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MAORI GREENSTONE PENDANTS IN THE AUSTRALIAN MUSEUM, SYDNEY

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Plates 22–24. Figs 1–33.

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SUMMARY

This paper examines a collection of 93 Maori greenstone pendants in the Australian Museum. Only straight *kuru* are abundant enough for quantitative analysis, but this is first preceded by an examination of the spatial-chronological distribution of the population of this type, changes in it numerically through time, and the characteristics of a random sample. The randomness of the Australian Museum sample of 58 pendants is questioned. A random sample of 70 straight *kuru* in the Auckland Institute and Museum is employed for comparative purposes, and an investigation made of the nature of and interrelationships between various pendant parameters, for the two samples. Other pendant types considered, in addition to straight *kuru* and anomalous forms, are the *kuru kapeu* (5 examples), *hei matau* (1), *koropepe* (4), *pekapeka* (4), *poria* (2), *rei puta* (1), and Triangular Pendant (6). Since none of these types is abundantly represented quantitative studies are impossible, and the spatial-chronological attributes of each are merely examined, and the Australian Museum specimens compared and contrasted with those in other museums.

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* The research reported in this paper was initiated between December 1968 and January 1969 while the author was employed as a Vacation Assistant in the Anthropology Department at the Museum. The New Zealand fieldwork and museum visits referred to in the text relate to the author's Ph.D. research and were not undertaken specifically for the study reported here.

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CONTENTS

INTRODUCTION

This paper is the third in a series aimed at placing on record details of interesting sections of the Maori ethnographic collection in the Australian Museum, Sydney. (The other papers are Orchiston 1970, 1971.) It deals with 58 straight greenstone pendants of *kuru mahora* and *kuru papa* forms, and 35 other pendants of *kuru kapeu* (*tautau*), *hei matau*, *koropepe*, *pekapeka*, *poria*, *rei puta*, and anomalous forms, and of an unnamed variety here termed "triangular pendant". Most of these forms are amongst those named and described by Best (1924: 537–542; 1952: 227–232.)

