MEANINGFUL STONES:
Obsidian stemmed tools from Barema, New Britain, Papua New Guinea

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Abstract
The technology, typology, context and probable mid-Holocene date of a newly discovered group of exceptional obsidian stemmed tools at Barema, New Britain, Papua New Guinea, opens a rare window on social life and ideology during a poorly known period in Melanesia. We argue that, because of their size, fragility and the skill required for their manufacture, these artefacts were valuable, conferring status on their owners. Their deliberately constructed silhouette of a phallus implies that stemmed tools played a meaningful role in social and/or ritual practices.

Introduction
Holocene sites dated before the occurrence of Lapita pottery (ca 3300 BP) are quite scarce in most areas of Near Oceania apart from the Papua New Guinea (PNG) highlands. An added difficulty for archaeology is that stone tool assemblages from these sites are dominated by simple flakes which in themselves yield limited information concerning social and ideological realms. Two groups of artefacts, however, do provide small windows into contexts of meaning and cultural practices during this poorly researched time period. Although mostly recovered as solitary surface or unstratified finds, mortars and pestles, and large obsidian stemmed tools have distinctive shapes and/or decorations reflecting ideological concepts that must have been meaningful to local groups and that may have been shared more widely by the communities who obtained them through exchange. The aim of this paper is to report the finding of a significant cache of obsidian stemmed tools that, like mortars and pestles, provides an exciting opportunity to access an aspect of past lives of people for whom we currently have so few other traces. We also outline a number of hypotheses designed to stimulate further research and debate about the potential roles of these tools.

Mortars and pestles have been collected and described for at least a century, but during the last few years Swadling (2005; Swadling and Hide 2005; Swadling et al. 2008; Torrence and Swadling 2008) has documented their forms and distributions in detail. Mostly shaped from tough volcanic rock into a range of different forms, each with specific distributions, they are widespread in PNG and beyond. In contrast, stemmed tools, originally identified by Golson (1974) as one aspect of hafting technology, were made by flaking obsidian. Based on relatively large assemblages found close to obsidian outcrops on New Britain, two distinct forms were described by Araho et al. (2002). Araho Type 1 consists of classic prismatic blades, the bulb ends of which have been carefully chipped into stems with a range of forms (e.g. Rath and Torrence 2003). Araho Type 2 artefacts are much more varied in shape and size, with some examples being demonstrably used in utilitarian tasks (Kononenko 2011, 2012; Kononenko et al. 2010; Torrence et al. in press). As described in detail in Araho et al. (2002), they were made on a specialised class of flakes (known as kombewa) that are made by striking across the ventral surface of a large flake so that the resulting flake bears traces of bulbs of percussion on both faces. Stems were then carefully made into distinctive shapes using retouch and occasionally also hammer-dressing (Torrence et al. 2009).

Standing out among both types of stemmed tool is a group of large artefacts that are distinctive because the body of the tool and/or the stem are very thin and/or have delicate retouched tips above the notch, so that the tool would break easily if subjected to even a minor amount of force (Araho et al. 2002; Specht 2005; Torrence 2004; Torrence et al. 2009). The fragility of these tools is exacerbated by being made on obsidian which, because it is a glass, will shatter easily if subjected to force. It therefore seems highly unlikely that the intended function of these tools was strictly work-a-day. The majority have been found near the Kutau-Bao and Baki raw material sources on the Willaumez Peninsula near Talasea in New Britain (Figure 1), but rare examples have also been recorded from across PNG (Torrence and Swadling 2008; Torrence et al. in press). Stemmed tools occur in the archaeological record stratified under a distinctive volcanic tephra dated to ca 6000 cal. BP, and disappear suddenly after another volcanic eruption dated to ca 3200 cal. BP (Petric and Torrence 2008; Torrence and Swadling 2008). As large, fragile, eye-catching products of specialist manufacture, they were almost certainly valuable objects of some sort (Torrence 2004). The existence of these widely distributed valuables in this early period has been used to support an argument that nonegalitarian societies were present in this region much earlier than had previously been suspected (e.g. Specht 2005; Torrence 2003). Until the find we report here, however, the potential meanings of the distinctive shapes of the artefacts have been difficult to imagine.

