1982:15). Whether this fairly dates all the deposits remains to be tested. If the Taiwanese evidence does prove to be technologically linked to that noted for Lapita, the pathway for the movement of these ideas (and perhaps even their direction) is not presently visible.

8.1.6 The Pteriidae and Isognomonidae

The working of pearl oyster in the families Pteriidae and Isognomonidae has a patchy geographic distribution (see Figure 8.10). There are no formal artefacts associated with either of these families although a set of basic working techniques are various applied – presumably for the production of expedient tools (see Figure 8.9). Cutting is the most common technique across space and time, with abrasion being linked to wear more than working. The simplicity and minimal extent of working mean that similarities in working between regions
may represent no more than fortuity. Despite this, the cluster of usage across sites falling into middle and late Lapita phases may be the first signal of its rise as a raw material going into the post-Lapita period. It is worth mentioning the presence of pearl oyster fishhooks recovered from the Fijian Lapita site of Lakeba here (Best 1984). Patchy occurrences in Island Southeast Asia aside, the consistent use of pearl oyster appears as a Lapita innovation in Remote Oceania. Its only recorded presence in Near Oceania is in at least two cut fragments from aceramic levels at Lebang Halika on Nissan Island (Spriggs 1991).

8.1.7 The Nautilidae

Unlike other taxa discussed in this research, Nautilus spp. shells are chance finds washed up on coasts from offshore waters. Currents, as well as localised concentrations of Nautilus spp. animals mean that shells will be washed up more frequently in some areas than others. I have collected specimens of Nautilus pompilius and Nautilus scrobiculatus from Ambitle Island, off the east coast of New Ireland. Nautilus macromphalus is restricted to New Caledonian waters, and is indeed the species identified at St Maurice-Vatcha.

Despite this patchiness, and the serendipity of availability, there is a clear cluster of Nautilus spp. working in the Near Oceanic region extending as far as Buka Island, and also taking in Uattamdi in the west (see Figures 8.11 and 8.12). Excepting the St Maurice-Vatcha pieces, which will be discussed in more detail below, all other fragments are simply cut. If formal artefacts were intended, there is no clue as to what these may have been. Three examples (one each from Uattamdi, Kamgot and Kili) utilise a portion of the septal wall
rather than the main body chamber. All three also incorporate the natural perforation provided by the siphon into the fragment.

One broken, whole *Nautilus macromphalus* shell was recovered from St Maurice-Vatcha. There are no direct signs of working, however the thin and brittle nature of *Nautilus* spp. shell means that it can be easily snapped leaving no recognisable signals of human modification. Two nacreous beads, also from St Maurice-Vatcha, have been tentatively identified as having been produced from *Nautilus* spp. shell. The use of *Nautilus* spp. for the production of shell beads is not unprecedented with numerous examples having been recovered from various sites in East Timor (see Glover 1986).

*Nautilus* spp. working has a consistent presence in the Near Oceania/Wallacea region with utilisation spanning from at least the mid-Holocene into the Lapita period. On present evidence it is unclear whether the St Maurice-Vatcha material links with working techniques evidenced further north, or represents a local innovation.

### 8.1.8 The Cypraeidae

Worked cowrie is represented by a single or few specimens in five sites (see Figures 8.13 and 8.14). Specimens at Illie and Kamgot derive from small species and are represented by the ventral surface minus the dorsum, while Nenumbo, Vao and Uattamdi provide evidence for the working of the dorsum of larger species. Working techniques and their applications differ in all cases.

### 8.1.9 The Nassariidae

Species of *Nassarius* with the dorsum removed, most probably by direct percussion were recorded here for both Illie and Leta Leta. Although minimally worked, patches of wear noted on some specimens indicate that the modified
shells were affixed to a surface or strung. Although a greater range of species have been uncovered from Ille, all species identified are of very similar size and morphology and do not appear heterogeneous unless closely examined. Nassarius spp. beads have been identified for other neolithic and Metal Age sites in Palawan (see Section 6.4.3.3). Nassarius spp. beads, stated to be cut, have been identified within undated ceramic-bearing middens in the eastern Ramu area of the north coast of New Guinea (Swadling 1994:134), and have also been recovered recently from deposits in East Timor where their appearance seems to date to the terminal Pleistocene/early Holocene (Sue O’Connor, pers. comm.; personal observation). The relationship between the artefacts from these regions is presently unclear, in large part due to the simple methods of production.

8.1.10 The Strombidae

Strombus spp. beads have only been identified for Palawan Island to date, with the Ille deposits providing evidence relating to production techniques (see Figures 8.15 and 8.16). Recent excavations in the vicinity of Duyong Cave (Chazine n.d.) indicate that this type was also present in central Palawan. The sheer numbers of examples recovered from Leta Leta, Ille, and ‘Upper Duyong’ indicate that Strombus bead manufacture was a highly patterned if localised practice associated with the neolithic.