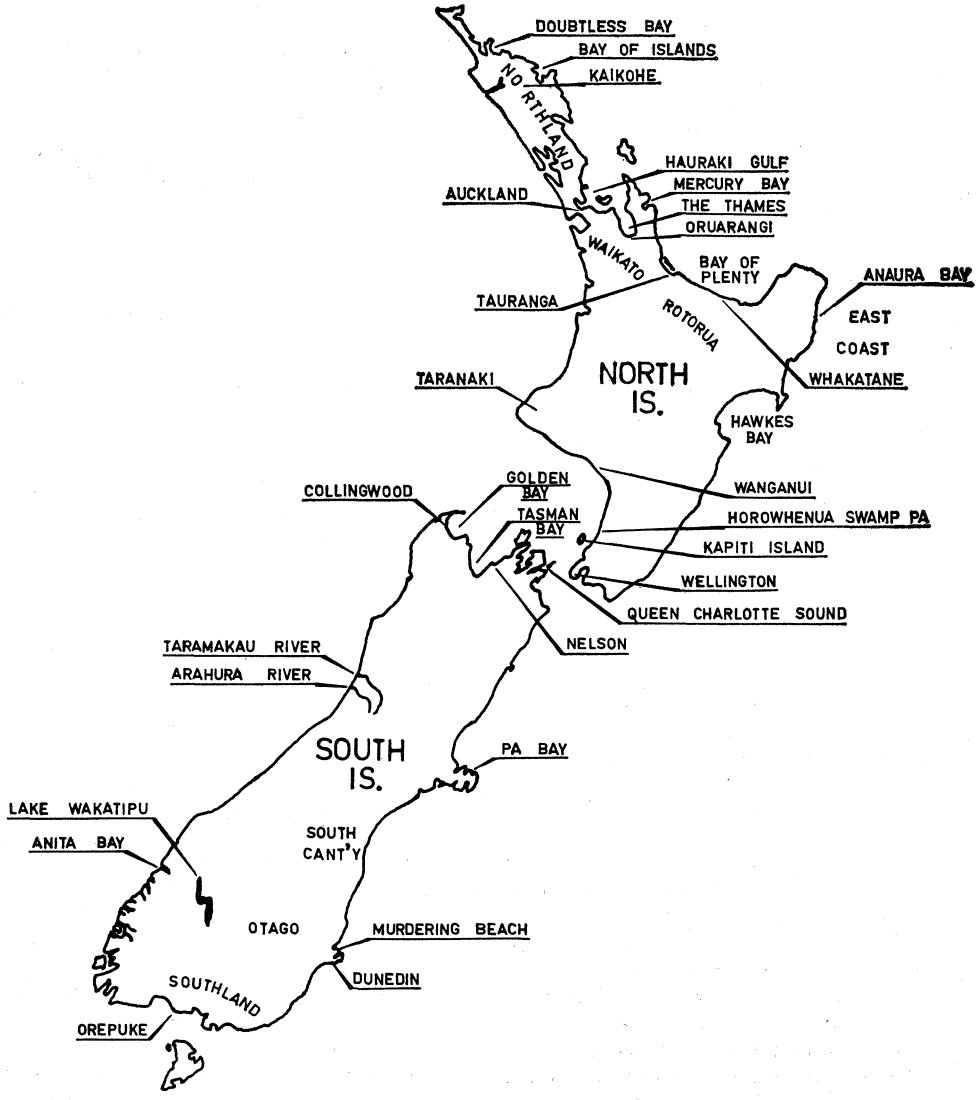


Fig. 1: Localities mentioned in the text

Best also discusses the ear pendant made from the tooth of the Mako shark, sometimes rendered in greenstone, no examples of which, however, are to be found in the Australian Museum collections, and the *tiki* and perforated chisel pendants, which are represented there but will be the subject of later studies. To this list of greenstone forms Golson (1959: 52–53) would add the *marakihau* (see Archey 1927: 72), but since this form is represented by only a very few specimens (Skinner 1933: 8), this seems a rash move. Archey (1933: 212; 1936: 51–52) and Skinner (1933: 7) claim that it is genetically related to the *pekapeka*. There are no examples in the Australian Museum.

Each of the 93 pendants investigated in this paper is described individually (either metrically or diagramatically), and where possible given a site, locality, or chronological attribution. In the case of the straight *kuru* (i.e., *kuru mahora* and *kuru papa*, combined) their abundance allows a quantitative analysis of various metrical and formal attributes. This is first preceded by an examination of the spatial-chronological distribution of the straight *kuru* population, and the characteristics of a random sample.

Most of the pendants considered in this paper, like many of the other Maori artifacts in the Australian Museum, are derived from two major sources:

(1) James Dall, formerly of Collingwood, who between the years 1886 and 1892 sold a total of 279 artifacts to the Museum. Many of these come from the Nelson Province and are localized.

(2) Sir William Dixson, who donated some 221 New Zealand artifacts to the Museum between the years 1912 and 1951. Dixson accumulated this magnificent collection, through various local and overseas sources, during the last decade of the nineteenth century and the first half of the present.

Both collections contain pendants that were manufactured with European implements ("E" specimens). Some of these were produced by the Maoris as genuine artifacts, using these new techniques of manufacture. Such pendants, although products of technological adaptation, cannot be distinguished from others that are fakes, made by Europeans. In this study all pendants produced with European implements are considered collectively and distinguished from those with a genuine appearance. These latter "M" pendants are characterized by an absence of grinding wheel striations, and an asymmetrical suspension perforation with a broad irregular arris (figure 2). Where there is some, yet not conclusive, evidence that European tools were employed pendants have been classed as "?E". This categorization system is not entirely satisfactory in that some pendants listed as "M" must in fact belong to the "E" category (as in the case of many of the "Rarer Pendants" discussed later in this paper) although they possess no obvious evidence of such a manufacture. Moreover, Skinner (1969) has outlined how realistic-looking faked pendants, through handling by a generation or two of Maoris (thus imparting a characteristic silkiness or soapiness to the surface), can actually be transformed from fakes into "genuine" artifacts. Fortunately such pendants are rare.

