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STONE CLUB HEAD MANUFACTURE ON DAUAN ISLAND, TORRES STRAIT

IAN J. MCNIVEN AND FRIEDRICH VON GNIELINSKI

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Stone-headed clubs continued to be used as weapons across parts of Melanesia until the early 20th Century. Despite the existence of hundreds of these clubs in museums around the world, few ethnographic descriptions or archaeological inferences are available on how stone club heads were manufactured. Analysis of partly made stone club heads found on Dauan Island in northern Torres Strait sheds new light on how these artefacts were manufactured. Most of the club heads are made from volcanic rock types known to occur on Dauan. These archaeological finds support previous ethnographic and archaeological research that Dauan was a place of club head production. Manufacture of Dauan club heads was a laborious and risky undertaking. Following selection of a suitable blank of volcanic stone, initial shaping by flaking was followed by more refined shaping by pecking and finally smoothing by grinding. The most risky aspect of club head manufacture was pecking, which could result in the club head breaking in two. To help minimise the risk of pecking breakage, the overall structural strength of the artefact was maximised by restricting final break-through of the central hafting hole to the end of the pecking process. The use of flake blanks for 2 of the Dauan club heads is unique in terms of existing information on Melanesian stone club head manufacture. The sourcing of 1 of the Dauan club heads to the Eastern Island Group of Torres Strait provides further support for McNiven's (1998) model of the role of club head exchange in cementing social relationships between Islander communities. ❒ *Stone club heads, artefact manufacture, technology, Dauan Island, Torres Strait.*

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A broad range of peoples and cultures, both prehistoric and recent, used perforated stones as club heads in Europe (Evans, 1897; Fenton, 1984), North and South America (Henshaw, 1887), southeast Asia (Draeger, 1972) and Melanesia (Haddon, 1900). In Torres Strait (NE Australia) and adjacent mainland Melanesia, stone-headed clubs were the weapon *par excellence* of warriors in battles and headhunting raids (McNiven, 1998). However, many stone-headed clubs also featured in ceremonial exchanges and a broad range of other ceremonial performances/dances (Grottanelli, 1951; Kooijman, 1952; McNiven, 1998; van Baal, 1966). Across some parts of New Guinea, morphologically similar 'perforated stone discs' (unhafted) were made specifically as status objects and/or ritual items for use in ceremonies (Hampton, 1999; Heider, 1970; Kooijman, 1952; van Baal, 1966). Club heads (weapons) come in a wide range of forms, including bi-convex (discs, triangles, etc), knobbed (those clubs with multiple rows of knobs often referred to as 'pineapple' clubs), ovoid/spherical, and star-shaped or rayed (e.g., Haddon, 1900). Circular bi-convex (disc) club heads are the most common type across Melanesia (Adam, 1947: 345; Haddon, 1900: 243). Most club heads were hafted onto a long wooden handle with the stone immobilised by use of woven supports and wedges. In rare cases, such as amongst the Marind-anim of SE West Papua, the club heads were hafted loosely such that as the blow is delivered, the 'disc shoots forward, greatly adding to the impact' (Kooijman, 1952: 97).

Stone-headed clubs ceased being manufactured across Melanesia between the late 19th and mid-20th Centuries. Today, stone-headed clubs are but a historical memory for most Melanesians, although a few families keep old clubs as heirlooms and some groups continue to curate old club heads as ritual items, particularly for garden magic to increase crops (Berndt, 1954; Hitchcock, this volume). Various individuals also keep old club heads found while gardening and the like for their intrinsic historical significance. In the past, archaeological club heads were also rehafted and put to use again as 'weapons' (Chinnery, 1919: 277). Stone club heads in Torres Strait are held by local families (e.g., Yam Island) and in local keeping places (e.g., Mabuiag Island) and

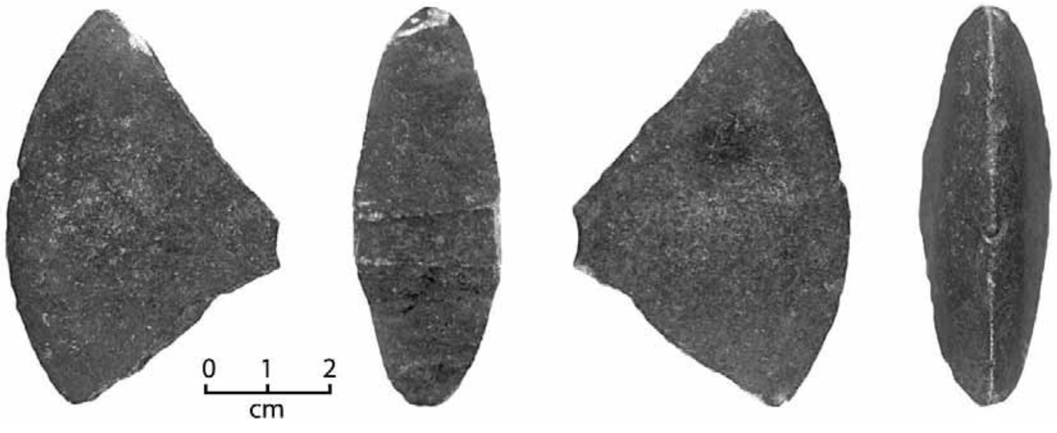

FIG. 1. Dauan club head #1.

schools (Dauan Island). Numerous other club heads are held by museums around the world (McNiven, 1998).

Despite information on the widespread use of stone-headed clubs, very little archaeological information exists on the long-term history of these items and few details are available on how club heads were manufactured. This paper sheds new light on stone club head manufacture through analysis of a unique collection of incompletely made stone club heads found on Dauan Island located in the Top Western Island Group of northern Torres Strait. Results are contextualised in terms of existing ethnographic and archaeological information on the manufacture of stone club heads across Melanesia.

