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## TORRES STRAIT AND THE ORIGIN OF LARGE STONE AXES FROM KIWAI ISLAND, FLY RIVER ESTUARY (PAPUA NEW GUINEA)

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For over 100 years, speculation has surrounded the origin of the unusually large axes (referred to here as Kiwai 'type' axes) found in various locations across the southern Papuan Lowlands and in particular on Kiwai Island at the mouth of the Fly River. As the Papuan Lowlands are essentially devoid of stone suitable for tool manufacture, early ethnographic research suggested the axes were traded 100s of kilometres down the Fly River from the New Guinea Highlands while later research focused attention southwards to the rocky islands of Torres Strait. Archaeological research over the past three decades has revealed a stone axe quarry and partly made axes of Kiwai 'type' in Torres Strait. That Torres Strait was indeed a likely source for these axes is revealed by preliminary geological sourcing of selected Kiwai 'type' axes held by the Queensland Museum and in private collections. Most of the axes are made from specific forms of fine-grained granite known to outcrop in Torres Strait and not within the Fly River basin. It is hypothesised that the large axes formed the basis of a symbiotic relationship between Islanders and Papuans whereby Papuans needed the axes to make canoes, which were traded to Islanders who needed the canoes for their maritime lifeway. As such, axe manufacture was critical to the late Holocene permanent settlement of Torres Strait. Furthermore, earliest use of Torres Strait islands may have been by Papuans on specialised stone quarrying trips to manufacture axes for the production of canoes solely for local use. More permanent settlement of Torres Strait facilitated movement of cultural traits between New Guinea and Australia, a view consistent with the tentative identification of Cape York gabbro as the raw material for one of the Kiwai 'type' axes. If accurate, this axe provides the first evidence for prehistoric raw material movement between mainland Australia and New Guinea. Ironically, as steel axes gradually made stone axes obsolete during the 'passing trade' era of the early to mid-19th Century, some Torres Strait Islanders may have imported large Kiwai 'type' axes from southern New Guinea for use as trade items with European visitors. □ *Stone axe trade, axe quarries, Kiwai Island, Torres Strait, Papua New Guinea.*

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The vast swampy lowlands that dominate the Fly River basin in the SW of Papua New Guinea (PNG) are home to numerous cultural/linguistic groups. The Trans-Fly region extending from the mouth of the Fly River west to the Indonesian border abuts Torres Strait, which separates the landmasses of Australia and New Guinea. East of the Trans-Fly along the W sections of the Papuan Gulf is found the Kiwai language-culture area, while to the W is found the Marind language-culture area (Knauff, 1993). Despite extensive anthropological and historical research in these areas over the last century, archaeological insights into the long-term cultural history of these peoples is scant. Some research has been undertaken on relict mound-and-ditch

agricultural systems, which characterised the Kiwai, Trans-Fly and Marind regions (Barham & Harris, 1983, 1985; Harris & Laba, 1982; Hitchcock, 1996; Swadling, 1983: 26-28). Excavation of an occupation site (shell midden) has taken place at Waidoro opposite Torres Strait (Barham & Harris, 1985; Harris & Laba, 1982). One long standing archaeological question that has remained unanswered is the age and origin of large stone axes found on Kiwai Island at the mouth of the Fly River (Fig. 1). [For the purposes of this paper, the general term 'axes' is used with the acknowledgment that many axes may also have been employed as adzes.] Available historical evidence suggests strongly that the axes, particularly the large axes, date to a period

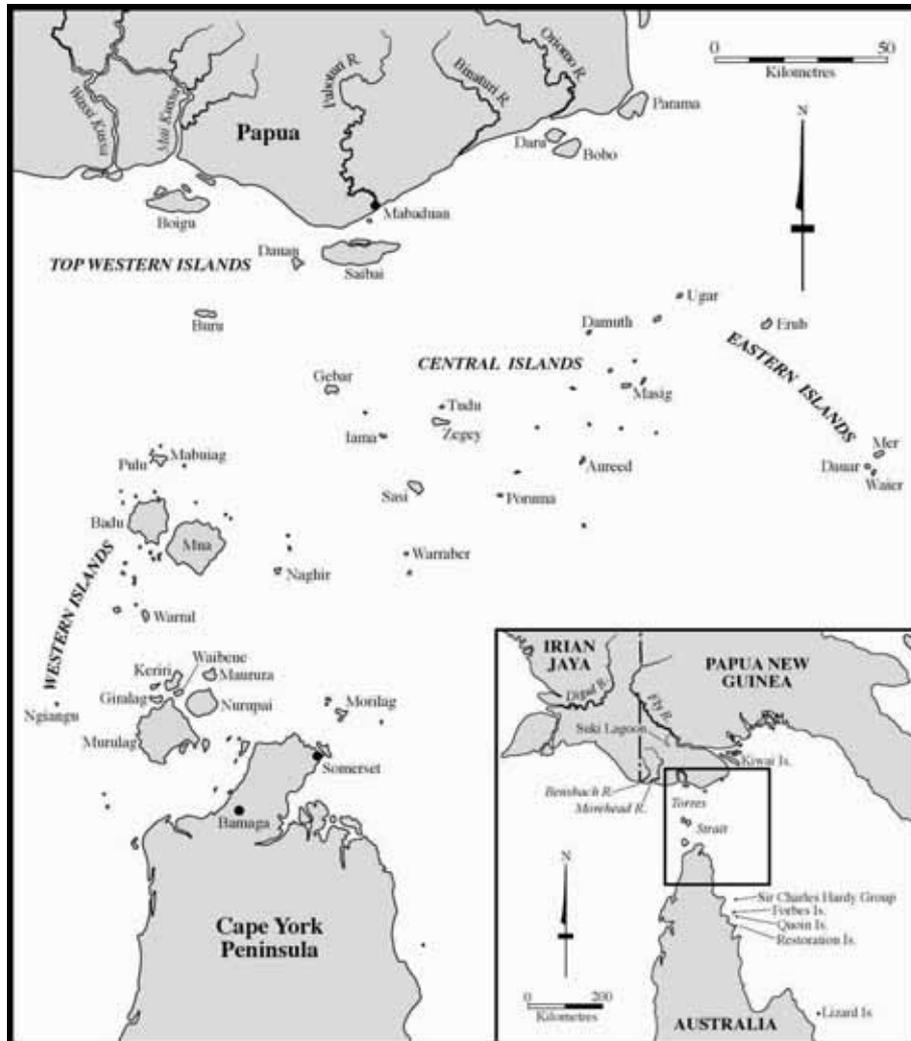


FIG. 1. Study area.

before sustained European contact in the late 19th Century. That the axes were manufactured elsewhere is indicated by the fact that Kiwai Island, like most of the Papuan Lowlands, consists of alluvial sediments and mud. Historical evidence concerning the origin of the axes suggests either the islands of Torres Strait to the S or the distant mountainous interior of PNG to the N. This paper sheds new light on this question with the first detailed descriptions of axe raw materials and their likely sources. The implications of these results are discussed in terms of changing trade relationships between PNG,

Torres Strait and Australia both before and after European contact.

#### KIWAI AXES

**HISTORICAL DESCRIPTIONS.** In 1898, Alfred Haddon visited Kiwai Island and saw numerous large stone axes:

In this island a number of very large, well-shaped, polished stone implements are found in the bush; the largest I have seen was in Mr. Chalmer's house – it measured 18¾ inches [47.5cm] in length. These stones are now placed at the head and foot, or all round the graves, and the natives do not appear to know anything about their former use. A small stone adze-head (*tapi*) was bought at

Iasa, and when I asked who made it, I was gravely informed, "He make himself he stop along ground all time." The large implements are so cumbersome and heavy that it is difficult to understand how some of them could ever have been used, and I suspect the largest ones were in reality symbols of wealth or possibly of authority (Haddon, 1901: 108).

Colonel Kenneth Mackay's recordings from the region reveal that the axes were plentiful along the Trans-Fly coast. On a visit to Daru Island immediately off the PNG coast S of Kiwai Island, Mackay (1909: 173-174) noted 'On either side of the steps leading up to the resident magistrate's bungalow a row of stone-axes stood, edge up'. These had been obtained from the 'beaches of the Fly River'. Some of these axes were 'over fourteen inches [36cm] long, and all were beautifully made'. In another instance, 'a storekeeper and trader' informed Mackay (1909: 174) that he used the axes 'in his boat as ballast'.

Between 1910 and 1912, Gunnar Landtman undertook detailed anthropological research on Kiwai Island and noted that stone axes could be 'acquired' in 'great numbers' as their value was minimal given the technological transition to metal tools (Landtman, 1927: 33). According to Landtman (1927: 34), the shape of Kiwai axes was:

more or less the same in the whole district independent of size; all are smooth, and some beautifully symmetrical and polished. In rare cases axes have a slight median groove or rib ...; the later occasionally show a notch on each side suggesting eyes.