In mid-2010 one intact stemmed tool was rescued from under the blade of a bulldozer at the Hargy Oil Palms Limited (HOPL) plantation at Barema, New Britain (Figures 1 and 2). Nine fragments, representing at least four further artefacts with similar distinctive forms, were later collected from the freshly cut surface or spoil heap (Figures 3 and 4). We propose that the expertise displayed in the manufacture of these unusual stemmed tools, along with their widespread distribution, implies that these objects gave their owners status. Further, at least two of these artefacts have what we interpret to be a clear phallic profile, opening up a window on the male sex organ as an important referent. Together with three other identical tools found in other locations, this newly recognised class of obsidian stemmed tool enables us

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Figure 1 Location of stemmed tool findspots mentioned in the text (map by Diana Izdebski).

Figure 2 Barema 1 stemmed tool recovered intact from the bulldozed terrace at FADP. Scale in centimetres (photograph by Peter White).

Figure 3 Reconstructed Barema 2 stemmed tool from FADP. Scale = 2 cm (photographs by Peter White).

Figure 4 Fragments of stemmed tools from FADP: (left) Barema 3 part of a retouched stem similar to Barema 1; (right) Barema 4, also from a retouched stem. Scales = 2 cm (photographs by Peter White).
to introduce some meaning into our reconstructions of mid-Holocene New Britain.

Technology and Typology
The Barema 1 stemmed tool is complete and has sustained little damage; the nine other retouched obsidian pieces collected from the terrace or bulldozer push are fragments of recently fractured tools. The freshly broken, missing segments are probably incorporated within the soil pushed over the cliff on the north side of the terrace, but other finds may still be buried in the unexcavated surrounding areas. By using consistency in the colour of the obsidian and the thickness of the flakes to make conjoins with other fragments, we have tentatively reconstructed four possible additional stemmed tools (Barema 2–5), all of which appear to have the same distinctive form as the complete tool. Barema 2 includes two refitting parts of the tip, a possible portion of the mid-section, and the base of the retouched stem (Figure 3). Barema 3 (Figure 4 left), broken in two pieces, may be a section of the retouched stem of a tool similar to Barema 1. Barema 4 (Figure 4 right) is probably another part of a stem. One bifacially retouched edge is intact but there is a fresh break on the other and an old break along the top surface. Barema 5 is the mid-section of a bifacially retouched kombewa flake with fresh breaks on all edges and may be a broken portion of a tool similar in shape to Barema 1 and 2.

Barema 1 and 2 (Figures 2 and 3) have the distinctive double bulbous faces of kombewa flakes, which is a primary feature of Araho Type 2 stemmed tools. They differ, however, from the majority of this kind of stemmed tool in several notable respects. The stem comprises a much larger proportion of the artefact than in most other examples. Secondly, the stem is flat, thin in cross-section and formed by a parallel series of large shallow flakes struck across both surfaces of the flake blank. Since only percussion flaking was used, the skill of the knapper was quite extraordinary. Thirdly, the distal end or ‘tip’ of these unique stemmed tools is formed by a large hinge fracture that intersects with the edge of the original flake core to produce a distinctive curved surface and contoured profile (Figure 5).

Given the difficulty of consistently achieving the exact angle of the large hinge fracture, the repetition of this shape must have been deliberate. Finally, the notches at the junction of the blade and the stem are quite small. All these features lend the tool its notably phallic character.

Like many other stemmed tools, the long axis of the retouched stem of Barema 1 lies at an oblique angle to the direction of force that generated the kombewa flake blank. This can be observed by comparing the angle of the direction of force for the hinge fracture at the distal end of the flake in Figures 2 and 5 with the layout of the stem. The orientation of the tool shape across, rather than along, the flake enabled the maker to select a portion that was flat and consistent in thickness for making the thin stem. To achieve this aim, however, the thick and irregularly shaped bulb of percussion and flake platform had to be completely removed (see Torrence 2004:168, Figure 6 for the same technique used on a differently shaped stemmed tool). To provide a large enough flat area to produce the stem (141 x 84 mm in the case of Barema 1), the original kombewa flake must have been extremely large and was probably nearly circular in shape.