TORRES STRAIT STONE CLUB HEADS

McNiven (1998) provided a detailed overview of stone-headed club use and raw materials in Torres Strait. His study was based upon 26 club heads obtained from archaeological and ethnographic contexts held in various museums and Torres Strait Islander keeping places. Significantly, none of the museum examples are provenanced to the Top Western Islands. Five different types of stone club head were identified for Torres Strait from museum collections: disc-shaped (n=17), knobbed (n=3), rayed (n=3), ovoid (n=2) and axe-shaped (n=1). The general language term used historically for these clubs was *gabagaba* (Haddon, 1912: 191) with *gabagab* the more popular contemporary term (McNiven, pers. obs.; Shnukal, 1988: 131). Rayed or star-shaped clubs were known more specifically as *saurisauri* in the Eastern Islands (Haddon, 1912: 192; Sharp, 1993: 70-72) and *gorapatutu* on Dauan Island (Teske, 1990: 18; see also Ray, 1907: 173).

In terms of raw materials, a key finding of McNiven (1998) was overturning previous views that Torres Strait stone club heads were imported mainly from New Guinea. Geological identifications of 11 clubs by one of us (FvG) revealed a range of local raw materials known to outcrop within the Top Western, Western and Eastern Island Groups. One of these local potential sources is Dauan, the only island in Torres Strait identified historically by Alfred Haddon as a raw material source for club heads and a possible 'factory' for club head manufacture (Haddon, 1912: 191-192, cf. 1904: 294). Haddon (1935: 76) suggested Yam Island (Central Torres Strait) as a second place where 'stone heads for clubs were made' after being shown grinding grooves on the island in 1914. McNiven (1998: 103) noted that Haddon's inferences for Dauan are consistent with archaeological evidence for a stone tool quarry site on the island (Vanderwal, 1973: 182). No quarries have been recorded to date on Yam Island.

DAUAN CLUB HEADS — DESCRIPTION

Over the last couple of decades, local residents have found a number of broken stone club heads on Dauan. Collections of these artefacts are held by Mr Fred Mooka (Artefacts 1, 4 & 7) and the Dauan State School (Artefacts 2, 3, 5, 6 & 8) (Table 1; Figs 1-8). In August 2000, IMcN obtained permission to borrow these 8 artefacts for analysis. Four represent fragments of 4 club heads that broke sometime after manufacture. The remaining 4 artefacts are broken fragments

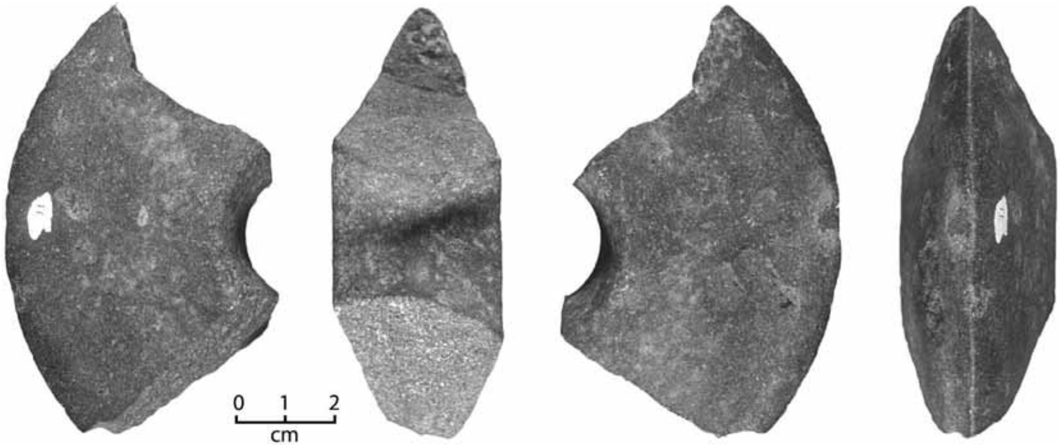

FIG. 2. Dauan club head #2.

of incompletely made club heads. In the context of previous research on stone club heads, it was clear that the Dauan artefacts had important implications for understanding stone club head manufacture in Torres Strait and other parts of Melanesia. Subsequent analyses were limited to club head type, raw material and manufacturing technique (Table 1).

BROKEN (COMPLETED) CLUB HEADS. These 4 artefacts are segments of 4 club heads that broke after manufacture. The artefacts all exhibit final surface treatment, either smoothing by grinding (Artefacts 1, 2 and 3) or linear incising of the surface (Artefact 4). The hafting hole in Artefacts 2 to 4 is hourglass shaped while the hole in Artefact 1 is straight sided and cylindrical. All hafting holes exhibit smoothing by grinding. Artefacts 1, 2 and 4 have use gloss in the hafting hole, indicating a considerable period of hafting with a wooden or rattan handle. The use gloss on Artefacts 2 and 4 is concentrated on the protruding 'neck' of the hourglass shaped hafting hole. On Artefacts 2 and 4, small pits within the ground surface represent remnant pecking ('hammer dressing'– Dickson, 1981).

The 4 fragments represent 3 club head types. Artefacts 1 and 2 are from bi-convex (disc) type club heads, the most commonly recorded club head type for Torres Strait (and Melanesia). Artefact 3 is from a rare ovoid type club. Artefact 4 is a new club head type for Torres Strait. It features a bi-convex shape but with a rounded, curved outer edge in contrast to the acute-angled edge of the more common disc type club heads. Both faces of the club exhibit numerous radiating linear incisions (mostly V-shaped grooves) up to 1mm deep. The outer edge of the club head is ringed by another linear incised groove <1mm deep. Similar patterns of linear incised grooves are found on some club heads from the Highlands of PNG (e.g., McCarthy, 1949: 160, fig. 22).

BROKEN (INCOMPLETELY MADE) CLUB HEADS. The 4 artefacts represent 1/2 of 4 separate and incompletely made club heads with various degrees of pecking and little or no signs of final smoothing by grinding. All exhibit partially made circular hafting holes (represented by circular depressions) pecked out to similar diameters and depths on both faces. The thickness of the remaining (unexcavated) stone separating the 2 depressions on the artefacts ranges 6-17mm.

Artefacts 5 and 6 appear to be large flakes. The dorsal surface of both flakes exhibits moderate to extensive pecking, some of which may also be natural cobble cortex. The ventral surface of both flakes is little pecked except for the partly made hafting hole. One small area of the ventral surface of Artefact 5 is particularly smooth, possibly from grinding. Intermittent unifacial and bifacial marginal flaking (retouching) of both flakes is associated with shaping the clubs into a circular outline.