Landtman (1927: 34) noted that the axes ranged enormously in size from 53.5cm down to nearly 6cm and that while hafting was feasible for the smaller axes, the larger axes would have had to be held in the hands. Amongst older Kiwai men earlier in the 20th Century, 'memory' of the use of the axes 'remained remarkably fresh and clear' (Landtman, 1927: 35). The smaller axes were hafted into wooden handles and were used in the manufacture of dugout canoes (Landtman, 1927: 209). Landtman was told that the larger axes had 'very great value' and could represent a large part of the payment for a bride or a canoe. He (1927: 34) felt that the 'unwieldiness' of the larger axes was consistent with a 'ceremonial' use. The ceremonial use of stone axes seems to have increased after the technological change to metal blades with axes 'often kept on graves or at water holes, stuck in the ground in an upright position' (Landtman, 1927: 35).

In the early 20th Century, Wilfred Beaver, long-time Resident Magistrate in the Western

Division of Papua, observed numerous Kiwai axes. He noted:

At the present day the large stone axes which may be occasionally seen in Kiwai or Fly River villages are supposed to be agricultural charms. The former use has been forgotten, and the only answer to be obtained, if you ask them, is that "They are old-time things." That they were ever actually used is not admitted by the people, but for a very long time past Kiwai has obtained iron by trade and so the knowledge of their former use can easily have been lost. Stone tools have scarcely been used for generations, but their can be no doubt that they were once used and, indeed in the story of Sido, the hero is referred to as using a stone axe. Some of these axes are so large that I have been inclined to regard them as once of a ceremonial nature. However, I have seen some as large or even larger from the interior of south-western Dutch New Guinea fitted to their handles and I was told they were found in actual use (Beaver, 1920: 187).

From the above historical descriptions, a picture emerges of 2 major groups of axes in the Kiwai region — smaller axes that were hafted and had a utilitarian value, and large axes that went unhafted and may have had a ceremonial function. Crosby (1973: 165) also came to a similar conclusion about the function of axes after an extensive review of historical records and museum collections.

QUEENSLAND MUSEUM COLLECTION. Further insights into the form of Kiwai axes were gained by examining 14 stone axes provenanced to Kiwai Island and held by the Queensland Museum. This sample was augmented with 7 privately owned axes loaned to the Queensland Museum for this study. These latter axes were collected by John Sweeney (Brisbane) during the 1960s while working as a trader along the Fly River and are currently held by Ian McNiven. Sweeney noted that he obtained the axes from Daru Island with an understanding that they originated from Kiwai Island (Sweeney pers. comm. to McNiven, 1998). Thus, a total of 21 Kiwai axes was examined.

The axes reveal a high degree of technical skill in their manufacture, with great care taken in producing a symmetrical form (Figs 2-3). While the surface of the axes is almost completely ground, most reveal traces of earlier flaking and pecking. It is clear that initial shaping of the axes was by percussion flaking with secondary shaping by hard-hammer pecking. Final smoothing by grinding usually only left behind deep flake scars and the basal portions of some pecked pits. Axes have either a lenticular or oval cross-section. All axes have a pointed poll.

The axes range enormously in length (9.2-46.5cm), maximum width (5.0-12.7cm) and

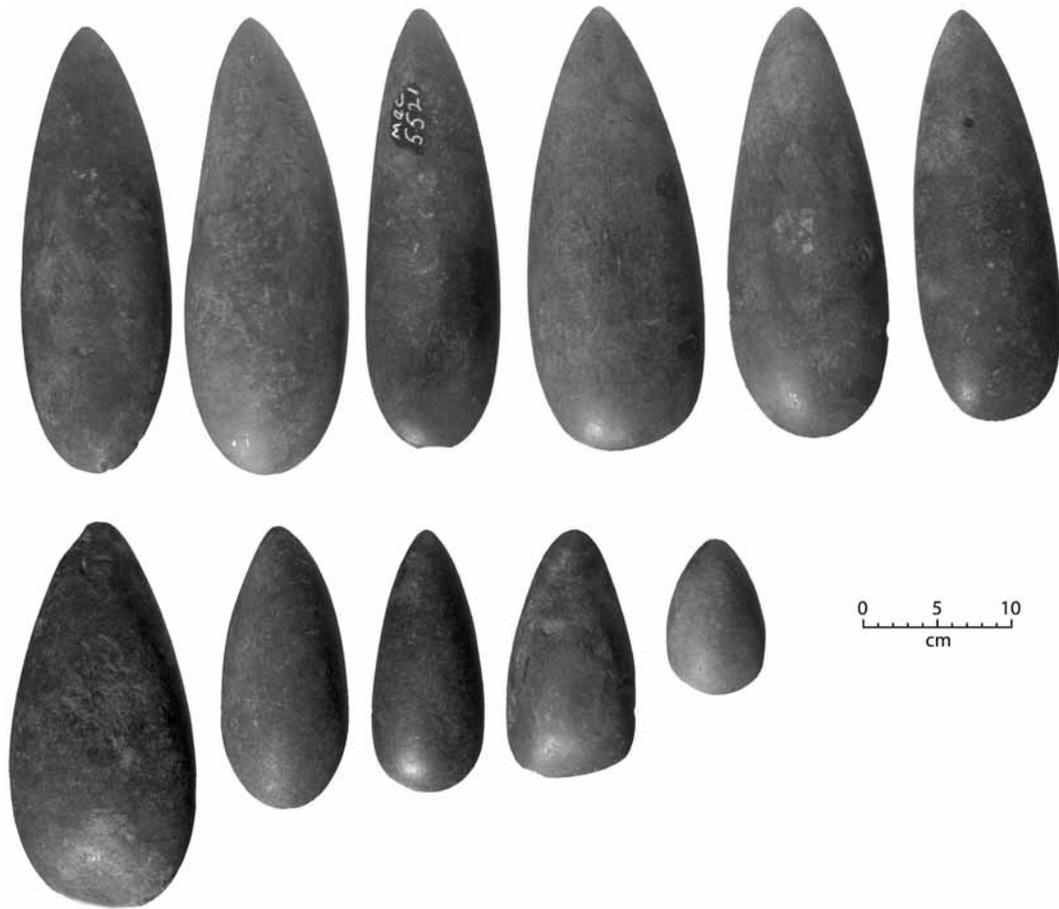


FIG. 2. Kiwai 'type' axes. Small to large. Top row (L to R): McN99, M5, Mac5521, E10767, E4591, E6129. Bottom row (L to R): QE4676, McN96, M189, McN101, McN98.

maximum thickness (3.1-8.7cm) (Fig. 4). The weight of axes ranges 333-6767g, with 10 axes weighing more than 2000g and 6 more than 3000g (Table 1). The largest specimen (E1774) is one of the largest ground axes ever recorded in Melanesia (Fig. 3). It is not possible to determine the morphological representativeness of the axe collection. While the length range is slightly more restricted than the size range (c.6.0-53.5cm) recorded by Landtman (1927: 34), no evidence is available to assess the representativeness of either the Landtman collection or the current sample in terms of size classes. For example, it is quite likely that the larger axes are over-represented in museum collections owing to European interest in such 'exotic' artefacts.