The Barema artefacts were examined for use-wear and residues at HOPL using a portable digital microscope at magnifications of 30–50x. The original surfaces have been removed through chemical damage that caused heavy pitting, a problem commonly encountered among ancient obsidian artefacts exposed to a hot, humid climate (Kononenko 2011:9). Although the stem on the Barema 1 artefact is too weathered for analysis, the unretouched distal end of the stem is reasonably well preserved. The microscopic flake scars and scratches observed result from recent bulldozer damage. Apart from these, under low power magnification there is no clear evidence for use-wear traces (e.g. striations, polishes, edge rounding) on this part of the tool. Our experience is that a high magnification study would be required to completely discount use, especially for cutting soft material or wear traces resulting from storage within a soft plant material wrapping.

Stratigraphic Context
The finding of a group of artefacts, apparently from a single context, is significant, since most stemmed tools have been surface finds at obsidian quarries in New Britain, derived from other eroded and/or disturbed contexts, or occur in museum and private collections with poor documentation (e.g. Araho et al. 2002; Rath and Torrence 2003; Specht 2005; Swadling and Hide 2005; Torrence 2004; Torrence et al. 2009). Although several workmen disagreed about the precise location where the intact Barema 1 tool was found, the argument settled on two possible findspots (A and K in Figure 6). The posts marking the two locations were embedded into a light-coloured volcanic tephra which we have linked to a stratigraphic section in another part of the site as described below. There was no evidence on the bulldozed surface of features dug into this layer, hence the artefacts must have been derived from above it.

The foreman remembered that the bulldozer was in the process of a third scrape, each of ca 30 cm thickness, when Barema 1 was found (i.e. between 60–90 cm deep). Two sections were cleared at the nearest remaining exposure, an old dirt road at the back of the area (Figure 6). These sections were approximately 6 m apart. Five stratigraphic layers were observed.

Figure 5 Hinge fracture on the Barema 1 stemmed tool (photograph by Peter White).
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(Figure 7). Moving up from the base (earliest to most recent in time) these are as follows:

- **Layer 1**: A massive volcanic tephra from a single eruption with layers of coarse and fine material ranging in colour from white to yellow to light brown. No artefacts were observed.
- **Layer 1a**: A well-developed brown soil with high clay content that formed in situ within the upper part of the volcanic deposit of Layer 1. A small obsidian flake was observed in Section 1.
- **Layer 2**: A weathered volcanic tephra varying in colour from yellow-orange to brown. As this layer is quite thin (ca 10 cm), it is difficult to trace along the section except through textural differences in clay content.
- **Layer 2a**: Modern topsoil formed in situ within the upper portion of the Layer 2 tephra. A flake made from a volcanic stone was recovered.
- **Layer 3**: A discontinuous disturbed layer of bright yellow-orange clay re-deposited by the bulldozer when the terrace was cut.

The most likely context for the obsidian stemmed tools is the Layer 1a soil formed on top of the lower massive volcanic tephra which comprises the base of the modern terrace. A small piece of carbonised material was collected from the freshly cut surface of Layer 1a in Section 2, but when subjected to radiocarbon dating was found to be modern contamination (Wk-30267).

Samples of Layers 1 and 2, together with photographs of the site, were discussed with Chris McKee from the Geophysical Observatory, Port Moresby, who has extensively researched the volcanic history of the Hargy area (McKee and Lolok 1998). In McKee’s opinion, Layer 1 is probably the Tiauru Pyroclastics, derived from an eruption of Hargy volcano about 11,000 ya. Although Layer 2 has very few diagnostic properties, in McKee’s experience the W-G tephra from Witori volcano, dated to about 1200 years ago (Machida et al. 1996), is the most common, highly visible Holocene-aged tephra in this region. Unfortunately, the volcanic stratigraphy is too coarse to provide good dates for the stemmed tools, but it does not disconfirm our proposal of mid-Holocene based on the similar kombewa technology dated elsewhere to this time period (Torrence and Swadling 2008).