Artefacts 7 and 8 exhibit pecking over the entirety of both faces. A number of small depressions on one face of Artefact 7 may be remnant flaking scars. Both artefacts feature a more refined circular outline and greater overall symmetry. They are considered to have been near the end of the pecking stage of the manufacturing

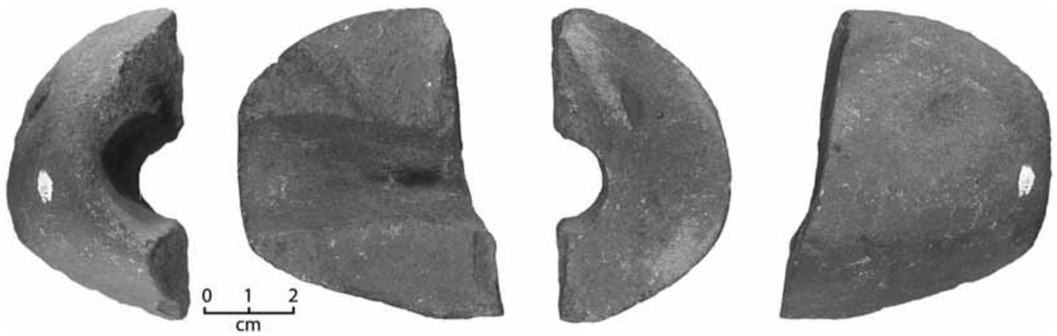

FIG. 3. Dauan club head #3.

process and nearly ready for finishing by grinding before breakage took place.

DAUAN CLUB HEADS — PROCESSES OF MANUFACTURE

Despite potential problems of representativeness associated with only a small sample of partly made club heads (n=4), a number of important insights can be gleaned from the Dauan artefacts. These insights are discussed in terms of raw material selection, blank selection, and 3 stages of shaping and finishing — flaking, pecking and grinding.

RAW MATERIAL SELECTION. Raw material selection is inferred from known raw materials used to make the club heads. Previous research identified a wide range of stone club head raw materials for Torres Strait. Most are igneous (volcanic) rocks such as andesite, and basalt (all most likely dykes within granite), ignimbrite (solidified pyroclastic ash) and tuff (consolidated pyroclastic rock – volcanic), along with various igneous (plutonic) rocks such as adamellite (fined-grained granite), and fine-grained microdiorite/quartz-gabbro, and sedimentary rocks (volcanolithic sandstone) (Hitchcock, this volume; McNiven, 1998). This study expands this list of raw materials to include fine-grained micromonzodiorite and trachybasalt. All these rocks belong to basement rocks of the Badu Suite and Torres Strait Volcanic Group, both of Permo-Carboniferous age (around 290 million years) (von Gnielinski et al., 1998). The exception is trachybasalt that is likely to originate from basaltic rocks of the Pleistocene (~3 million years) Maer Volcanics Group of Eastern Torres Strait (Willmott, 1972). Clearly, Islanders were targeting certain fine-grained igneous rocks that were: 1) homogenous and isotropic (e.g., free of faults and cleavage lines) — able to be predictably shaped by flaking; and 2) tough (i.e., fine-grained, random, interlocking crystal structure) — able to withstand the prolonged shock and stress of impact pecking and conducive to the production of a smooth, glossy finish with grinding (Dickson, 1981: 27-32).

Most of the targeted raw materials for club head manufacture occur in scattered, spot locations in various parts of Torres Strait amongst a background of unsuitable rock types such as coarse-grained granites (including granodiorite) and porphyritic microgranites (von Gnielinski et al., 1998). The source rock targets for suitable materials are likely to be very small and localised, since most stone clubs examined for this study appear to consist of rock materials associated with minor intrusive dykes in a complex granite intrusion system. The dykes may only be several metres wide in places. Previous geological investigations have identified dykes of different compositions on Dauan, Gebar, Mabuiag and Mua Islands and other islands in the western Torres Strait region, but it can be reasonably expected that far more suitable dykes do exist here. Also, floaters from small creeks or coastlines could have been collected and used, leaving no traces of sampling at the place of origin. An outcrop of this rock may not be apparent or may even be concealed some distance away from where these floaters may be sourced.

It is possible that most of the Dauan stone club heads examined for this paper were quarried locally given that they are made from raw materials known to occur on Dauan Island. This inference is consistent with the identification of volcanic rock quarries associated with dykes of basalt/andesite on the island (McNiven, von Gnielinski & Quinnell, this volume; Vanderwal, 1973) and Haddon's inference concerning a club head 'factory' on Dauan. However, superficial

FIG. 4. Dauan club head #4.

examination of these quarries failed to record evidence of club head manufacture (e.g., incompletely manufactured club heads). Indeed, no stone club head quarries have been identified in Torres Strait.

BLANK SELECTION AND INITIAL SHAPING (FLAKING). Except for Artefacts 5 and 6 from Dauan, all other stone club heads from Torres Strait have been modified to such a degree that all evidence has been removed of the original form of the stone blank. We define a blank as a piece of rock at a stage in the tool production/ reduction process where it is ready for formal shaping into the intended tool. All pieces of stone subsequently removed from the blank are, by definition, smaller than the blank. Theoretically, club head blanks could be naturally or humanly shaped stones (cores or flakes – definitions after Hiscock, 1984). Whether or not the stone raw material was originally picked-up from the ground surface, excavated from sediments, or separated from bedrock is another matter. Artefacts 5 and 6 are large retouched flakes indicating use of large flakes as club head blanks. These flakes were struck from large cobble cores given apparent cobble cortex on the dorsal surface of both flakes. It is likely that club head makers were taking advantage of the natural curvature of the cobble to produce the desired convex shape of the club face. The bulb of percussion on the ventral flake surface assisted formation of the convex form of the opposite face. Marginal retouching enhanced the bi-convex cross-section and circular outline of the artefacts.