Despite questions over the size representativeness of the axe sample, it is clear that it is dominated by a distinctive axe form, with a teardrop shape and thick oval or lenticular cross-section (Crosby, 1973: 165). While 'McN98' (Fig. 2) indicates that these distinctive axes can be small, for the most part they are either large or very large. The form of these axes is unusual and localised within Melanesia to the Kiwai and broader Trans-Fly region (Crosby, 1973). For this reason it is useful to refer to this particular class of axe from Kiwai as the *Kiwai 'type' axe* (Figs 2, 3). However, we use this typological designation with full acknowledgment that no detailed, formal definition is provided and that other axe forms (mostly smaller axes) also occur in the region and within our sample (Fig. 5). A

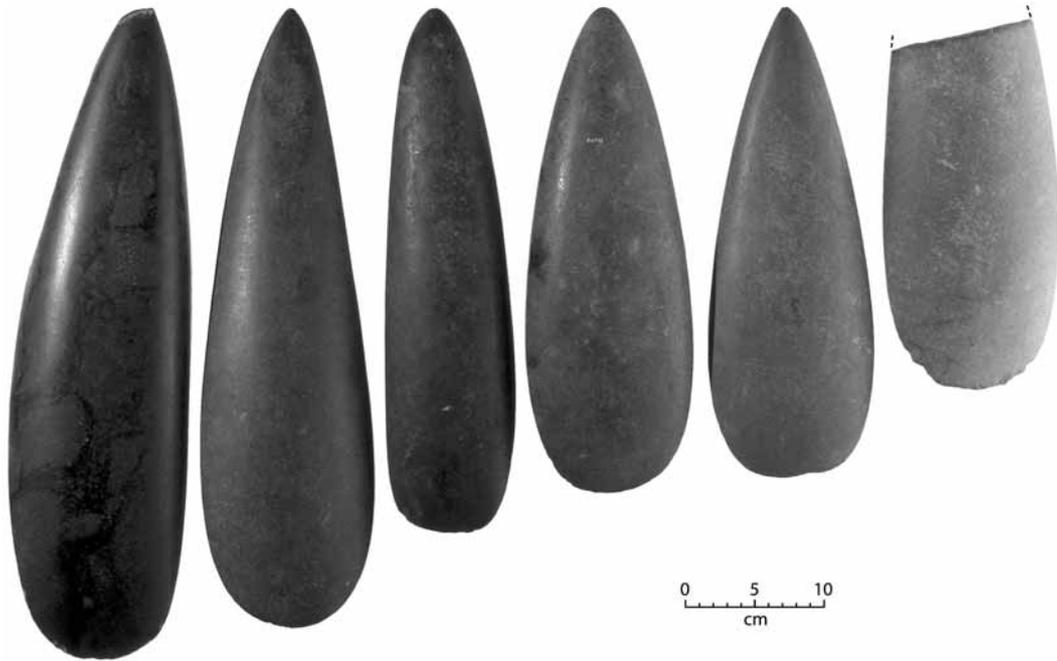


FIG. 3. Kivai 'type' axes. Extra-large. (L to R): E1774, M3, E4589, E4593, M2, McN100.

much larger and possibly more representative sample of axes from the region will need to be obtained and studied to determine if morphological and metrical boundaries for the Kivai 'type' axe can be isolated. For the purposes of this paper, we highlight the distinctive teardrop form of many Kivai axes, particularly the larger specimens. This morphological information is important for the first stage of our sourcing investigation — a comparison of Kivai 'type' axes with 1) axes produced at known quarry sites from across central New Guinea, and 2) axes found in Torres Strait. The origin of many of the smaller axes from Kivai Island that fall outside the Kivai 'type' axe is beyond the scope of the present study. None of these typological issues have any bearing on the second stage of our analysis — raw material identification and geological sourcing of the Queensland Museum sample of axes from Kivai Island. Before presenting the stage 1 and 2 results, we present previous insights into the origin of Kivai Island axes.

#### DIFFERENT VIEWS ON AXE SOURCES

Haddon (1901: 108) realised that axes on Kivai Island must have been imported:

As no stone occurs *in situ* for a distance of many miles, and none of this kind is known in the district, the implements have in all probability come down the Fly River. It is quite possible that stone implements have been out of use in this district for perhaps a century, owing to natives getting iron from wrecks and passing ships, and then bartering it to their neighbours; thus in two or three generations the knowledge of the use of stone implements would easily die out.

Beaver (1920: 187) also believed that the axes were imported from the inland:

I do not think the Kivais themselves ever manufactured stone tools, and of course there is no stone on the island and certainly there is none of suitable composition anywhere within many miles, unless in the vicinity of Mabuduan [Mabuduan], and I am inclined to think stone axes must have reached Kivai by some trade route down the Fly.

Landtman (1927: 33-34) took a different tack to Haddon and Beaver and suggested that the Kivai axes resulted from 'the extensive traffic in various articles that in former times was carried on between Kivai country and the islands in Torres Strait'. More specifically, Landtman (1927: 34) provided details on axe procurement and manufacture that he elicited from people at Mawata village on the Papuan coast:

the Torres Strait islanders obtained the stones out of which axes (or adzes) and club-heads were made principally from the bottom of the sea, by diving. The diver had a long rope attached underneath one shoulder, by which his

companions in the canoe helped him up to the surface when loaded with heavy stone. If the stone brought up by him seemed suitable to be shaped into an axe or club-head, he put it into the canoe, otherwise it was dropped back into the sea. The shaping of the stone was effected by means of a hammerstone (*Gubakira*) and the grinding by means of a somewhat softer stone (*ibaiba*). I was told that the axe stones were kept in the sea during intervals in the work to soften them, and that afterwards they were hardened in the sun or before a fire. Grindstones were obtained by the Mawata people from Mabudavane [Mabaduan], and constituted one of their important articles of barter in trading with the peoples further east.

This information is consistent with a story recorded by Landtman (1917 cited in Haddon, 1935: 53) where Kiwai people 'remained friends with the Mawata people, as ... [they] used to provide them with stone axes'.

In his final report on the Cambridge Anthropological Expedition to Torres Straits, Haddon (1935) changed his views on the origin the Kiwai axes more in line with those of Landtman. While visiting Yam Island in the Central Strait in 1914, Haddon was shown a number of granite blocks with 'grooves and oval depressions' at a site located on the edge of a tidal mangrove forest. He interpreted the site as 'a factory for making – or at least for grinding – stone implements' and surmised that:

Naturally one would assume that stone axe-heads were made here, but I do not know of any authentic stone axe-blades of local manufacture having been collected in Torres Straits. ... It is however possible that the large axe blades that were so numerous on Kiwai Island, and were often of a very large size, were made here (1935: 76).

Swadling (1983: 142) suggested that the larger stone axes used by the Marind-anim are most likely Kiwai axes which were obtained either by trade or during known raids along the Trans-Fly coast. In this connection, Landtman (1927: 34 citing Wirz, 1922) noted that the Marind-anim 'have a tradition according to which the first axe of this kind was obtained from one of the very large teeth of a certain being or man named Monubi, who had come from far away'. Swadling (1983: 107) suggested that 'Torres Strait stone was being used to make the large stone axe blades known in the Kiwai area'. Lawrence (1994: 338) was more reserved about

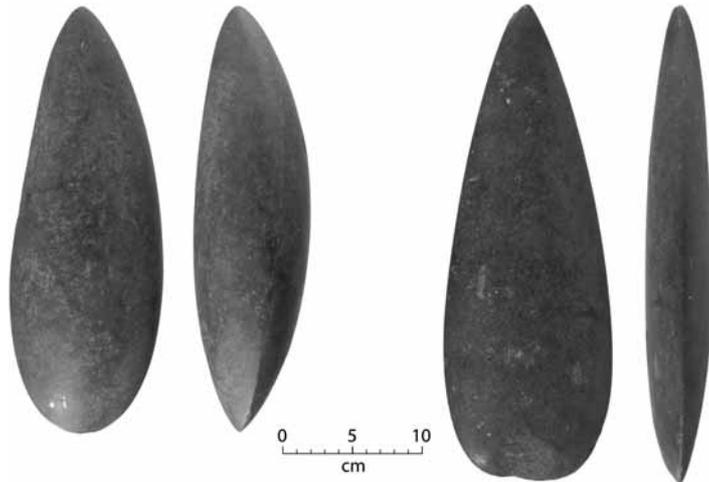


FIG. 4. Top and side views of Kiwai 'type' axes showing range of thickness. (L to R): M5 (relatively thick), M2 (relatively thin).

existing information on where Kiwai axes were manufactured and stated that 'The true origin of stone axe and adze heads remains obscure'.

The suggestions by Haddon and Landtman that Kiwai axes could have originated from either Torres Strait to the southwest or the Highlands to the far north are both feasible. Apart from Swadling's (1983) comments, no detailed re-assessment of the origin(s) of Kiwai axes has taken place. However, since the work of Haddon and Landtman, anthropological and archaeological information on the location of axe quarry sites has been published for New Guinea (West Papua and PNG) and Torres Strait. This new information allows testing of the various ideas on the origins of the Kiwai axes. In the following section, this information is summarised and the likelihood of different quarries representing potential sources for the Kiwai axes is assessed in terms of the morphology of axes produced and known trade routes. This analysis is limited to Kiwai 'type' axes as too few data are available on the form of other axes (usually smaller axes) from Kiwai Island and the surrounding Trans-Fly region.