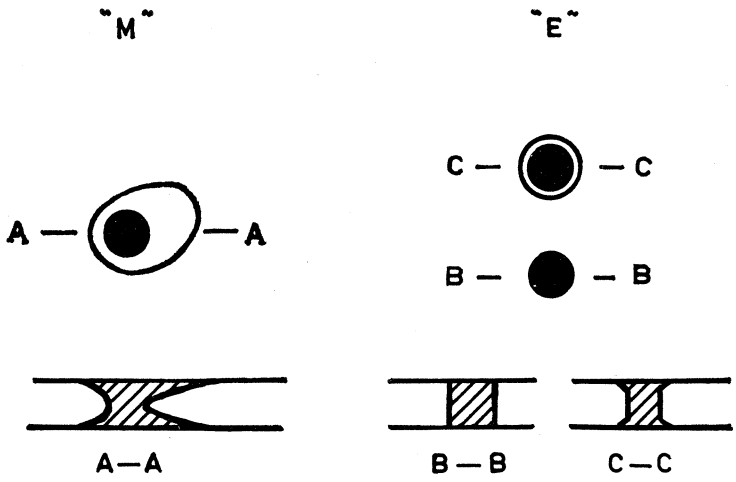


Fig. 2: Characteristics of "M" and "E" perforations

In this paper "greenstone" is held to include both semi-nephrite/nephrite (the essential constituents of which are either tremolite $H_2Ca_2Mg_5(SiO_3)_8$ or actinolite H_2Ca_2 $(MgFe)_5$ $(SiO_3)_8$) and bowenite (composed mainly of a mineral of the serpentine group, $H_2Mg_3(SiO_3)_4$). In hardness bowenite is little inferior to nephrite and semi-nephrite (Turner 1935: 203). Nephrite, because of its highly felted crystalline microstructure, is much tougher and less fissile than semi-nephrite, while bowenite lies at the opposite end of the fissility-toughness continuum (Turner 1935: 204). In the hand specimen it is sometimes impossible to distinguish semi-nephrite from bowenite.

Little is known of "traditional" Maori techniques employed in greenstone working, although there are Heaphy's observations made at the Taramakau River in 1846:

> "We found here six men and about fifteen women, with a large proportion of children. The inmates of each house were busily engaged in making *meri pounamu* and ear pendants of that material for 'trade' or presents to the northward. They saw the slab with a piece of mica slate, wet, and afterwards polish it with a fine sandy limestone which they obtain in the vicinity. The hole is drilled with a stick pointed with a piece of Pahutani flint. The process does not appear as tedious as has been supposed; a month sufficing, apparently, for the completion of a *meri* out of the rough but approximately shapen slab." (Heaphy 1846: 237. Cf. Best 1912: 49–86; Chapman 1891: 497–501, 511–513, 515–516, 519, 525–526; Heaphy 1862).

Nephrite and semi-nephrite were obtained by the Maoris from both the Taramakau-Arahura and Lake Wakatipu areas, while bowenite, the *tangiwai* of the Maori (see Coutts 1971), came from Anita Bay, Milford Sound (see figure 1 and Beck 1970).

Throughout this paper a tripartite chronological system is employed. The term "prehistoric" relates strictly to the period prior to 1769 (at which date Cook rediscovered New Zealand) but, since Maori material culture did not undergo immediate Pakeha-induced modification, documentation from the 1770's (Cook, Surville, and Du Fresne voyages) is often used in prehistoric reconstructions. In this way the end-point of the prehistoric period can be accurately delineated. The "protohistoric period" which followed is characterized by sporadic documentation in some areas and virtually none in others, and saw the breakdown of Maori society and culture due to the disruptive influences of European settlement. By 1850, with the commencement of the "historic period", there was European settlement throughout much of New Zealand, and in most areas traditional Maori society and culture had vanished. This period brought with it a wealth of historical documentation.

STRAIGHT *KURU*

More than 60 per cent of Australian Museum greenstone pendants are straight *kuru:* thin, highly polished, near parallel-sided, cigar-shaped objects, between 40 and 170 mm in length, and with circular to oval or double convex cross-sections. Best (1952: 227) identifies two straight *kuru* types (*kuru mahora* and *kuru papa* respectively described as "straight" and "flattened") but does not elaborate. Perhaps L'Horme's (1769–70: 323) observations on the Doubtless Bay Maoris in 1769 are relevant:

> ". . . all have holes in the lobe of the ears—men and women—and from these holes hang different ornaments. The most common is a kind of stone of a green colour . . . These stones are sometimes shaped like a cylinder pointed at the bottom, sometimes they are flat like playing counters."

A cursory examination failed to reveal these two forms amongst Australian Museum pendants, and, instead, it was found to be easier and more expedient to subtype straight *kuru* according to cross-sectional morphology. The two subtypes adopted for this study are termed A and B, the latter with B1 and B2 components. A, B1, and B2 refer to rectangular, oval, and double convex cross-sections respectively, and theoretically encompass, in each case, the full range of width/thickness ratios from 1·0 to infinity (see figure 3).