REFINED SHAPING AND HAFTING HOLE PRODUCTION (FLAKING & PECKING). One of the first steps in the refined shaping of the blank was near completion of the central hafting hole. This is indicated by the similarity in the degree of completeness of the hafting hole on all 4 artefacts, despite differences in the overall completeness of each implement. In each case, excavation of the hafting hole was undertaken evenly on both faces. It is likely that the hafting hole was nearly completed early in the production process to provide a centre point and point of reference for subsequent shaping of the club head. Artefact 6 exhibits bevelling with subtle smoothing around the rim of each pecked depression. These bevels appear to be remnants of reaming (grinding) associated with maintaining the circular outline of the hole. As such, the process of hole excavation, at least on this artefact, most likely alternated between pecking (primarily to remove stone) and reaming (primarily to shape the hole). Artefacts 7 and 8 reveal that final breakthrough of hafting holes was scheduled as one of the final acts in the shaping of club heads by pecking. We suggest this late scheduling was to maintain the structural strength of the artefact and reduce the risk of breakage from impact stock.

FINAL FINISHING (GRINDING). Smoothing the faces of club heads required the assistance of grinding stones. In this connection, grinding grooves on bedrock outcrops have been recorded across Torres Strait (Carter et al., this volume; McNiven, 1998; McNiven, Fitzpatrick & Cordell, this volume). These grinding groove

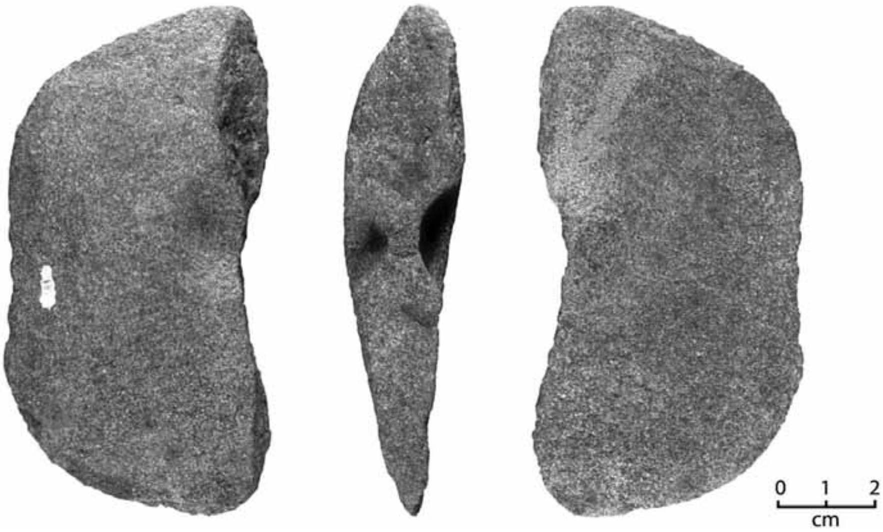

FIG. 5. Dauan club head #5.

sites are all located either adjacent to the sea (HMW) or near creeks as water is a necessary part of the grinding process. Smoothing of the hafting hole would have required the insertion and rotation of some grinding implement, most likely a conical stone. Equal and alternating application of a grinder to each end of the hafting 'hole' is necessary to produce an hourglass cross-section. Artefact 4 indicates that the faces of some club heads could be finished not by grinding but by application of incised linear grooves, possibly as decoration.

DAUAN CLUB HEADS — BROADER TECHNOLOGICAL COMPARISONS

The broader significance of the Dauan stone club heads is examined mostly in terms of available information on stone club head manufacture from New Guinea. Most comparative material is ethnographic, as little archaeological research has been undertaken on the manufacture of Melanesian stone club heads. Comparisons are also made with Fenton's (1984) important experimental work on replicating prehistoric Scottish stone club heads.

RAW MATERIAL SELECTION. As with Torres Strait, igneous rocks are the preferred raw materials for stone club heads across mainland New Guinea. Examples of New Guinea stone club head raw materials include diorite (Adam, 1947: 350), basalt (MacGregor, 1897: 13), andesite (McCarthy, 1949: 159, 161-162), gabbro (McCarthy, 1949: 159), granite (Chinnery, 1919: 276), biotite granite (Blackwood, 1950: 34) and quartz (Chinnery, 1919: 276; Williams, 1930: 83). Uncommon raw materials include limestone (Haddon, 1900: 227) and wood (Crawford, 1981: 365; Grottanelli, 1951: 106; Swadling, 1983: 106), fungus (Crawford, 1981: 368; Price et al., 1978) and fired clay ('pottery') (Butterworth, 1897: 19; Neverman, 1941, cited in Swadling, 1983: 106) when stone was in short supply.

BLANK SELECTION. Natural 'pebbles' are the only documented club head blanks in New Guinea. In March 1891, a man from Mawatta on the PNG coast of Torres Strait told Sir William MacGregor (1891) that 'stones to make clubs' are obtained 'by diving into the sea and picking them up'. In what may be an independent recording, Landtman (1933: 45) was told by villagers at Mawata that coastal Papuans obtained club heads (along with stone axes and adzes) from Torres Strait Islanders who obtained the raw materials 'principally from the bottom of the sea, by diving'. In the broader context of tool stone quarrying and provisioning within the Torres Strait region, McNiven (1998: 103) remarked that the:

> references to a submarine source seem peculiar given that terrestrial rock outcrops would be easier to access and quarry. Is it possible that the idea of 'diving' for rocks was a deliberate attempt by Islanders to mislead Papuans for the purposes of either protecting their stone quarries by keeping their location secret and/or exaggerating procurement effort to increase the stone's value in the eyes of the non-maritime Papuans?

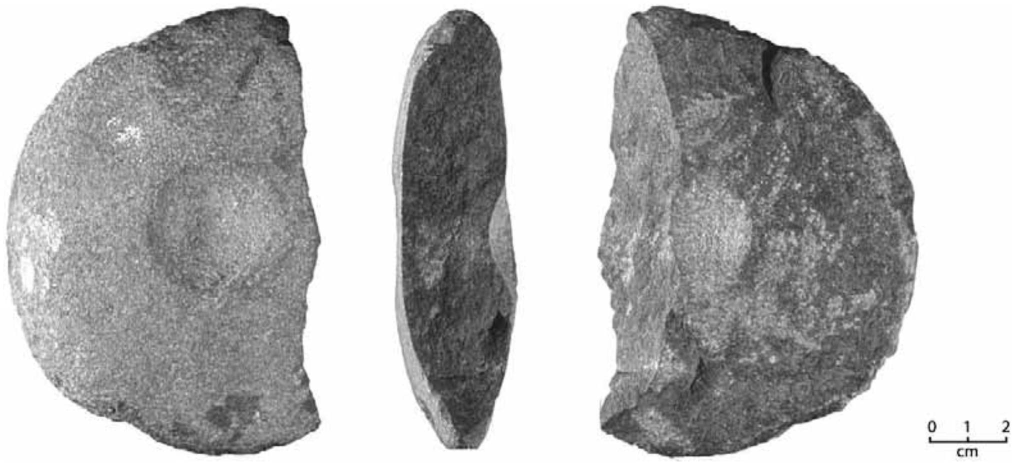

FIG. 6. Dauan club head #6.