#### POTENTIAL QUARRY SITES IN NEW GUINEA, TORRES STRAIT AND MAINLAND AUSTRALIA

**WEST PAPUA HIGHLANDS.** Four major axe quarry complexes have been documented for the highlands chain of West Papua. Moving from east to west, the first is the Red Digul quarries located in the upper reaches to the Digul River

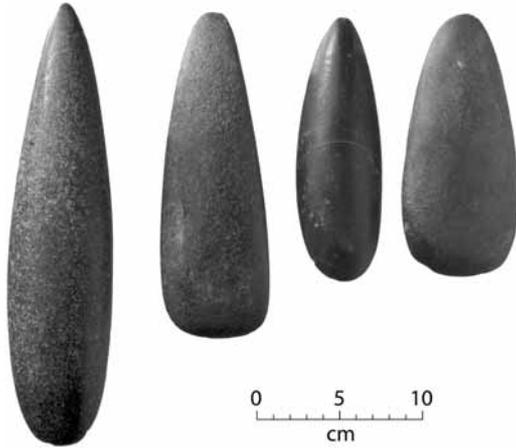


FIG. 5. Other Kivai axes. (L to R): E12787, McN26, E12788, McN101a.

immediately W of the Fly River. Red Digul axes were traded eastwards into the upper Fly River and upper Strickland River regions and S along the Digul River valley into Marind territory (Swadling, 1983: 85-86). The quarry was in a 'horizontal sill of black-brown basaltic rock' (Lindsay cited in Swadling, 1983:85). Kooijman (1962: 23-24, 31-32) also reported that axes made from a stone with the minerals nephrite, quartz and andesine were quarried from the upper Digul River and traded eastwards. Northwest of the Digul River is a complex of axe quarries operated by the Kimyal people (Sela quarries) and Una peoples (Langda quarries – the Mumyeme quarries of Swadling, 1983: 86) (Hampton, 1999). Raw materials are 'basalt/andesite', which in some cases has been metamorphosed to produce 'metabasalt/andesite' (Hampton, 1999: 83-84). Axes were traded westwards into the fringes of the Grand Valley Dani territory in the Baliem River valley and eastwards into the upper Fly River region and into the upper Sepik River region (Hampton, 1999: 276; Swadling, 1983: 86). The Tagime quarries (Tagi quarries of Swadling, 1983: 86-87) are operated by the western Dani people of the upper Baliem River valley. The raw material ranges from marginally metamorphosed mudstone (argillite) (Mitton, 1972 cited in Swadling, 1983: 86) to highly metamorphosed 'black meta-argillite' from which the best axes are manufactured (Hampton, 1999: 60, 244). The Yeineri quarries (Jelime quarries of Swadling, 1983: 87) are located within Wano territory near the border with the Western Dani (Hampton, 1999). Axe raw materials range 'from

blueschist to epidote amphibolite, to epidote chlorite schist' (Hampton, 1999: 64). Hampton (1999: 276) documented Tagime and Yeineri axes traded across the western Highlands of West Papua. Swadling (1983: 86-87) noted axes from the Yeineri and Tagime quarries were traded along the Baliem River southwards to the coast within the Asmat language-culture area. None of the axes produced at the West Papuan quarries conform to the Kivai 'type' axe (cf., Hampton, 1999; Kooijman, 1962: pls 10, 16, 17; Swadling, 1983: pls 13,14).

PAPUA NEW GUINEA HIGHLANDS. Most research on PNG stone axe quarries concerns those of the central Highlands. Axes from the numerous quarries of the Jimi, Wahgi and Chimbu River valleys are made from thermally metamorphosed, fine greywackes and inter-bedded argillites (Chappell, 1966). Some of these axes have a lenticular cross-section but most are planilateral or flat-sided (Bulmer & Bulmer, 1964; Burton, 1984; Chappell, 1966; Strathern, 1965, 1969) and look nothing like the Kivai 'type' axe.

Numerous stone axe quarries are known for the highlands bordering the upper Fly River basin (Swadling, 1983: 79-90). Stone axes were produced from the Mt Stolle and Tan De Bom quarries on the N side of the highlands but their distribution seems to have been localised to peoples of the upper Sepik River (Swadling, 1983: 84-85). To the east of these 2 quarries are the Wario River quarries. They are within outcrops of Gufug gneiss that are represented by 'glaucophane blueschists, greenschists, meta-volcanics and similar rocks' (White & Modjeska, 1978: 279). Some Wario axes were traded S into the Fly River basin, travelling along the upper Strickland River and its tributaries (including the Great Papuan Plateau), then into Marind territory around Lake Murray and over the border into West Papua (Swadling, 1983: 82, 84; White & Modjeska, 1978). Peoples of the upper Strickland River and adjacent Southern Highlands (e.g., Tari Basin) were also on the far western margins of the central Highlands axe trade system (Glasse, 1968-69; Hughes, 1977: 181; Sillitoe, 1982). The people of the Oriomo River immediately west of Kivai Island also obtained stone implements from trade connections with Fly River peoples 'who traded them from up-river' (Pretty, 1965: 127). None of the axes produced from these Highlands quarries conform to the Kivai 'type' axe (Swadling, 1983: pls 10-14).

PAPUAN LOWLANDS. No quarry sites have been recorded across the middle and lower Fly River regions (McNiven, 1998; Swadling, 1983). This situation is attributed by anthropologists and archaeologists to the belief that the lowland region extending at least 300km inland from the Torres Strait coast to the edge of the mountains (Papuan Plateau) 'is alike in the almost total absence of hard stone suitable for making stone implements' (Pretty, 1965: 124; see also Haddon, 1935: 365; Landtman, 1933: 45; Ohtsuka, 1983: 4; Swadling, 1983: 103 for similar comments). Blake (1972: 1190) noted that the 'only hard rocks exposed ... [across the Oriomo plateau and Fly-Digul shelf] ... are the granite at Mabaduan, Miocene limestone near the Oriomo, and mudstone and sandstone of possible Pliocene age along parts of the Bensbach and Wassi Kussa Rivers'. The Gogodala of the Fly River mouth region demonstrate the effects of stone scarcity well by their use of fungal sclerotia as a 'substitute' to manufacture club-heads (Price et al., 1978: 375). The lack of tool stone is borne out by geological surveys that reveal that Mabaduan on the Papuan coast is the northern outcrop of the upper Palaeozoic volcanics and granites characteristic of Torres Strait. Petroleum exploration bores in the Papuan Lowlands indicate that the granites do extend N of Mabaduan but are buried deeply by Cainozoic sediments (APCP, 1961; Blake, 1971; Blake & Ollier, 1971). Bores on the Morehead and Oriomo Rivers revealed sedimentary sequences in excess of 2400m and 500m respectively. Further inland, bores located 60km and 160km from the coast found the granite was buried by 1900-2000m of sediment. The only known rocks suitable for ground stone tool manufacture that have penetrated these sediments in the greater region are Quaternary volcanoes forming the Eastern Islands of Torres Strait (Willmott et al., 1973: 16). The recent age of these volcanoes indicates that if they extended N across the Papuan Lowlands, evidence of their existence in the form of basaltic hills (volcanic cones) should be forthcoming. Furthermore, none of the APCP bores revealed volcanics above the basal granites. In short, a century of European exploration coupled with anthropological and geological research has failed to indicate the existence of volcanic or plutonic tool stone suitable for club and axe/adze manufacture across the Papuan Lowlands. Whether or not outcrops of 'pale grey sandy mudstones' located on the banks of the Bensbach and Tarl Rivers (Blake, 1971: 61) were used to manufacture flaked stone tools (e.g.

cutting and scraping implements) is another question.

Despite the lack of suitable stone in the middle and lower Fly River regions to manufacture axes (and club heads), peoples of these areas traded, used, curated and possibly manufactured axes. For example, although Pretty (1965: 125) noted that no evidence of stoneworking exists for the Strickland River, Hyndman (1982 pers. comm. cited in Swadling, 1983: 89) recorded that the people of Asunangi of the middle Fly River obtained axe raw materials from stones caught in the roots of trees floating down the Fly River. Trans-Fly people such as those from the Morehead River district imported axes into their 'stoneless country' from Fly River peoples to the north (i.e., the Wiram) and from people on the Torres Strait coast opposite Boigu Island (Williams, 1936: 428). That people of the Trans-Fly region could have shaped stones into axes is revealed by the recording of portable grinding stones (Pretty, 1965: 127; Williams, 1929: 384) and axe grinding grooves within a granite outcrop at Mabaduan on the coast (Landtman, 1927: 287; 1933: 45-46; Lyons, 1913-1925, IV: 129). Riley (1925: 112) observed people on the Bamu River sharpening axes on bark using river sand as an abrasive. Moving east of Kiwai Island into the Papuan Gulf region, again lack of suitable stone for axes resulted in importation of axes either from central Highlands quarries to the north (e.g., Abiamp quarry) or from coastal traders from the east who obtained axes from the Owen Stanley Range (Hughes, 1977: 180; Rhoads, 1983: 111-112; Rhoads & Mackenzie, 1991). Most axes from the Kikori River in the western Gulf were made from a type of metamorphosed andesite/basalt thought to be available in the eastern Gulf (Rhoads & Mackenzie, 1991: 47-48). None of the Papuan Gulf axes conform to the Kiwai 'type' axe.