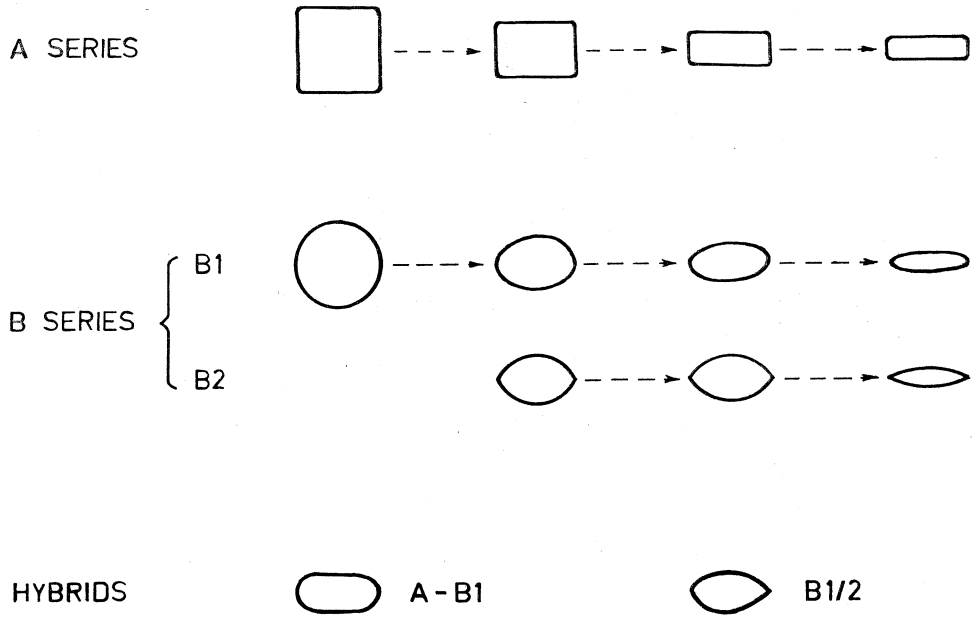


Fig. 3: Cross-sectional continua categories for straight *Kuru*

(1) Descriptions of the Pendants

Table 1 lists details of all straight *kuru* in the Australian Museum. Entries include measurements of total pendant length; distance from the proximal end of the pendant to the centre of the suspension perforation; internal diameter of the suspension perforation; pendant width, measured perpendicular to the axis of the suspension perforation, at both one-third (0·33) and two-thirds (0·66) of the distance from proximal to distal ends, at the location of the greatest width, and at the perforation; and some corresponding thickness measurements. Entries under "Distal End" relate to shape: R = rectangular, C = circular, E = elliptical, P = parabolic, and H = hyperbolic. As in later tables methods of acquisition include presentation (D), exchange (E), and purchase (P). All measurements given in the tables appearing in this paper are in millimetres to one decimal place.

Pendants E 54454 to E 54518 inclusive are from the Dixson Collection, whilst H 332 and H 333 were amongst "Cook Relics" purchased from Calvert, a London collector, and were reputedly derived from the Museum of Sir Joseph Banks. Elsewhere the author has shown (Orchiston 1970) that Calvert's claims should sometimes be regarded with suspicion.