While this may be the case, submarine sources should not be ruled out given that seabed outcrops may have included cobbles of desirable ovoid form that had been shaped and worn smooth by strong tidal currents.

In August 1895 on the Mambare River in the Northern (Oro) Province, MacGregor (1897: 13) observed a club head 'lying on the ground' and made from 'a flat piece of basalt stone, apparently picked out of the river, already of the requisite thickness for a disc stone club, smooth on both sides, and ellipsoid in outline'. Williams (1930: 83) observed similar use of 'river pebbles' as club head blanks in the Northern Province. Beatrice Blackwood (1950: 34) observed that Kukukuku men from the Eastern Highlands would 'travel a long way to find good stones' of 'roundish' form from the 'bed of a stream' for club head blanks. Similar first-hand observations of river pebbles used as club head blanks exist for the Ok Tedi region of the upper Fly River (Pretty, 1965: 125; Swadling, 1983: 103) and the Border Mountains of the upper Sepik River (Geyle, 1998: 18). Remnant areas of cobble cortex on club heads have also been used to infer use of water-rolled stones as club head blanks in the Ok Tedi region (Schuurkamp, 1995: 226) and Papuan Gulf region (Haddon, 1900: 245). Even if archaeological finds are included, Pretty (1965: 124) notes that Melanesian club heads 'appear to have been made from rounded pebbles only, and not from quarried blanks'. It is in this connection that Artefacts 5 and 6 from Dauan Island are significant. Both artefacts provide the first insights into Melanesian stone club head manufacture using large flakes as blanks.

HAFTING HOLE EXCAVATION. Drilling and pecking are the 2 techniques recorded ethnographically across New Guinea to create the central hafting hole in stone club heads. At Port Moresby, Haddon (1901: 245) observed a man 'chipping a hole in a stone club-head with a piece of flint'. MacGregor (1897: 13) made the following inferences concerning the partly made 'ellipsoid' stone club head he observed in a village on the Mambare River in August 1895:

> Each side was already pierced half-an-inch deep, the little pit being about an inch and a-half wide at the surface and tapering to a point at the deepest part. Evidently it was being bored by a hard stone with sharp angles, in the same way as the natives bore large holes in the thick slabs of shell with splinters of quartz on Duau and elsewhere. Unfortunately, although the intended club-head was then in position, the borer had been taken away.

In a follow-up visit to the village in August 1896, MacGregor (1898: 4) recorded that:

> Here, for the first time, I had an opportunity of seeing how natives make the hole that receives the handle in a stone club. Some time ago I found one they were in the act of boring, but they had taken away the borer. That same specimen, with the borer, is now in my possession. They select a number of small stones of the size and shape of a rifle bullet. They chip a hole through the stone club by light blows from the point of the small stone. It is surprising what progress can be made in boring the hole by this very simple contrivance.

The 'ellipsoid' club head along with three stone borers formed part of the 'Macgregor Collection' at the Queensland Museum and are now housed in the National Museum of Papua New Guinea in Port Moresby (Michael Quinnell, pers. comm., 2003).

In 1927, Williams photographed a boy from the Ukaudi community (Abau District) in eastern

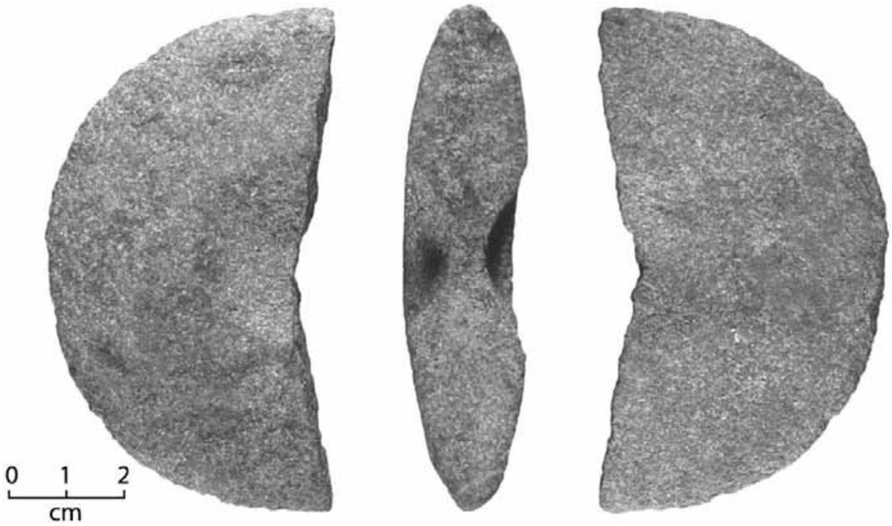

FIG. 7. Dauan club head #7.

PNG using a c.10cm-long stone to peck a hole in an ovoid club head (Young & Clark 2002: 155).

In 1936-37, Blackwood (1950: 34) observed and photographed a Kukukuku man from the Eastern Highlands of PNG using a hammerstone to peck-out a hafting hole in a pebble club head blank:

> The perforation is done by pecking with a pointed stone — often the end of an old adze-blade — some care being taken to begin the pecking at the spot marked. … The pecking is done alternately on both sides, the stone being turned so that the depth of the hole on each side is kept approximately equal. As it gets deeper a reaming movement is used to enlarge the outer part so that the point of the piercing-implement can reach the centre. … The finished perforation is smaller at the centre than at the periphery ('hour-glass' shaped).

Blackwood (1950: pl. 8A-F) recorded use of 'large' and 'small' pecking tools during the 'early stage of perforation', and a stone 'reamer' during the 'later stage' of perforation.