CAPE YORK PENINSULA. Aboriginal people of Cape York Peninsula used ground-edge axes similar to those used across most parts of the continent (Dickson, 1981). While few details are available on the nature of axe manufacture and exchange in Cape York Peninsula, archaeological/material culture research has failed to locate any axes that even remotely approach the size or form of Kiwai 'type' axes (e.g., Bailey, 1999; Greer, 1999; McConnel, 1953; Morwood & Trezise, 1989; Roth, 1904; see also Dickson, 1981; McCarthy, 1976). Despite the absence of Kiwai 'type' axes in Cape York Peninsula, Torres Strait Islanders were documented sailing down the E

coast to obtain stone for axes and club heads (McNiven, 1998: 101-103). Haddon (1935: 88, 391, 394) was informed that men from the Central Islands of Torres Strait canoed up to 300km S to the Forbes Islands off the E coast of Cape York to quarry stone for the manufacture of club heads (see also Laade, 1969: 39, 1973: 159). This evidence is corroborated by Thomson (1939: 82), who reported that 'the people from Torres Strait came frequently in big canoes to Mitirindji (Quoin Island)' immediately S of the Forbes Islands 'to obtain supplies of stone for their axes'. Despite this historical information, neither stone axes nor club heads manufactured from Cape York stone have been documented in either Torres Strait or the Papuan lowlands (McNiven, 1998). However, it is clear that the Cape York Peninsula, and the islands off the east coast in particular, should not be ruled out as a potential raw material source for Kiwai axes.

**TORRES STRAIT.** The other major source option for the Kiwai 'type' axes is Torres Strait. While evidence for stone axe use and manufacture in Torres Strait is minor, this information is far more consistent with Torres Strait as the source of the Kiwai axes than that available for New Guinea. Haddon (1935: 76) suggested that the Yam Island grinding grooves might have been where Kiwai axes were manufactured. Vanderwal (1973: 173) suggested that the 'sheer number and depth' of the Yam Island grinding grooves pointed towards local axe manufacture as opposed to 'mere sharpening'. Unfortunately, no direct evidence of stone tool manufacture such as flaking debris or axe blanks has been seen at the site (I. McNiven pers. obs., 1998). Excavation of mangrove muds that surround the grooves may reveal otherwise.

The only Torres Strait stone tool quarry that Haddon heard about was located on Dauan Island (Haddon, 1935: 76). In this connection, Haddon (1912: 192) obtained a stone club head (*gabagaba*) from Murray Island (Mer) known as *nigir gabagaba* that was 'made of *nigir* stone, which is said to be found in Dauan'. Subsequent archaeological survey of the western side of Dauan has confirmed a stone tool quarry (Vanderwal, 1973: 182). Furthermore, the 'pole end of a broken adze or axe rough-out' found on Dauan was made from a 'relatively coarse grained slaty grey to green igneous rock' known to outcrop on the island but not further south (Vanderwal, 1973: 182). That Dauan stone may have been traded to the Papuan Lowlands is indicated by gross

similarities in thin-sections taken from the quarry stone and from adzes collected from the Oriomo Plateau immediately W of the Fly River mouth (Vanderwal, 1973: 182). However, the axe found by Vanderwal is small and looks nothing like the Kiwai 'type' axes (Vanderwal, 1973: fig. 2h). In marked contrast, 4 axes found on the island are broad, thick and teardrop-shaped like the large axes from Kiwai Island (Teske, 1990: 18, photo). Significantly, 1 of these artefacts is only half-made, revealing flaking and pecking and no grinding. The presence of axes in Torres Strait which resemble Kiwai 'type' is corroborated by 6 large, polished and complete axes of classic Kiwai 'type' found on Erub and Mer in the Eastern Strait (see below). All other axes found on Torres Strait islands in recent years are small and bear no resemblance to Kiwai 'type' axes (Booby Island – Richard Robins pers. comm. 1999; Naghir Island – Rowland, 1985: 129; Mabuia – Ian McNiven pers. obs.; Gebar Island – Vanderwal, 1973: 181, fig 2j; Murray Island – QE4695).

From the above discussion, it is clear that none of the known stone quarries from New Guinea produced axes similar to the Kiwai 'type' axe. Furthermore, no evidence of these axes has been recorded to the S on Cape York Peninsula. Kiwai 'type' axes have only been found along the S Papuan Lowlands, particularly the Trans-Fly region opposite Torres Strait and on Kiwai Island to the immediate E. The only other location where Kiwai 'type' axes have been located is on the Top Western Islands of Torres Strait. That Dauan Island may have been an important manufacturing centre for these axes is revealed by the existence on the island of the only known axe quarry in Torres Strait and the only known half-made axes of Kiwai 'type'. The known voyaging of Torres Strait Islanders down the E coast of Cape York Peninsula to quarry stone for axes also points to another possible source for the Kiwai axes. In the next section, we put these hypotheses to the test using preliminary raw material sourcing of the Queensland Museum sample of 22 axes provenanced to Kiwai Island.

#### RAW MATERIAL SOURCING OF KIWAI AXES

One of us (FG), who has undertaken geological research in Torres Strait (von Gnielinski et al., 1998), identified raw materials for the axe sample in the Queensland Museum. In all cases, axes were examined macroscopically and with the aid of a  $\times 10$  hand lens. Selected areas of each axe

TABLE 1. Data for Kiwai axes.

	Axe Provenance Qld Museum No.	Collector and Collection Date	Manufacture PD = poll damage ED = edge damage	Size(max.) (mm) and weight (g)	Raw material type	Raw Material Source
1	Kiwai I. M2	Sir William Macgregor 1892-93	Complete. ED. Flaked, pecked & ground over >99% surface	L = 336 W = 119 Th = 49 Wt = 2309	Very fine to fine-grained, equigranular, microdiorite, minor altering. Finer grained phase within Badu Granite.	Probably from Badu/Mua area
2	Kiwai I. M3	Sir William Macgregor 1892-93	Complete. Flaked, pecked & ground over >95% surface	L = 447 W = 124 Th = 73 Wt = 4629	Volcanic arenite which is very fine-grained with very common crystal fragments and rare lithic fragments such as a rounded clast of fine-grained granodiorite, 2.5-3cm in size, which is mafic-rich.	Unknown
3	Kiwai I. M5	Sir William Macgregor 1892-93	Complete. Flaked, pecked & ground over >95% surface	L = 292 W = 106 Th = 79 Wt = 3127	Very fine to fine-grained, equigranular (mafic-rich) form of microgranite within Badu Granite, which has been chlorite-epidote altered.	Probably from Badu/Mua area
4	Kiwai I. (Lasa Village) M189	Sir William Macgregor 1893-96	Complete. Flaked, pecked? & ground over >99% surface	L = 172 W = 75 Th = 46 Wt = 749	Fine-grained, uneven grain size form of granodiorite within Badu Granite with phenocrysts of feldspar and hornblende up to 2mm. Stone given a pale green colour by chlorite-epidote alteration.	Probably from Badu/Mua area
5	Kiwai I. Mac5521	Sir William Macgregor 1893-96	Complete. Flaked, pecked & ground over >95% surface	L = 283 W = 88 Th = 47 Wt = 1564	Very fine-grained, equigranular, medium to dark greenish grey microgabbro, slightly altered by chlorite-epidote. Very small (0.1-0.3mm) white feldspar, some fine clear quartz, black flecks of biotite (up to 3mm) and dark green chloritic hornblende are readily identified. This could be igneous dyke material or mafic phase within the Badu Granite. Also noted is some euhedral fresh pyrite.	Probably from Badu/Mua area
6	Kiwai I. E1774	Donated Major A. Wynyard Joss 1926	Complete. ED EP Flaked, pecked & ground over >95% surface	L = 465 W = 127 Th = 87 Wt = 6767	Hyaloclastite with arenite (type of volcano-sediment) or pyroclastic volcanic clasts which have locally broken up with fracture zones filled with mudstones and siltstones, enriched with fragments of volcanic clast material.	While could be from Torres Strait, no actual samples are known
7	Kiwai I. E4589	Capt. F.R. Barton 1899-1901	Complete. ED Pecked & ground over >95% surface	L = 379 W = 95 Th = 64 Wt = 3158	Crystal-rich, intermediate to rhyolitic volcanic of the Torres Strait Ignimbrite Group (undifferentiated). Probably from a dyke or lava flow.	Possibly from Ului Islet, southwest of Mua Island
8	Unprov. Probably Kiwai I. E4591	W.M. Lee Bryce 1911-16	Complete. ED Flaked, pecked & ground over >95% surface	L = 276 W = 104 Th = 57 Wt = 2477	Very fine-grained, equigranular form of Badu Granite which has been chlorite altered.	Probably from Badu/Mua area
9	Unprov. Probably Kiwai I. E4593	Donated H. Phillips 1908	Complete. ED Flaked, pecked & ground over >95% surface	L = 347 W = 120 Th = 76 Wt = 3961	Very fine to fine-grained, equigranular (mafic-rich) form of Badu Granite which has been chlorite-epidote altered and exhibits a fine quartz veinlet.	Probably from Badu/Mua area
10	Unprov. Probably Kiwai I. E6129	Donated T.W. Connah Estate 1916	Complete. ED Flaked, pecked & ground over >95% surface	L = 267 W = 92 Th = 62 Wt = 1938	Slightly porphyritic microgranite from Badu Granites. Mafic rich with white phenocrysts of feldspar up to 3mm and very common hornblende phenocrysts around 1mm. Chlorite altered.	Probably from Badu/Mua area
11	Unprov. Probably Kiwai I. E10767	Donated Dr E.O. Marks 1978. Ex Dr C.F. Marks coll acquired before 1920	Complete. ED Pecked & ground over >99% surface	L = 286 W = 114 Th = 66 Wt = 2688	Volcanic arenite, possibly part of Torres Strait Volcanics.	While probably from Torres Strait, no actual comparable sites are known
12	Unprov. Probably Kiwai I. E12787	F.A. Bensted 1966-69. Acquired at Daru I.	Complete. Ground over 100% surface	L = 266 W = 64 Th = 41 Wt = 943	Dark grey, equigranular, fairly even-grained, granodiorite to diorite representing a clear example of fine-grained to medium-grained variety of Badu Granite.	Probably from Badu/Mua area
13	Unprov. Probably Kiwai I. E12788	F.A. Bensted 1966-69. Acquired at Daru I.	Complete. ED Flaked, pecked & ground over >95% surface	L = 159 W = 53 Th = 33 Wt = 345	Very fine-grained, slightly porphyritic (cubes of 1mm pyrite phenocrysts) to aphyritic andesite to basaltic dyke within Badu Granite.	Probably from Dauan Island