TABLE 1. AUSTRALIAN MUSEUM STRAIGHT *KURU*

Register number	Cross section	Length (l)		Perf. dia.	Width (w)				Thickness (t)			w/t			Distal end	Manufacture	Acquisition		Remarks
		Total	To perf.		At perf.	0·33	0·66	Max.	0·33	0·66	At $w_{(max)}$	0·33	0·66	At $w_{(max)}$			Method	Date	
E 487	B1	69·2	6·4	2·6	8·5	9·3	9·3	9·4	7·3	7·8	8·1	1·3	1·2	1·2	P	E	P	1887	Dall Collection.
E 488	B1	76·5	7·3	2·2	10·3	13·5	14·1	14·1	5·7	5·9	6·0	2·4	2·4	2·4	E	?E	P	1887	Dall Collection.
E 1896	A-B1	48·5	9·0	1·7	16·8	17·4	17·3	17·4	6·4	6·4	6·4	2·7	2·7	2·7	P	M	P	1888	Dall Collection. Riwaka.
E 1897	B1	59·8	5·9	2·9	8·3	10·3	11·3	11·4	7·5	8·0	7·8	1·4	1·4	1·5	R	E	P	1888	Dall Collection. "Nelson."
E 2374	B1/2	87·3	6·1	3·5	9·6	10·4	10·3	10·4	5·8	5·8	5·8	1·8	1·8	1·8	H	M	P	1889	Great Barrier Island.
E 2375	B1	⩾78·4	3·2	2·3	7·7	9·2	9·7	10·0	8·6	8·7	9·0	1·1	1·1	1·1	H	M	P	1889	Great Barrier Island. Broken at former perforation.
E 2400	B1	121·0	8·6	2·6	13·4	15·8	17·5	17·5	14·3	15·9	16·4	1·1	1·1	1·1	P	M	P	1889	
E 2669	B1	62·3	8·4	3·0	12·9	15·4	16·9	17·1	12·7	13·5	13·6	1·2	1·3	1·3	P	M	P	1890	Dall Collection. From a Maori killed at Gate Pa (hence predates 1864).
E 2670	B1	51·8	6·5	4·6	14·1	16·5	16·6	16·9	3·9	4·2	4·4	4·2	4·0	3·8	C	M	P	1890	Dall Collection. Pakawau.
E 3553	B1	157·5	4·0	3·2	10·0	14·2	14·3	14·9	12·9	13·0	13·6	1·1	1·1	1·1	E	E	P	1892	
E 9241	B1	115·0	5·6	2·6	7·8	10·0	10·6	10·8	9·2	9·7	9·6	1·1	1·1	1·1	P	M	P	1900	
E 9242	B1	150·0	5·0	2·9	10·2	11·9	11·1	12·1	8·3	8·2	8·9	1·4	1·4	1·4	P	M	P	1900	
E 35342	B1	68·9	7·4	3·4	15·7	19·8	22·3	22·3	18·0	19·0	19·0	1·1	1·2	1·2	C	?E	P	1932	
E 54454	B2	86·3	6·6	3·0	11·6	12·8	13·9	14·0	2·5	2·6	2·8	5·1	5·4	5·0	E	E	D	1951	
E 54472	B1	168·0	13·7	5·9	27·3	32·8	35·4	36·2	12·9	12·9	12·3	2·5	2·7	2·9	C	M	D	1951	
E 54473	B1	149·5	8·6	3·6	16·8	19·0	20·5	21·5	6·9	7·2	7·9	2·8	2·8	2·7	C	?E	D	1951	
E 54474	B1	139·0	10·0	3·5	13·0	16·0	17·5	18·1	9·4	10·8	10·9	1·7	1·6	1·7	E	E	D	1951	
E 54475	B1	115·5	6·1	4·2	10·5	15·7	16·0	16·0	8·2	9·5	9·7	1·9	1·7	1·7	P	E	D	1951	
E 54476	B1	124·0	11·4	5·6	17·1	20·1	21·3	21·5	6·0	6·1	6·4	3·4	3·5	3·4	E	M	D	1951	
E 54477	B1	122·0	11·6	2·6	11·0	15·1	17·7	17·8	6·6	6·9	6·9	2·3	2·6	2·6	P	M	D	1951	
E 54478	B1	114·0	7·8	4·0	16·4	19·8	18·7	20·0	10·0	9·8	9·8	2·0	1·9	2·0	P	M	D	1951	
E 54479	B1	105·1	8·7	5·2	14·0	19·5	19·6	20·2	8·7	8·8	9·0	2·2	2·2	2·2	P	M	D	1951	
E 54480	B1	86·9	6·8	2·9	13·2	17·1	19·2	20·0	6·6	6·9	6·7	2·6	2·8	3·0	C	M	D	1951	
E 54481	B1	111·6	10·1	3·7	10·8	13·8	14·3	14·4	6·7	6·5	6·8	2·1	2·2	2·1	P	M	D	1951	
E 54482	B2	103·0	7·0	3·1	13·9	21·0	20·9	21·0	8·3	8·7	8·7	2·5	2·4	2·4	E	M	D	1951	
E 54483	B1	86·4	6·1	4·0	13·4	20·4	21·5	21·5	6·4	6·7	6·7	3·2	3·2	3·2	P	M	D	1951	
E 54484	B2	87·2	10·9	2·6	12·9	15·8	15·7	15·8	8·9	8·1	8·7	1·8	1·9	1·8	H	M	D	1951	
E 54485	B1	81·6	8·7	3·2	15·6	18·9	19·1	19·1	10·5	12·0	12·0	1·8	1·6	1·6	C	M	D	1951	