8.2 Communities of practice through space and time

In Chapter 3, I defined a community of practice as a group of people who have a shared outlook and set of practical encultured dispositions regarding particular technological practices, whether this be through time or across space. Even
though issues such as small sample sizes and lack of availability of midden shell have hindered the construction of chaîne opératoire for non-Lapita assemblages and particular artefact types, clear patterns of practice have nevertheless emerged. I will firstly assess evidence of communities of practice identifiable on a (primarily) spatial dimension, and will then turn to the issue of the reproduction of practice (primarily) through time.

Despite variability over its geographic/temporal range, the Lapita samples studied show clear and strong relationships to one another. Conus spp. working in particular shows strong connections and very little variability from site to site. Furthermore, Conus spp. working techniques group strongly with each other, with the production of most of the different classes of Conus spp. artefact being linked by a single, strongly-patterned chaîne opératoire and associated set of techniques. Trochus niloticus and Tridacna spp. working also appear to be consistent across Lapita sites, although much smaller sample sizes preclude detailed reconstructions of working practices.

Despite he recognition of clear and consistent linkages between Lapita shell-working practices from site to site, both change and variation are evident. Following trends in ceramic form and decoration, the greatest diversity of both artefact types and raw materials employed is seen in the early ‘far western’ sites – represented by Kamgot in this analysis. When Kamgot is compared to Naigani in particular, the latter seems very much a subset of the former. At the same time as techniques and raw materials fall into disuse, new ones are drawn into practice. With regard to Lapita, this is most clearly seen in the Remote Oceanic distribution of pearl oyster working. The same may be true of working of Terebra maculata.
The other major shell-working community of practice across space can be observed in Palawan. While this is perhaps not so apparent from the discussion and distributions presented in the previous section, if the (generally) small samples are supplemented with additional information provided by Fox (1970) for other sites on the Island, the close links between sites are readily apparent. The greatest diversity of techniques and working materials is seen at Ille Cave, and this is doubtless due to a combination of the large sample size, time depth and the fact that it is a habitation as well as a burial site. The vast majority of artefacts identified for Ille have parallels elsewhere in Palawan, although as a complete assemblage it is presently unmatched. The Palawan shell-working community of practice is linked by Conus spp. ground and perforated spires, Conus spp. rings, Melo sp. scoops, Turbo marmoratus spoons, shell lingling-o, Tridacna spp. adzes, and beads in Nassarius spp., Cypraea annulus/Cypraea moneta, Pyrene sp., Pictocolumella ocellata, Strombus spp. Some of these artefacts, such as Turbo marmoratus spoons and shell lingling-o have parallels outside of Palawan, although they rarely occur elsewhere in such profusion.

What is especially notable about Palawan sites is that the neolithic/Metal Age transition seems to have had little impact on shell-working. In some instances, as noted for Duyong Cave and Paredes Shelter, the same artefacts continue to be produced with metal tools. New forms of shell beads are associated with the Metal Age at Ille, but most other forms weather the transition into Fox’s ‘Developed Metal Age’ well. This surely attests to the significance of shell artefacts in everyday life and practice.

Stepping back from the neolithic, other links are evident. These earlier expressions of shared practical dispositions do not manifest as strongly or
coherently as seen within the Lapita cultural complex or Palawan-based
traditions; though a paucity of sites and issues of sample size surely have a part
to play in this. The working of *Nautilus* spp., *Trochus/Tectus* spp., *Turbo
marmoratus* and *Tridacna* spp. show clear groupings and relationships both
across space and through time. Cut *Nautilus* spp. pieces have been recovered
from mid-Holocene deposits at all three Near Oceanic sites studied for this
thesis. Notably, the only Lapita site at which the same practice is seen is
Kamgot. The presence of cut *Nautilus* spp. shell and drilled beads in Timor
should perhaps also be included here. The presence of cut *Nautilus* sp. shell at
Uattamdi is interesting. When combined with the evidence for *Trochus* spp.
rings, a lone *Conus* sp. ring fragment and the radiocarbon dates, Uattamdi
presently appears to be a Lapita ‘express-train going west’ more than a
Southeast Asian one going east.

Evidence for the working of *Trochus niloticus* is seen over a wider area
than that associated with *Nautilus* spp. Early evidence for the working of this
species (as well as the closely related *Tectus pyramidis* to which the working
methods are frequently applied) stretches from Near Oceania, as far west as
Kamuanan and as far south as East Timor (see O’Connor and Veth In press for
the latter). While working protocols have yet to be investigated for *Trochus
niloticus* in East Timor, material from the Kamuanan sample links very closely to
results published for New Ireland by Smith and Allen (1999). Worked *Trochus
niloticus* is rarely seen west of Kamuanan.