TABLE 1 (Cont.)

14	Kiwai I. 99 McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Complete. ED Flaked, pecked & ground over >90% surface	L = 292 W = 101 Th = 51 Wt = 2036	Medium greenish grey, fine-grained, equigranular microdiorite or microgabbro, fresh; unaltered; small white anhedral feldspars (0.5-1.2mm) are abundant next to dark green hornblende or pyroxene minerals; this could be igneous dyke material intruded into the Badu Granite	Probably from Badu/Mua area; maybe Dauan Island.
15	Kiwai I. 96 McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Complete. ED Flaked, pecked & ground over >95% surface	L = 184 W = 84 Th = 58 Wt = 1131	Medium greenish grey, fine-grained, equigranular microdiorite or microgabbro, fresh; unaltered; small white anhedral feldspars (0.3-1.0mm) are abundant next to dark green hornblende or pyroxene minerals; this could be igneous dyke material intruded into the Badu Granite.	Probably from Badu/Mua area; maybe Dauan Island.
16	Kiwai I. 98 McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Complete. Flaked?, pecked & ground over >99% surface	L = 103 W = 65 Th = 39 Wt = 333	Very fine to fine-grained (0.1-0.3mm), equigranular biotite hornblende microgranite or microgranodiorite with small rounded, dark grey dots or xenoliths of microdiorite. Pale brown anhedral crystals of potassium feldspar, white plagioclase feldspar, clear quartz and dark green hornblende have been identified readily. This could be a fine-grained phase of the Badu Granite.	Probably from Badu/Mua area.
17	Kiwai I. 100 McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Half axe only. Flaked?, pecked & ground over >95% surface	L = 263 W = 129 Th = 63 Wt = 3225	Fine-grained, moderately altered, equigranular biotite granite with minor quartz veinlets. Black 0.2-0.6mm biotite flecks are abundant, pale brown 0.2-1mm ?feldspar, 0.2-0.5mm transparent-clear quartz have been well defined. A number of small rounded dark grey microdiorite dots, up to 2.5mm. Very likely to be a fine-grained phase of Badu Granite.	Probably from Badu/Mua area including the islands around Bramble Channel.
18	Kiwai I. 101 McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Complete. Flaked, pecked & ground over >95% surface	L = 163 W = 85 Th = 43 Wt = 1790	Fine-grained, slightly porphyritic microgranite or microgabbro, possibly chlorite altered. Rock matrix is crystalline with small 0.1-0.3mm mafic minerals and small white anhedral feldspar crystals which could be leached pyrite cubes (contain some iron staining) this could be igneous dyke material intruded in Badu Granite.	Probably from Badu/Mua area; maybe Dauan, Gebar or Mabuiag Islands.
19	Kiwai I. 101a McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Complete. Flaked, pecked & ground over >95% surface	L = 158 W = 71 Th = 31 Wt = 513	Fine-grained, equigranular, igneous rock. Minerals were not identified due to high degree of gloss. Probably a microdiorite or microgabbro.	Probably from Badu/Mua area.
20	Kiwai I. 26 McNiven coll	J. Sweeney 1960s. Acquired at Daru I.	Complete. Flaked, pecked & ground over >95% surface	L = 196 W = 66 Th = 33 Wt = 619	Medium grained, equigranular, uneven grained gabbro, with white subhedral (0.5-3mm) feldspar and dark green hornblende or pyroxene. No quartz was seen. It is an intrusive rock.	Gabbros like this one are not yet known in the Torres Strait region. Similar to rare gabbros from northern Coen Inlier in Cape York. One locality of similar rock near Cape Griffith. Alternatively, northern side of PNG cordillera.

were wiped with alcohol to enhance the visual properties of mineral inclusions. Visual comparisons were made with an extensive collection of sectioned samples of Torres Strait rock types.

**AXES FROM KIWAI ISLAND.** Fourteen of the axes are manufactured from fine-grained to very fine-grained intrusive rocks, similar to lithologies known in the Badu Granite in Torres

Strait (Table 1). It represents the most common raw material used to manufacture the axes. While Badu Granite outcrops in various locations across the Western Islands of Torres Strait, the particular forms exhibited by the axes most likely occur either on Mua (Moa) Island or Badu Island.

One and possibly 2 axes are made of rocks identical in lithology with parts of the Torres Strait Volcanic Group. The first axe (E4589) is

TABLE 2. Data for Kiwai 'type' axe recovered from Torres Strait.

	Axe Provenance Qld Museum No.	Collector & Collection Date	Manufacture PD = poll damage ED = edge damage	Size (max.) (mm) and weight (g)	Raw material type	Raw Material Source
1	Darnley I. Torres Strait QE4676	P.G.H. Guillemot 1911-12	Complete. PD. Flaked, pecked & ground over >90% surface	L = 254 W = 122 Th = 55 Wt = 228	Medium dark grey, very fine to fine-grained, equigranular, hornblende-biotite microgranodiorite or microdiorite from a possible dyke within the Badu Granite. Appears chlorite altered and silicified.	Maybe Dauan or Gebar Islands

made from a type of ignimbrite known to outcrop on Ului Islet SW of Badu Island. This inference is consistent in part with the original museum register entry for this artefact, which reads 'stone implement said at Kiwai to be brought from Saibai'. It is quite possible that the axe had been traded up from the Badu region to Saibai where it was passed onto Papuan people. This trade/exchange pathway is well-documented historically (Vanderwal, this volume). The axe could not have originated from Saibai as the island has no rock outcrops. The second axe (E10767) is made from volcanic arenite for which no source is known but may be part of the Torres Strait Volcanic Group.

Two axes are manufactured from andesitic/basaltic rocks known to occur as dykes within Badu Granite (E4593 & E12788). The most likely source of these dykes is Dauan Island in the northern part of Torres Strait.

The extremely large axe (E1774) is made from sedimentary rock comprising arenite or pyroclastic volcanic clasts surrounded by a fill of mudstone and siltstone. While this distinctive, brecciated raw material could come from Torres Strait, no specific outcrops have been recorded. Another axe (M3) is made entirely of volcanic arenite for which no source is known.