TABLE 1. AUSTRALIAN MUSEUM STRAIGHT *KURU*—continued

Register number	Cross section	Length (l)		Perf. dia.	Width (w)				Thickness (t)			w/t			Distal end	Manufacture	Acquisition		Remarks
		Total	To perf.		At perf.	0·33	0·66	Max.	0·33	0·66	At $w_{(max)}$	0·33	0·66	At $w_{(max)}$			Method	Date	
E 54486	B1	94·5	7·8	3·1	13·5	14·8	14·6	14·9	9·7	9·5	9·4	1·5	1·5	1·6	H	M	D	1951	
E 54487	B1	93·6	10·0	2·9	11·0	13·7	15·3	15·4	6·3	6·7	6·7	2·2	2·3	2·3	P	M	D	1951	
E 54488	B1	72·6	6·0	3·2	12·5	14·9	16·8	16·9	8·1	8·3	8·6	1·8	2·0	2·0	E	M	D	1951	
E 54489	B2	95·5	6·8	3·0	13·9	17·8	18·8	18·8	5·9	5·2	5·2	3·0	3·6	3·6	E	E	D	1951	
E 54490	B1	79·6	6·9	3·1	12·1	13·5	12·4	13·6	8·1	7·4	8·2	1·7	1·7	1·7	E	M	D	1951	
E 54491	B1	78·2	7·1	2·9	13·7	17·1	16·4	17·1	7·2	6·7	7·2	2·4	2·4	2·4	P	M	D	1951	
E 54492	B2	81·1	5·8	2·6	11·4	14·5	15·6	15·7	6·0	6·4	6·1	2·4	2·4	2·6	P	M	D	1951	
E 54493	B2	61·8	4·7	2·2	19·8	21·6	22·4	22·4	7·1	7·2	6·8	3·0	3·1	3·3	C	M	D	1951	
E 54494	B1	78·4	7·8	3·0	10·9	14·6	15·3	15·5	8·4	8·9	8·9	1·7	1·7	1·7	E	M	D	1951	
E 54495	B1	78·8	6·5	2·4	8·8	12·6	13·7	13·9	5·1	5·4	5·5	2·5	2·5	2·5	E	M	D	1951	
E 54496	B2	66·5	7·0	3·0	16·2	18·4	19·6	19·6	6·6	7·4	7·4	2·8	2·7	2·7	C	M	D	1951	
E 54498	B1	68·2	11·3	3·9	14·0	14·8	15·0	15·0	7·4	7·8	7·8	2·0	1·9	1·9	E	M	D	1951	
E 54499	A-B1	54·3	6·7	2·0	10·5	12·4	13·4	13·4	3·2	3·5	3·5	3·9	3·8	3·8	E	M	D	1951	
E 54500	B1	43·7	5·4	3·0	13·0	16·9	17·0	17·7	6·4	6·4	6·4	2·6	2·7	2·8	P	M	D	1951	
E 54501	B1	54·1	7·5	3·5	11·8	13·9	14·8	14·9	5·7	6·1	6·2	2·4	2·4	2·4	E	?E	D	1951	
E 54505	B1	78·8	6·6	3·2	9·4	11·1	11·1	11·5	5·0	5·0	4·8	2·2	2·2	2·4	H	E	D	1951	
E 54506	B1	76·2	7·0	2·1	9·8	11·0	12·7	12·7	6·6	6·7	6·7	1·7	1·9	1·9	P	M	D	1951	
E 54507	B1	89·1	4·0	2·8	8·1	10·0	10·3	10·3	6·4	6·0	6·0	1·6	1·7	1·7	E	E	D	1951	
E 54508	B1	78·4	7·2	1·7	8·6	10·6	11·9	12·3	6·7	7·7	7·5	1·6	1·5	1·6	C	?E	D	1951	
E 54509	B1	⩾117·0	..	~2·2	7·9	8·9	8·0	8·9	5·8	4·9	5·8	1·5	1·6	1·5	P	M	D	1951	Broken at the perforation.
E 54510	B1	120·5	6·2	3·6	11·0	15·2	15·8	15·8	11·4	13·0	13·0	1·3	1·2	1·2	E	M	D	1951	
E 54512	B1	72·2	7·5	3·9	10·1	13·2	13·5	14·0	10·9	11·6	12·0	1·2	1·2	1·2	P	M	D	1951	
E 54513	B1	63·6	4·1	2·6	10·6	13·2	14·0	14·4	10·2	11·7	11·8	1·3	1·2	1·2	P	M	D	1951	
E 54514	B1	57·4	5·9	2·2	7·4	8·6	9·6	9·9	7·2	8·7	8·6	1·2	1·1	1·2	C	M	D	1951	
E 54515	B1	53·5	4·9	3·1	7·3	12·0	12·4	12·8	11·3	11·3	11·9	1·1	1·1	1·1	H	M	D	1951	
E 54516	B1	82·2	6·9	2·7	10·6	11·3	10·8	11·4	11·1	10·8	11·3	1·0	1·0	1·0	E	M	D	1951	
E 54518	B2	81·0	6·8	2·8	15·2	18·1	19·3	19·4	4·7	4·9	4·8	3·9	3·9	4·0	E	M	D	1951	
H 332	B1	61·0	3·5	2·0	6·5	7·5	7·8	8·3	6·4	6·4	6·0	1·2	1·2	1·4	E	M	D	1895	
H 333	B1	90·2	6·2	3·4	9·4	12·7	12·6	13·0	11·2	10·9	11·3	1·1	1·2	1·2	P	M	D	1895	
None	B1/2	144·0	5·6	2·2	15·1	21·8	19·7	22·8	6·7	5·6	6·8	3·3	3·5	3·4	P	M	?	?	