Williams (1936: 416) noted that holes were made in stone clubs heads in the Trans-Fly region by use of a 'bamboo drill [that] was used to cut a cylindrical core out of the centre of the club'. Whether or not Williams actually observed this drilling process is debatable. Adam (1947: 347) certainly concluded that Williams' comments were only inferences.

In 1953, Geyle (1998: 18-19) made a rare, first-hand observation of the excavation of a hafting hole using a bamboo drill in the Border Mountains of the upper Sepik River. A 'circular water-worn stone the size of a club' was 'set in clay' on the floor of the house and the bamboo drill was 'about 2-3cm in diameter'. The drilling process was as follows:

> The bamboo shaft was heavily weighted by rocks in the string bags. The hollow structure of the bamboo had no point as such, but the hard bamboo provided a cutting edge by grinding into the stone, with dust produced by the grinding action itself. The rotary action was supplied by gently rotating the bag[s] of stones hooked to the upright bamboo shaft-drill. The dust from this action built up as the hole deepened and its partial removal left enough of it to wear away the sides of the bamboo, diminishing its diameter. The result was a bevelling of the hole through the stone to provide the perfect fitting for a handle.

It is unclear from Geyle's (1998) description if the bamboo drill removed stone within the hafting hole either as a cylindrical plug or as ground stone powder. Unfortunately, Geyle was not in a position to ask for the drill to be lifted out of the stone club so that the form of the 'drill bit' could be ascertained (Adrian Geyle, pers. comm., 2003). However, it is worth hypothesising that drilling with bamboo tended to produce cylindrally shaped (straight-sided) hafting holes while pecking with a hammerstone mostly produced hourglass-shaped (bi-conical) hafting holes.

Club heads in archaeological and ethnographic collections provide further insights into the creation of hafting holes. D'Albertis (1880) collected numerous stone club heads from the Fly River. Two of the disc club heads illustrated have incomplete hafting holes. McCarthy (1949: 159) described a well-formed disc club head made

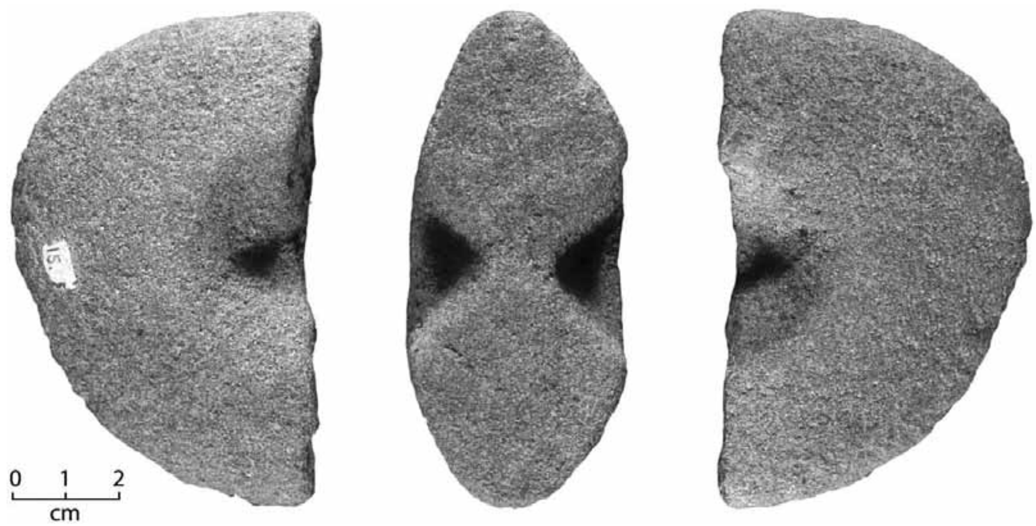

FIG. 8. Dauan club head #8.

from andesite exhibiting an incomplete hafting hole that is 'worked from both sides'. Why the hafting holes on these clubs were not completed is unknown as none of the implements exhibit obvious signs of damage. In this connection, Wirz (cited in Swadling, 1983: 103) observed that coastal Marind-anim of SE West Papua imported unperforated club heads from the upper Digul River whereupon they made their own hafting holes. The Queensland Museum holds a partly made stone club head (M5734) collected from the Strickland River in 1885 (Michael Quinnell, pers. comm., 2003). One side of the 17mm-thick implement exhibits a 25mm wide and 6mm deep pecked depression while the other side features minor traces of pecking and only the beginning of hafting hole excavation. This implement demonstrates that not all hafting holes on club heads were excavated equally on each side (cf., Blackwood, 1950).

For the most part, inferences on the manufacture of hafting holes on Dauan Island clubs match the pecking technique used across different parts of Melanesia. In particular, Blackwood's observation of a pecking and reaming technique is consistent with inferences made for Artefact 6 from Dauan.

SHAPING. After the hafting hole was completed, 'the outside is battered into shape with an old adze-blade or other piece of stone until it is more or less spheroidal and has a fairly smooth surface' (Blackwood, 1950: 34-35). In the Northern Province, Williams (1930: 83) recorded that the 'small pyramidal points of the pineapple club are made by means of a white man's file'. Refined shaping of club heads by pecking is clearly universal across Torres Strait and mainland Melanesia.

FINISHING. The stone club head Blackwood (1950: 35, pl. 9C, pl. 10D) observed being made by a Kukukuku man was given a 'good smooth surface' simply by rubbing it with a hand-held stone. In a unique observation, Blackwood (1950: 35) stated that the 'stone head is smoked in the fire "to make it good"', a process she described as 'hardening' in the caption to pl. 10D. Some perforated stone ritual discs of West Papua are 'rubbed with pig fat and smoked' (Hampton, 1999: 215). As with pecking, finishing of club heads by grinding is universal across Melanesia.

BREAKAGE DURING MANUFACTURE. Blackwood (1950: 34) provided the only ethnographic observation of a stone club head breaking during manufacture. The breakage occurred during pecking of the hafting hole, breaking the club head in half. She noted, '[s]ometimes the stone chosen proves too soft, and cracks in two before the piercing is finished. This did, in fact, happen to the white stone … whereupon the worker threw it away, saying that he had chosen a bad one'. Fenton (1984: 222) noted that 'the shafthole greatly weakens the implement'. As such, it can be expected that as excavation of the hafting hole nears completion, the structural strength of the club head decreases and the chance

TABLE 1. Stone club heads from Dauan Island, Torres Strait.
Maximum Thickness for artefacts is on the edge of the central hafting hole. As such, it measures the length of the hafting hole. The exception is Artefact #3 which is incomplete. Maximum Diameter is applicable only for club heads with a circumference ≥50% complete (N/A = not applicable).