While tracing the tephra layers along the road section, two pieces of a tool with old breaks were found within Layer 1a in Section 2 (Figure 8). The artefact is very heavily weathered, with
a thick cream-coloured cortex covering the grey-blue volcanic stone observed in a fresh break. A few coarse volcanic stone tools with similar retouched stems have been found in the Talasea region (Figure 1) (Robin Torrence unpub. data), but always in surface contexts, so their relationship to the obsidian stemmed tools has never been determined. The Barema site supports the idea that stemmed tools made from obsidian and coarse volcanic stone were broadly contemporaneous but, given the length of time represented by Layer 1a, the broader utility of this observation is limited.

A Recognisable Form

As illustrated in Araho et al. (2002) and Torrence et al. (in press), nearly every large Araho Type 2 stemmed tool has a slightly different shape which sets it apart from the others, perhaps as a way of identifying its maker or owner. However, the sample size of the potential ceremonial stemmed tools is still quite small. With the recovery of multiple copies of the same distinctive shape within the Barema assemblage, we need to consider the possibility of recurrent forms with particular functions and meanings, especially since the Barema tools are not unique. An example reported by Specht (2005:376–377) from Auwil hamlet on Apugi Island, near Kandrian off the south coast of New Britain (Figure 1), is remarkably similar to Barema 1 (Figure 9b). It also has extensive bifacial retouch, a large, thin stem and the characteristic hinge fracture at its distal end that creates the phallic profile. Another example with an identical stem and distal hinge has recently been identified by us at the Ethnologisches Museum in Berlin (Catalogue no. VI 54912) (Figure 9a), but it has no provenance. Finally, a tool fragment with only the distal end bearing the hinge fracture and a small portion of the wide thin stem is held in a private collection in New Britain and was probably collected near Talasea (Figure 10). The stem may have been broken during manufacture. Analysis by portable XRF has determined that all the Barema artefacts, as well as the Apugi, Berlin and Talasea examples, were made from obsidian obtained from the Kutau-Bao obsidian source near Talasea, as are the majority of stemmed tools that have been characterised (Torrence and Swadling 2008; Torrence et al. in press).

Potential Meanings

Kononenko (unpub. data) has conducted experimental replications of stemmed tools that make two points abundantly clear. First, it takes a very high level of expertise and much experience to successfully produce the large kombewa flake used as the blank for the Barema and other phallic tools. This process requires two skilled operations. The initial one is to split a very large obsidian cobb in half in such a way that a large bulb of percussion is created on one side of the split. Following this, the knapper must strike a flake across the face of the bulb on the split cobb flake. Secondly, the process of creating the large kombewa flake makes heavy demands on raw material, since very sizeable and completely homogeneous nodules of obsidian are required. Our surveys of the obsidian sources have found that cobbles free from internal fractures and of the necessary size are rare. Due to the raw material requirements and the need for specialist training and practice to keep up a high level of performance, we suggest that the maker(s) of these tools probably resided near the obsidian sources. Barema is about a couple of days travel by canoe from Talasea. Apugi, off the south coast of the island, is considerably further. The tools that ended up at these places were probably transported as finished products and were possibly the outcomes of multiple exchanges.

Given that the very specific form of the Barema stemmed tools is repeated elsewhere, it is reasonable to consider the role of these carefully designed artefacts in mid-Holocene New Britain. The large size, high degree of skilled workmanship and delicate nature of the Barema finds support the idea that these tools had significant social and ceremonial roles, but the discovery of an assemblage from a single location opens up further avenues for exploring uses and meanings. We begin with what the purely physical features of the artefacts imply about the roles of these artefacts.
objects in society. As illustrated in Figures 2, 3 and 9 and Table 1, the similarities in the shape and size of the tools, the character of the bifacial retouch and the carefully placed large hinge fracture all suggest they might have been made by the same craft specialist. There can be little doubt that great skill was required to make these tools and that the production of multiple copies would have demanded long-term training and continuous practice. Perhaps one individual had developed a specialty in the production of the hinge fracture responsible for the distinctive phallic outline? If that was the case, then the possession of one of these objects might have carried further meaning beyond that embedded in the phallic shape. Perhaps it also linked the owner to a specific place or person.