(2) Site, Locality, and Chronological Attributions

Localized straight *kuru* are featured in figure 4. E 1896 is from Riwaka, which, on artifactual (Nelson, Australian, and other Museums; Duff 1949: 128), traditional (see Peart 1937: 52, 54, 58–63, 67–68), and protohistoric evidence (Field

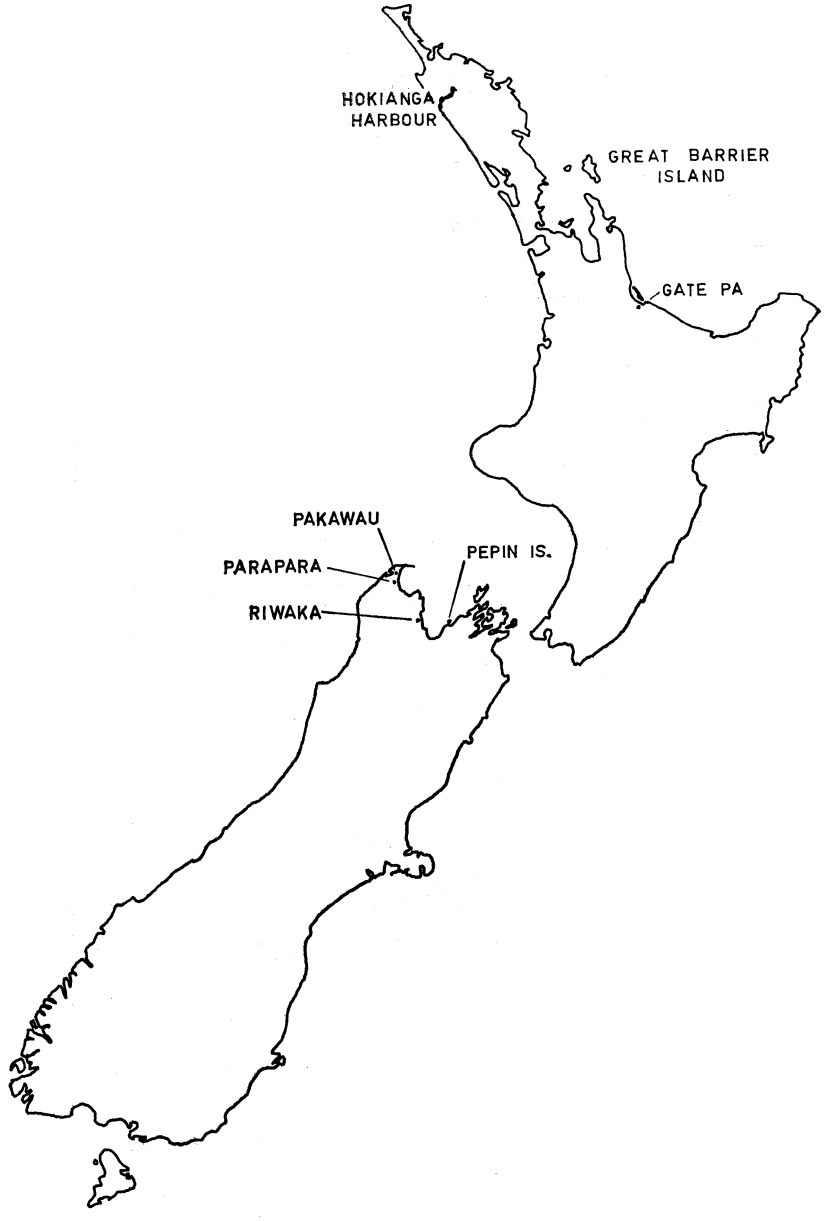


Fig. 4: Distribution of localized Australian Museum pendants

1942: 89–90, 115–117, 138; Peart 1937: 102–103; and early maps in the Lands and Survey Office, Nelson) was the site of both prehistoric and protohistoric Classic Maori settlements. Pendants E 2374 and E 2375 are from Great Barrier Island where Classic Maori sites are apparently abundant (Spring-Rice 1962, 1963). E 2669 was obtained from a Maori killed at Gate Pa, and so pre-dates 1864. Pakawau, the locality from which E 2670 came, was the site of a protohistoric settlement (Heaphy 1846: 205; Tuckett 1842: 64–65). Field survey work by the author in December 1969 revealed that Classic Maori sites and artifacts were abundant around the Inlet and along the narrow coastal strips immediately to the north and south.

Although genuine "Cook Relics" cannot often be localized, some conclusions are possible. It has been shown (Orchiston 1972a) that during Cook's first voyage there were no localities where any quantity of greenstone pendants could possibly have been traded, although the odd specimen may have been picked up at the Bay of Islands, Mercury Bay, or Anaura Bay. In all likelihood H 322 and H 333, if genuine Cook relics, came from Queen Charlotte Sound during the second or third voyages, where much trafficking in greenstone occurred (Orchiston 1972b).