The only axe made from a raw material that may have come from beyond Torres Strait is 'McN26'. It is made from a type of gabbro which has yet to be recorded in Torres Strait but which is known to occur along eastern Cape York Peninsula, at least in the Cape Griffith area. Alternatively, gabbros are common along the northern side of the central cordillera of PNG in the Sepik Region and the Papuan Ultramafic Belt south to Mt Lamington (Bain et al., 1975; Davies, 1971; Dow et al., 1972; Page, 1976; Smith & Davies, 1976). The only outcropping intrusive rocks within the Fly River basin are the Ok Tedi diorites, Strickland granites and Mabaduan granites (Page, 1976).

Thus, 18 or 86% of the 21 axes are made from raw materials with known or possible outcrops within Torres Strait. Of the remaining 3 axes, the source(s) of 2 is unknown while the source of the other could be either E Cape York Peninsula or N PNG. No axes are made from raw materials known to occur within the adjacent Fly River basin of New Guinea.

**KIWAI 'TYPE' AXES IN TORRES STRAIT.** Apart from the 4 Dauan axes, the only other islands in Torres Strait where large Kiwai 'type' axes have been found are Erub and Mer in the Eastern Strait. The 6 Erub axes are featured in Cropp (n.d.) (n=1), Teske (n.d.: 61) (n=1), Lauer (1988: 42) (n=3) and the Queensland Museum (QE4676) (n=1). A single Kiwai 'type' axe has been found on Mer (M. Quinnell, pers. obs., 2002). The 3 axes listed by Lauer (held by Dreamtime Cultural Centre, Rockhampton) have maximum lengths of 35cm, 26cm and 23cm (based on photographic scale in Lauer, 1988: 42). The QM axe has a maximum length of 25.4cm (Table 2). Raw material assessment was limited to the QM axe which is of classic Kiwai 'type' (Fig. 2). It is made of micro-granite or microdiorite from Badu Granite outcrops on either Dauan or Gebar Islands (Table 2). This designation is consistent with two other axes of classic Kiwai 'type' on Erub that are said to be made of 'granite' (Teske, n.d.: 60).

## DISCUSSION

The weight of ethnographic and archaeological evidence supports the view that most of the Kiwai axes (including the Kiwai 'type' axes) were made from stone quarried in Torres Strait. None of the known raw materials from New Guinea axe quarries match the Kiwai axe raw materials, particularly the granites. Furthermore, none of the New Guinea quarries are known to have produced the large Kiwai 'type' axes. These new data are inconsistent with earlier views that the axes were manufactured from stone

transported down from the Highlands of central New Guinea (Beaver, 1920; Haddon, 1901). Rather, they support Landtman (1927), Haddon (1935) and Swadling (1983) who suggested the axes originated from Torres Strait. Surprisingly, previous ethnographic and archaeological research that pointed to Dauan as the major source of axe stone in Torres Strait was not borne out by the geological sourcing data. Only one axe from Kiwai Island and the Kiwai 'type' axe examined from Darnley Island may have been manufactured from Dauan stone. The vast majority of Kiwai axes were made from granite, indicating that other axe quarries focused on the exploitation of granite occur in Torres Strait. Preliminary sourcing data indicate that these quarries are most likely located in the vicinity of Mua and Badu Islands in the central western part of Torres Strait. These new insights into the existence of axe quarries in Torres Strait build on recent identification of a range of stone club head (*gabagaba*) sources (McNiven, 1998; Hitchcock, this volume). Available sourcing data suggest a wide range of stone quarries in Torres Strait for axes (e.g., granite, ignimbrite, andesite/basalt and volcanic arenite) and *gabagaba* (e.g., ignimbrite, andesite, adamellite, volcanilithic sandstone and tuff).

**CANOE/AXE HYPOTHESIS AND THE SETTLEMENT OF TORRES STRAIT.** The Dauan evidence draws attention to the surprising fact that despite Torres Strait being the primary source for Kiwai axes, very few axes of Kiwai 'type' have been recorded in Torres Strait. Most axes of Kiwai 'type' have been recorded in coastal areas of the Trans-Fly region of S PNG. This situation raises 2 intriguing hypotheses. First, Torres Strait Islanders made the axes primarily for export to the Papuan lowlands. If the axes were used for heavy woodworking, this lack of use is explicable by the simple fact that in contrast to southern Papua, large trees are not a feature of Torres Strait. This is a major reason why Torres Strait Islanders imported dugout canoe-hulls from southern Papua (Haddon, 1935: 305-310). In short, Torres Strait Islanders had little use for large, woodworking axes. (Indeed, most stone axes found to date in Torres Strait are small and possibly associated with canoe maintenance and carving small items of material culture such as masks.) It is likely that this export in axes developed in the late Holocene as the major occupation of Torres Strait occurred within the last 3000-2500 years (Barham, 2000). The relationship between Islanders and Papuans

with regards to canoe manufacture may be classed as *symbiotic*. Papuans required Islander axes to manufacture canoes for Islanders (and themselves), while Islanders required Papuan canoes to support their specialised maritime lifeway. Landtman's (1933: 45) information on Torres Strait Islanders diving for tool stone from canoes suggests in some situations that canoes were essential to the manufacture of the axes.

The centrality of large dugout canoes to the Torres Strait Islander lifeway has been discussed at length by Barham (2000; see also Beckett, 1972: 311-12; Golson, 1972). In summary, he noted:

Without the canoes, neither the regular exploitation of offshore resources, particularly male-dominated dugong and turtle-hunting, nor social exchange of both specialist goods, horticultural produce and marital partners, would have been possible. Moreover, the canoe provided insurance against drought and associated crop failures, which represented the greatest risks to semi-permanent sedentary occupation on the small islands, by offering a reliable means of temporary evacuation in the event of crisis. Seen in this perspective, the need for sound reciprocal arrangements with both communities on adjacent islands and on mainland coastlines, through marital exchange and alliances, was paramount. Above all, the outrigger canoe, and associated systems of canoe procurement, technical maintenance, and regular hull replacement, appear to represent essential pre-requisites for the functioning of the Torres Strait Island communities as observed at European contact (Barham, 2000: 240-241).

In this context, Torres Strait Islanders had a vested interest in maintaining the supply of stone axes to Papuans who had access to large trees necessary to carve out canoe hulls.

The economic and social significance of canoes in Torres Strait is also reflected in the complex arrangements associated with their procurement and trade. Haddon (1908: 186-187) observed that orders would be put out by particular Islanders for a canoe and eventually the message, along with an armlet valuable (*wauri*) made from cone shell as partial payment, would get passed on the Papuan mainland and onto a canoe-making village in the Fly River district (Vanderwal, this volume). Various middlemen would also have to be paid with 'presents' both with the order and as the canoe eventually made its voyage back to the purchaser. In the latter case, the list of 'presents' added to the canoe is elaborate and could include cassowary feathers, bird-of-paradise plumes, dog teeth necklaces, boar tusks, woven skirts, mats, and bows and arrows. Landtman (1927: 214) noted that:

On delivery of the canoe he [canoe maker] received the main portion of the payment, and on every subsequent visit to the seller's village, or on other suitable occasions,

the purchaser added further contributions as long as the canoe remained good for use ... When at last the canoe broke up, the owner sent the seller an armshell or a string of dog's teeth (which highly valued ornaments seem to have been conventionally regarded as the last instalment in paying for a canoe), and, to emphasise the significance of this gift, he attached a small piece of the broken craft to it.

Is it possible that the extra-large Kiwai 'type' axes with their possible ceremonial function developed as a result of the central role of canoes in Islander-Papuan trade and ceremonial exchanges? While no data are available to test this hypothesis, it is likely that the extra large axes would have had extra special meaning among peoples of the Trans-Fly who inhabited a world essentially devoid of stone. As the complex, canoe-based maritime lifestyle of Torres Strait Islanders is thought to be less than 3000 years old, the extra large Kiwai axes should also date to the late Holocene. Whether or not the manufacture of these large axes was for a long or short duration is impossible to know until absolute dates are obtained. However, the key point is that the production of the axes was associated with an efflorescence of a Papuan-Torres Strait exchange system at sometime in the past. It is unknown if this efflorescence indicates groups 'infinitely more numerous than that of to-day, must have lived on the banks of the great river [Fly River]' as speculated by Mackay (1909: 174) nearly a century ago. It is conceivable that the axes were made for one particular exchange system and then their function changed as memory of their production faded and the axes took on a spiritual role similar to that seen in the 19th Century. Indeed, it is quite possible that the axes were made well before the 19th Century, given that they are concentrated on Kiwai Island at the Fly River mouth. It was only during the 19th Century that Kiwai-speaking peoples expanded out from the mouth of the Fly River W along the coast as the W threat of Marind raiders was removed by colonial authorities (Barham, 2000: 235). Crosby (1973: 165) also speculated that the large Kiwai axes had some antiquity.