As shiny, fragile and distinctive items that were manufactured by highly skilled specialists, obsidian stemmed tools embody many of the attributes typical of objects used by their owners to display their position or status within society (Araho et al. 2002; Specht 2005; Torrence 2003, 2004). To obtain a stemmed tool, one needed to acquire raw material from the obsidian sources. Due to the nature of their geological formation, the outcrops are restricted in space (cf. Torrence et al. 1992), so access to the raw material was probably limited and guarded by owners, as has been noted with desirable sources of stone found elsewhere in the world (Torrence 1986:82–85). Besides gifts or payments to the owners to obtain the obsidian cobbles, we propose that one might also have had to provide some sort of payment to the skilled maker(s) of the tools. As a consequence of being able to muster the necessary resources and, most importantly, make the required social connections to acquire a stemmed tool from the obsidian owners/makers, people who possessed these items would earn status. Further recognition or prestige could be gained by using them as strategic gifts or to cement social connections through marriage, etc.

Previously, discussions of the meanings of obsidian tools in PNG have focused on the raw material properties of obsidian—lustrous, black, homogeneous—and the links that a distinctive raw material with spatially limited outcrops can provide between people and place, or between people and unknown distant peoples and places (e.g. Green 1987; Kirch 1988; Sheppard 1993; Torrence 2005). Rath and Torrence (2003) have also pointed out that partially worked blanks in various stages of production were transported among distinct localities where they were further worked, perhaps by different knappers. The movement between places and people would have forged additional social links among the obsidian owners and the various makers of the stemmed tools. The history of these social ties would have helped create the value of these specially constructed objects.

Although the performance surrounding the manufacture of the hinge fracture and elaborate retouch on the Barema tools could also have contributed to the value and meanings they had for their owners, as has been suggested for hammer-dressing on stemmed tools (Carter 2007; Torrence et al. 2009), people residing away from the sources, at places like Barema and Apugi, were possibly ignorant about how they were made. For them, the meanings might only be associated with the physical properties of the obsidian, the final form of the artefact, the distant peoples and places from where they were derived, or as a consequence of the local social interactions through which they were exchanged (Torrence 2005). The Barema type of stemmed tools, however, reminds us that the specific shapes of the objects must themselves have had significant meanings beyond providing opportunities for knappers to show off their talents. With an obviously phallic profile, owners and audiences distant from the sources, at places like Barema or Apugi, could surely have appreciated these objects in their own right.

Since considerable effort and skill were invested in the production of the Barema stemmed tools, it seems reasonable to assume that the phallic shape was deliberate and therefore meaningful to their consumers. With such a small sample, and lacking good data on context, unfortunately we can only make broad suggestions about what these specific meanings might have been. The most obvious possibility is that the phallic-shaped tools related specifically to the male sex, with perhaps an implication of a male/female duality or dichotomy in how humans or the world at large were conceived. Another scenario is that either fornication and/or procreation were the properties of interest. So, for example, the stemmed tools could have referred to the importance of reproduction of people, animals and/or things, or particular valuables. Moving away from an explicit connection with sex, the shape of the tools could be a referent for masculinity, defined as a group of properties seen within a society as relating to, or deriving from, male persons. In this interpretation their role as valuables to enhance status might suggest that masculinity was an attribute linked to the acquisition of status.

The explicit depiction of a phallus raises additional questions about how the stemmed tools were used. For instance, the tools may have been made exclusively for activities involving only one sex (e.g. initiation). Did the objects derive meaning or power by being kept secret or did the owners use the tools to express strength, power and status by either flaunting or challenging masculinity? Such behavior would have resonances with themes expressed within the ritual and social lives of many recent Melanesian societies (e.g. Gregor and Tuzin 2001), although with

<table>
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<th>Dimension</th>
<th>Barema 1 (mm)</th>
<th>Apugi (mm)</th>
<th>Berlin (mm)</th>
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<td>195</td>
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<tr>
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</tr>
<tr>
<td>Stem thickness</td>
<td>19</td>
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Table 1 Maximum dimensions of Barema-type stemmed tools.
so little data it is highly speculative to make simple analogies to explain symbols used by their prehistoric ancestors.