No.	Type	Breakage & Completeness	Size (max.) + Weight	Surface engraving	Hafting hole	Manufacturing technique	Raw Material & Source(s)
1	Bi-convex/ Sharp-edged (Disc)	Small arc segment (20-30% complete). Broke after manufacture.	L = 65mm Th = 22mm D = N/A Wt = 72.7g	None	Cylindrical with hafting polish	Entire outer faces ground smooth with remnant evidence of prior pecking. Subtle bevelling along part of the edge of one face.	Rock type: micromonzodiorite Rock description: Fresh very fine to fine-grained (0.05-1.2mm), fairly even-grained micro-monzodiorite with distinctive euhedral-shaped crystals of plagioclase (white-cream) and dark grey-green hornblende, also some altered pseudomorphs after pyroxene. Geological unit: This rock is possibly a dyke rock within the Badu Granite and could be locally produced (Dauan Island).
2	Bi-convex/ Sharp-edged (Disc)	Small arc segment (30-40% complete) with heat damage (potlid scars) on one face. Broke after manufacture.	L = 87mm Th = 34mm D = N/A Wt = 163.8g	None	Hourglass with hafting polish	Entire outer faces ground smooth with possible remnant evidence of prior pecking.	Rock type: basaltic andesite Rock description: Greenish-grey to dark grey fine-grained moderately lithic-rich basaltic andesite (volcanic rock) with glomeroporphyroblasts (a group of different minerals grown together in clots and lithic enclaves - one of a hornblende tonalite, which shows a chilled margin - dark thin rim around clast). Geological unit: This rock could be associated with the Torres Strait Volcanic Group, even though this rock appears to be too mafic compared to the rocks known from this unit (mostly rhyolites and dacites). This rock could originate from the western part of Dauan Island, Gebar Island or even Marakara Island (PNG).
3	Ovoid	Large arc segment (40-50% complete), one end only. Appears to have broken after man-ufacture. Transverse fracture sur-face exhibits minor grinding.	L = 76mm Th = 55mm D = N/A Wt = 173.2g	None	Hourglass with possible hafting polish	Entire outer surface ground smooth with possible remnant evidence of prior flaking and pecking.	Rock type: trachybasalt Rock description: Fresh very fine to fine-grained, even-grained brownish-grey trachybasalt with some black augite (pyroxene) phenocrysts. Geological unit: Very likely to belong to the Tertiary Maer Volcanic Basalts - could be from neighbouring islands (Daru, Ugar, Erub Islands or the Murray Island Group).
4	Bi-convex/ Round-edged (Dougnut)	Large arc segment (40-50% complete) with large flake detach-ed from one face. Broke after manufacture.	L = 117mm Th = 37mm D = N/A Wt = 310.5g	Radiating linear incisions on both faces + linear incision around outer edge	Hourglass with hafting polish	Entire outer faces pecked to an even contour with little or no grinding. Linear incisions cut directly into pecked surface.	Rock type: porphyritic microdiorite Rock description: Fresh slightly porphyritic microdiorite, with a very fine to fine-grained (<0.05mm) granular groundmass and phenocrysts of euhedral black augite, dark greenish-black laths of hornblende and small cream-white laths of plagioclase (feldspar). Geological unit: This rock is possibly a dyke rock within the Badu Granite. It probably would be located towards the centre of the dyke because of its porphyritic texture suggesting a somewhat slower cooling period. This rock could be locally produced (Dauan Island).
5	Bi-convex/ Sharp-edged (Disc)	Large arc segment (50-60% complete). Broke during manufacture.	L = 101mm Th = 25mm D = 101mm Wt = 145.9g	None	Bi-conical (incom-plete by 6mm)	One face is a fracture surface with contours consistent with the ventral surface of a flake. Minor edge flaking (retouching). Small areas of possible pecking and one small area of smoothing from grinding. Incomplete hafting hole is partially pecked (max. depth =	Rock type: quartz microdiorite Rock description: Altered light to medium grey fine-grained equigranular hornblende biotite quartz microdiorite with most mafic minerals altered to chlorite-epidote and adularisation (alteration of feldspars). Geological unit: This rock is possibly a dyke rock within the Badu Granite. Due to its equigranular (even-grained) texture, this rock could be from a smaller dyke or from close to the