The pattern evident for pre-Lapita *Trochus niloticus* working matches well
with that seen for *Turbo marmoratus*. Evidence from Kilu and Palandraku
demonstrates a pre-Lapita occurrence in Near Oceania, while material from
Kamuanan and Golo attest to the presence of the same technological
approaches in the west. *Turbo marmoratus* is not reported as a raw material elsewhere in the Philippines until the production of the spoons seen in Palawan in the late neolithic/early Metal Age. Pre-Lapita worked body fragments utilise the same portion of the shell, with reduction and shaping achieved by cutting, chipping with a sharp point, or a combination of both. As with Nautilus, the only Lapita site to show clear links with these earlier traditions\(^7^0\) is Kamgot.

### 8.3 So what is Southeast Asian about Lapita shell-working?

When Matthew Spriggs (1996b) asked the general question “What is Southeast Asian about Lapita?” he was necessarily working with rather grossly-defined categories with regard to shell artefacts. One of the things this thesis has aimed to demonstrate is that ‘all shell beads/rings/adzes/etc are not equal’ and coincident functional/morphological labels do not necessarily indicate ‘sameness’. Spriggs (1996b) recognised that there is more than one ‘Southeast Asia’ to be considered, and that pre-Austronesian Island Southeast Asia may very well have a part to play. Unfortunately, this idea has been little developed to date and arguments for integration of cultural practices already extant in the region into the Lapita Cultural Complex have focused squarely on the Bismarck/Solomons area (e.g. Smith and Allen 1999; but see Allen and Gosden 1996 for a different approach). I do not mean to imply that this latter region is of secondary importance, but that an exclusive focus upon it is overly restrictive.

The working of *Trochus niloticus*, *Turbo marmoratus*, *Tridacna* spp. and *Nautilus* spp. have long histories in the broader Near Oceanian/Wallacean region and links in practice across this region are apparent. The straight-line

\(^{70}\) Apart from the case of TK-4 on Tikopia discussed earlier.
trajectory of these raw materials and associated working techniques into early Lapita deposits at Kamgot is, to me, clear evidence that Lapita shell-working is strongly influenced by older regional traditions.

So what is Southeast Asian about Lapita shell-working? This entirely depends on how one defines ‘Southeast Asian’. If it to be thought of as synonymous with ‘Austronesian’, the answer would have to be ‘not very much’. If it is to be thought of as a region rather than a specific group of people, then the answer is ‘quite a bit’. The geographic spread of evidence for early *Turbo marmoratus*, *Trochus niloticus*, and *Tridacna* spp. working, however, would suggest that a division into ‘Southeast Asia’ and ‘Pacific’ for early to mid-Holocene times may obfuscate more than it clarifies.

*Conus* spp. working within Lapita remains enigmatic, with neither pre-Lapita Near Oceanic nor pre-Austronesian/Austronesian Island Southeast Asia offering convincing technological antecedents. I maintain that the efflorescence of *Conus* spp. working within Lapita, although significant, is not as diverse and multi-faceted as the range of artefacts imply. Innovation of many, if not most, artefact forms is a distinct possibility as the technological differences are rather minor.

8.4 Living culturally in a Lapita sort of way

Searching for the technological (or linguistic and biological) antecedents of any recognised cultural grouping may give insights as to ‘etic’ relationships. If we follow the Triple-I model for Lapita, and recognise that Lapita may be a contingent association of elements and traits that have a variety of different histories (*sensu* Kroeber, see Chapter 2), then we surely start moving towards
an emic appreciation of Lapita. Rather than seeing Lapita as the inevitable culminaton of an expansion or evolutionary process, I prefer to see Lapita as a cohesive cultural expression. Not as a ‘people’ in any Childean sense, but as a social dynamic which is manifest archaeologically in a distinctive material culture and encapsulating way of life. Regardless of genetic, linguistic, or any other ancestral affiliation, Lapita probably saw themselves as a community, and it is this that patterns the archaeological record in such a distinctive manner. Whether there are strands of connectedness to other peoples, times and places does not detract from this, but it does mean that Lapita is no more Southeast Asian than it is an extension of Near Oceanic culture. Lapita is Lapita; as a cultural expression, it is no more or less than itself.

In the quest for Lapita origins, we perhaps need to differentiate between the historical pathways that coalesce to provide the conditions for the materialisation of Lapita as a distinct ‘cultural complex’ or ‘community of culture’, and what this coalescence in itself actually represents. To answer the latter will require a recasting of focus to investigate the social dimensions of Lapita and why such a strong and cohesive identity becomes manifest in the Bismarck Archipelago around 3300 B.P. The answer to this does not lie in shell or ceramic technology, linguistic reconstructions, genes or obsidian transport, though in the words of Boas (1940:153), “all may be made to contribute to the solution of the general problem”.

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