At this early stage of research in New Britain it is not possible to know if the Barema-type stemmed tools comprise a distinct style that was limited to a particular maker or time horizon or had a specific function not shared with other stemmed tools. If we make a comparison with the mortars and pestles also made and used in the mid-Holocene (Swadling 2005; Swadling and Hide 2005), it seems likely that some styles became popular and were passed along exchange routes together with songs, dances, ceremonies and costumes. For instance, the bird of paradise motif on mortars ranged over an area linking the New Guinea mainland to the western part of New Britain (Torrence and Swadling 2008:Figure 3), and many of the pestles have clear phallic references (e.g. Pretty 1965; Schmitz 1966:Figures 61–65). The shared form of the phallic stemmed tools, along with basic similarities with some of the Araho Types 1 and 2 artefacts (Torrence et al. in press), might also reflect the exchange of ideas and practices during this time period.

Context of Use

We gain some indication of the contexts in which stemmed tools might have been used simply by knowing that a group of tools all with the same shape was found at a single locality. It therefore seems reasonable to question whether there are any distinctive features of the Barema site. The bulldozed terrace is situated just below the crest of a prominent hill with a steep drop off down to a river valley. Since finding a good vista within a forested environment is difficult, this location might have had embodied special meanings during the mid-Holocene. The setting offers panoramic views to the north across a low lying plain stretching to the coast. Looking northeast, there is also an excellent view of the distinctive peak of Uluwan, an active volcano.

Spectacular views overlooking a river valley and to distant mountains are also dominant features of the only other place where multiple stemmed tools have been found nearly in situ (also following bulldozing). The site of FABN at Boku Hill sits on top of an ancient lava flow with steep cliffs on three sides (Torrence 2004). Unlike the Barema finds, the three stemmed tools recovered from the bulldozer push at FABN vary in shape and size but all have the short stems typical of most Araho Type 2 stemmed tools. Although it is possible that Barema and Boku Hill were chosen because of their defensive properties, their unusual physical properties and the vistas they afforded could certainly have lent themselves to be considered as places with special significance.

Perhaps at these two localities stemmed tools had been intentionally placed in a cache as part of a ritual or within a high status burial (bones do not preserve in these volcanic soils subjected to high rainfall). Another possibility, suggested by Tim Denham (pers. comm. 2010), is that these objects had been stored among the contents of a special building, such as the house of a high status individual or within a man’s house, like those commonly found in modern PNG villages. In these structures men from the same clan or kin group, socialise, eat and sleep. In some cases artefacts that hold special ceremonial and ritual meanings are stored and looked after, since some require special care, perhaps even feeding, to maintain their efficacy (e.g. Hampton 1999:125–161). Alternately, the stemmed tools might have been held in a structure specially constructed for a particular function, such as initiation, and their sexual reference might mean they had been part of rituals related solely to men or women or more widely to reproduction.

At this stage it is premature to favour one particular interpretation for the use, caching, burial or other forms of deliberate deposition of the Barema stemmed tools, but their phallic referent is clear. When contextualised in its particular setting, the distinctive Barema assemblage, together with the other phallic stemmed tools, opens up possibilities to access the meaningful world of people whose sparse traces have eluded interpretation until now. These distinctive artefacts suggest that in mid-Holocene New Britain the male sex organ was an important referent for at least one stone knapper and some members of the community resident at Barema who had acquired a number of these distinctive tools. The additional Apugi and Berlin finds indicate the depiction of the phallic form had broader popularity.

Challenge for the Future

Although we cannot yet ‘reconstruct’ or ‘interpret’ the prehistoric meanings and contexts of use for the newly discovered Barema stemmed tools or the other phallic tools from Berlin and Apugi, the recognition that they carried meanings has important implications for other large, highly worked obsidian stemmed tools. The deliberate creation of meaningful shapes adds support to claims by Araho et al. (2000), Torrence (2003, 2004; cf. Torrence and Swadling 2008; Torrence et al. 2009, in press) and Specht (2005) that all the large, fragile, stemmed tools were valued objects within the societies where they were made and circulated. The phallic tools also provide the stimulus for researchers to revisit the wide range of forms expressed by the Araho Types 1 and 2 stemmed tools and to canvass their potential meanings in a new light. Although currently it may appear that their shapes lack an obvious referent, it nonetheless seems likely that they were carefully constructed and, like the Barema stemmed tools, were meaningful for the communities who made, exchanged and consumed them. The challenge for future research is to find new ways to learn more about the varied roles that these artefacts played in daily, social and/or ritual life in mid-Holocene Near Oceania.

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