						7mm) and circular in outline (max. diameter = 28mm). Other face exhibits a series of large flake scars consistent with the dorsal surface of a flake. Moderate area of smoothing by pecking, some of which may also be cobble cortex. Incomplete hafting hole is partially pecked (max. depth = 7mm) and circular in outline (max. diameter = 28mm).	edge with a host rock - possibly close to a chilled margin of a dyke (because of an evenly cooling environment - no early growth of larger crystals). This rock could be locally produced (Dauan Island).
6	Bi-convex/ Sharp-edged (Disc)	Large arc segment (60-70% complete). Broke during manufacture.	L = 116mm Th = 32mm D = 116mm Wt = 413.6g	None	Bi-conical (incom-plete by 17mm)	One face is a fracture surface with contours consistent with the ventral surface of a flake. Minor edge flaking (retouching). Moderate area of pecking, focused on removing high points. Incomplete hafting hole is partially pecked (max. depth = 6mm) and circular in outline (max. diameter = 31mm). Other face nearly completely pecked smooth with a few unpecked depressions that may be remnant evidence of prior flaking. Some pecked areas may also be boulder cortex. Incom-plete hafting hole is partially pecked (max. depth = 7mm) and circular in outline (max. diameter = 34mm).	Rock type: microdiorite Rock description: Dark greenish-grey fine-grained (0.01-1.2mm), equi-granular microdiorite, with visible white plagioclase (feldspar), biotite and hornblende minerals. This rock appears partly recrystallised. Possible chlorite alteration of mafic minerals. Some clots of white plagioclase with only minor hornblende crystals seen, otherwise fairly even-grained. Geological unit: This rock is possibly a dyke rock within the Badu Granite. Due to its equigranular (even-grained) texture, this rock could be from a smaller dyke or from close to the edge with a host rock - possibly close to a chilled margin of a dyke (because of an evenly cooling environment - no early growth of larger crystals). This rock could be locally produced (Dauan Island).
7	Bi-convex/ Sharp-edged (Disc)	Large arc segment (50-60% complete). Broke during manufacture.	L = 85mm Th = 20mm D = 85mm Wt = 115.8g	None	Bi-conical (incom-plete by 6mm)	Both faces completely pecked with possible remnants of prior flaking. Both partially excavated, circular hafting holes pecked out to depths of 7mm with maximum diameters of 33mm and 32mm.	Rock type: micromonzodiorite Rock description: Altered medium greenish-grey fine-grained (0.01-1.5mm), equigranular biotite pyroxene hornblende monzodiorite, with small (4mm) white-cream clots of Kali-feldspar. Note that the surface has relatively fresh ironstains due to weathering / (recent) oxidizing of a euhedral pyrite grain. Geological unit: This rock is possibly a dyke rock within the Badu Granite. Its equigranular (even-grained) texture and relatively high Kali-felspar content suggest that this rock could be from a dyke. This rock could be locally produced (Dauan Island). Same rock type and source as club head #8. A similar dyke was seen on Horn Island.
8	Bi-convex/ Round-edged (Dougnut)	Large arc segment (50-60% complete). Broke during manufacture.	L = 88mm Th = 41mm D = 88mm Wt = 244.9g	None	Bi-conical (incom-plete by 12mm)	Both faces completely pecked with no obvious evidence of prior flaking. Both partially excavated, circular hafting holes pecked out to depths of 13mm with maximum diameters of 35mm and 38mm.	Rock type: micromonzodiorite Rock description: Altered light to medium greenish-grey fine-grained (0.01-1.5mm), equigranular biotite pyroxene hornblende monzodiorite, with small (4mm) pale pink and cream clots of Kali-feldspar (and very fine aggregate hornblende); traces of quartz were seen, but are very small. Geological unit: This rock is possibly a dyke rock within the Badu Granite. Its equigranular (even-grained) texture and relatively high Kali-felspar content suggest that this rock could be from a dyke. This rock could be locally produced (Dauan Island). Same rock type and source as club head #7. A similar dyke was seen on Horn Island.

of breakage from pecking impact correspondingly increases. However, the 2 club heads that broke during manufacture by Fenton both fractured from pecking impact associated with general shaping of the implements. None of Fenton's experimental club heads broke during pecking of the hafting hole. Significantly, all 4 Dauan clubs also broke in half during the pecking process. However, it is unknown if these clubs broke during pecking of the hafting hole or club face.

DURATION OF MANUFACTURE. Only one example of club head manufacturing times was found for Melanesia. Blackwood (1950: 35) recorded that the stone club head she observed being made 'took three days' to complete, 'but the work was not continuous'. Attaching the elaborate haft to the club head 'took four hours of almost continuous work'. These estimates are in line with experimental work on prehistoric Scottish club head manufacture by Fenton (1984). Fenton found that while initial flaking took very little time, pecking took 3-5 hrs, grinding took 1-3 hrs, polishing took 3 hrs, and hafting hole excavation took 15-20 hrs. Concluding on his experimental work, Fenton (1984: 230) stated that 'most' of the club heads 'could be produced from a good blank in 20-25hr – two or three days of intensive work'. In this context, Schuurkamp's (1995: 226) comment that it took '4-6 months' for a hafting hole to be 'drilled' in stone club heads of the Star Mountains (PNG) clearly refers to intermittent work.

DAUAN CLUB HEADS — IMPLICATIONS FOR TORRES STRAIT EXCHANGE SYSTEMS

The identification of one Dauan stone club head (ovoid Artefact 3) as manufactured from trachybasalt — a rock type known to outcrop in Torres Strait only in the Eastern Island Group — indicates importation of some club heads (and club head quarries in the Eastern Island Group). This finding is interesting in light of Haddon's (1912: 192) collection of an ovoid club head from Mer that was 'made of *nigir* stone, which is said to be found in Dauan' and recent recording of grinding grooves on Mer (Carter et al., this volume). The fact that a club head made from Eastern Islands stone has been found on Dauan Island and a club head made from Dauan stone has been found in the Eastern Islands reveals exchange relationships between both areas in the past. From a theoretical point of view, exchange in like objects between both areas provides firmer empirical footing for McNiven's (1998: 108) hypothetical model that stone-headed clubs (*gabagaba*) had an important function in ceremonial exchanges across Torres Strait aimed at cementing social relationships (including alliances) between different Islander communities. However, consideration also needs to be given to the possibility that at least some club heads moved indirectly between Dauan and the Eastern Islands via southern (mainland) PNG (see McNiven, 1998: 107-8). In this case, indirect movement of club heads may have had little or no association with cementing social relationships.

CONCLUSION

This paper joins mounting archaeological information gathered over the past 30 years pointing towards Dauan Island as a key location for the manufacture of stone club heads (and stone axes/adzes) used in Torres Strait and across the adjacent PNG lowlands (Hitchcock, this volume; McNiven, 1998; McNiven, von Gnielinski & Quinnell, this volume; Vanderwal, 1973). However, some club heads were manufactured from raw materials known to outcrop in other parts of Torres Strait such as the Eastern Islands, Central Islands (e.g., Gebar) and Western Islands (e.g., Mua, Mabuiag, Prince of Wales Group). To date, stone quarries have only been recorded on Dauan and further survey work is required to see where tool stone quarrying occurred on other islands in the Strait. In terms of existing site records, the scene is now set for a thorough investigation of tool stone quarries and stone tool manufacture on Dauan. Apart from providing detailed technological insights into the manufacture of club heads and axes/adzes, excavation of sites will provide chronological insights into changes in both tool production and the strategic role of Dauan Islanders in provisioning their neighbours with stone tools. Such studies need to be undertaken in conjunction with attempts to link club heads to potential sources via petrographic and geochemical analyses. As with previous research, future archaeological initiatives on Dauan Island will be co-developed with the local Islander community.

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