The significance of Torres Strait as a source of stone axes to manufacture canoes in the Trans-Fly region raises the important question as to the origins of this technological association. We suggest that as the Trans-Fly region is essentially a stoneless environment, the history of human exploitation of marine subsistence resources along this coast not only required a canoe technology, but also required access to the nearest potential tool stone sources in Torres Strait. This association most likely pre-dates sustained human settlement

of Torres Strait given that it is likely that the first Papuan colonisers of Torres Strait came from the Trans-Fly region (Barham, 2000). If this were the case, it is worthwhile hypothesising that the first, intermittent use of Torres Strait islands by lowland Papuans may not have been only for key marine resources such as dugong and turtle as suggested by Barham (2000: 298, 300), but also for stone to manufacture tools. Thus, the earliest archaeological evidence for use of Torres Strait islands by these late-Holocene Melanesian colonists may be quarries and associated short-term campsites. These early quarries would have been associated with the exploitation of a wide range of suitable solid igneous rocks such as granite, andesite and other volcanic rocks for edge-ground tools and (vein) quartz for flaked tools. Key locations for such sites are likely to be the northern rocky islands of Dauan and Daru. However, this hypothesis does not deny early Holocene use of some of the large islands of the central W and SW sections of the region (Badu, Mua and Murulag) by Aboriginal peoples of Cape York during the marine transgression. Indeed, these peoples may have represented descendants of 'mainland' peoples whose territory took in these islands before flooding of the Torresian Plain some 8000 years ago (Barham, 2000; Golson, 1972; Haddon, 1935; Moore, 1979). However, the cultural system which produced the Kiwai axes appears to be much more recent and associated with the development of a pan-Strait maritime cultural system.

**PREHISTORIC CONNECTIONS BETWEEN AUSTRALIA AND NEW GUINEA.** This study has identified a Kiwai 'type' axe made from gabbro that may have been obtained from E Cape York Peninsula. This axe provides the first tentative evidence for prehistoric movement of material culture from mainland Australia to New Guinea. This axe and historical evidence for movement of Cape York Peninsula stone into Torres Strait and possibly across the Papuan coast (McNiven, 1998) runs counter to simplistic diffusionist arguments for the movement of Papuan material culture down the Queensland E coast (McCarthy, 1940). These arguments have their roots in colonial ideology that represented Aboriginal Australians simply as receivers of external, complex cultural traits (McNiven & Russell, 1997; Russell & McNiven, 1998). Cultural interaction between the mainlands of New Guinea and Australia would have been 2-way and part of a broad *Coral Sea Cultural Interaction Sphere* which may have taken in

coastal regions from the Papuan Gulf down to the central Queensland coast (Barham, 2000; Barker 1996: 38; Lilley, 2000; Rowland, 1987). Care needs to be taken when discussing the direction of cultural influences within this sphere that recourse is made to objective data and not assumptions of a natural, southward flow from so-called advanced (i.e., Papuan) to simple (i.e., Aboriginal) cultures. For example, Haddon (1935: 411) thought that 'cultural movements from New Guinea to Australia are much more probable than in the opposite direction'. Ideas and material culture generally move between groups through 2-way trade and reciprocal exchanges. Thus to understand Papuan influences along the Queensland coast requires understanding of the development of large- and small-scale cultural interactions and concomitant movements of Australian material culture northwards into Torres Strait and Papua. As it is well documented historically that items of Papuan material culture (bows and arrows, drums) moved into Aboriginal societies of Cape York Peninsula (Byerley, 1867; Hamlyn-Harris, 1915; McCarthy, 1940; McConnel, 1953; Thorpe, 1924) and Aboriginal items (spears, spear throwers, red ochre, dugong harpoons) moved into Torres Strait (Haddon, 1904: 295, 1935: 403; Moore, 1979: 224, 301), it is not altogether surprising that archaeological evidence has been found for the possible movement of Australian mainland items to the Papuan coast.

As Barham (2000: 225) rightly pointed out, late Holocene contacts between New Guinea and Australia should be seen as a 're-activation of cultural interaction' that had its roots in the Pleistocene when the 2 regions were joined by a land bridge. We argue that after the sundering of what was the Torresian Plain, such re-connections required the emplacement of a conduit of resident Islander people across Torres Strait to facilitate the movement of people, ideas and material culture across the region. These cultural movements also would have been associated with movements of plants and animals analogous to broader-scale movements seen in the Pacific (Kirch, 2000). For example, historical records attest to trade in dingoes (*Canis lupis dingo*) from Cape York to Murray Island (King, 1837) while the transport of cuscus (*Phalanger* sp.) has been recorded from PNG across to the Eastern Islands of Torres Strait (MacGillivray, 1852, II: 48-49) and from PNG to Mabuiag in the Western Strait (McNiven & Hitchcock, this volume).

**ERUB AXES AND CONTACT TRADE.** Three of the 6 Kiwai 'type' axes found on Erub are made from granite/micro-granite/micro-diorite and not the distinctive basalts (lava and tuff) on Erub or any other islands in the Eastern Strait (Willmott, 1972). Thus, apart from Dauan Island where many Kiwai 'type' axes may have been manufactured, the only islands in Torres Strait known to have imported these large axes are Mer and Erub in particular. It is difficult to know how these axes arrived on Erub and Mer. However, it seems unlikely that the items were obtained from axe producers in the Western Strait via the Central Islands given that anthropological and archaeological research over the last 150 years has failed to recover evidence of Kiwai 'type' axes in the Central Strait. The most parsimonious explanation for Kiwai 'type' axes in the Eastern Strait is importation from Kiwai peoples of the PNG coast. Thus, this hypothesis posits axe manufacture in the Western Strait followed by exchange across to PNG, followed sometime later by movement into the Eastern Strait.

Despite a lack of dates associated with the axes, we hypothesise that their focus on Erub may relate to the island's special location as an important stopover for European mariners crossing the Strait from east to west in the early and mid-19th Century (McNiven, 2001). While stopping at Erub for freshwater, the people of Erub encouraged trade in order to obtain European items, coveting 'iron tools', especially axes. In return, the Europeans not only obtained water and food (e.g., coconuts), but plates of 'tortoise-shell' (presumably to sell for profit in Europe) and a wide range of material culture — bows and arrows, clubs, spears, turtle-shell masks and various other 'curiosities' (some of which may have been sold for profit in Europe, but certain items may have been kept as 'curios'). McNiven (2001: 191) posited that 'Islanders would have needed to intensify production of certain trade goods during the early nineteenth century in order to maintain trade relationships with Europeans' (see also Moore, 1988). Furthermore, certain Islanders may have increased their stocks of artefacts to trade with Europeans by increasing importation of artefacts from other Islander communities or Papuans. For example, the people of Erub may have increased importation of Papuan arrows given King's (1837: 40) observation that arrows were their 'principal article of trade' with Europeans and stocks were known to run out (Jukes, 1847, I: 179). Trade/exchange relationships between the Eastern

Islanders and coastal (Kiwai) Papuans are well documented historically (Lawrence, 1989, 1994) and are consistent with linguistic links between both areas (Wurm, 1975). Although historical records make no mention of contact trade involving stone axes, we suggest that Erub Islanders enhanced their strategic position as traders in 'curiosities' with European mariners by importing large stone axes from their nearest viable source — Kiwai peoples of the Fly River mouth. Such a view accords well with Moore's (1998: 278; see also Moore, 2000: 299) hypothesis that the 'colonial intrusion into the Strait would have altered the dynamics of power between the Strait's inhabitants and other neighbouring language-culture groups'. For the people of Erub, their privileged access to European metal artefacts would have placed them in a prime position to obtain a wide range of artefacts from Papuans who also coveted metal but had little direct access to Europeans.

#### CONCLUSION

Stone artefact sourcing data reveals that the human history of Torres Strait is intimately connected with the human history of the Papuan Lowlands. Indeed, this relationship may be extended from PNG to Cape York Peninsula (Barham, 2000; Rowland, 1987). This conclusion is indicated by exchanges of axes and *gabagaba* between Torres Strait and PNG and possible axe movements (and/or raw material movements) between continental Australia and PNG. While historical evidence indicates analogous broad-scale cultural interactions and material culture movements, their long-term development remains elusive. Using various hypotheses advanced in this paper, our next stage of research aims to unravel the chronology of axe and *gabagaba* manufacture and exchange throughout the area encompassed by Barham's 'Torres Strait Cultural Complex': the Trans-Fly, Torres Strait and northern Cape York Peninsula. This work will involve detailed excavation and radiometric dating of manufacturing sites (i.e., quarries) and places of artefact use and discard (e.g., old village sites) in conjunction with finer-grained chemical and mineralogical characterisation of raw materials and sourcing of artefacts.

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