(3) The Problems of Sampling

The population of straight *kuru* to which the Australian Museum sample belongs possesses both spatial and chronological attributes, and includes all pendants manufactured with native implements in all geographical areas of New Zealand throughout the entire prehistoric, protohistoric, and historic periods.

Published accounts of indisputably prehistoric straight *kuru* (from either North or South Island) are exceedingly rare (Meeson 1889; 69, f70; Skinner 1936: figure 6) and in each case the pendant concerned differs markedly from table 1 examples. Nor is there any indication that straight *kuru* were anywhere abundant,

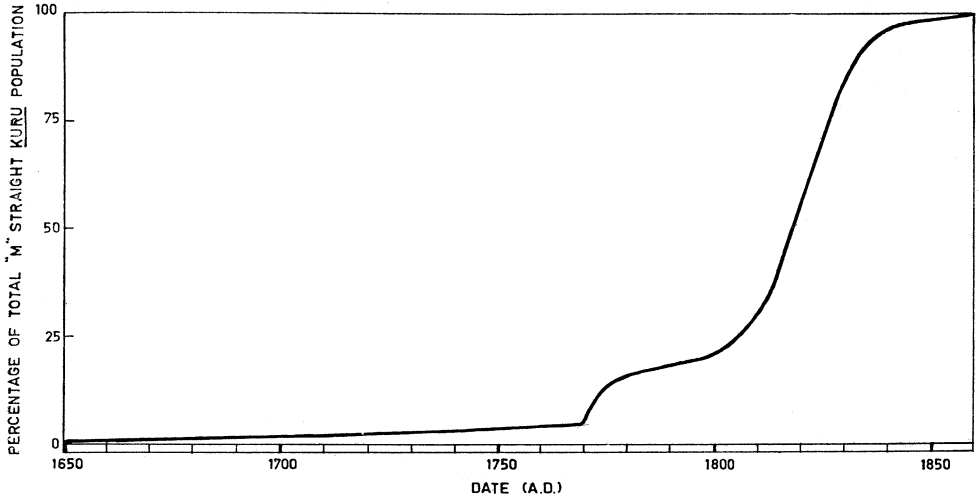


Fig. 5: Cumulative frequency curve for the "M" straight *Kuru* population

except perhaps in Northland, in 1769–1770. However, these pendants were being manufactured for trade with Europeans as early as 1773 (Orchiston 1972b), and during the second and third decades of the nineteenth century the increased tempo of Maori-Pakeha trade relations led to an efflorescence in greenstone ornament manufacture, which continued through into the 1840's (as witnessed at the Taramakau River by Heaphy). This rapid, yet irregular, numerical increase in the straight *kuru* population is illustrated graphically in figure 5, where it can be seen that the great majority of "M" pendants currently in museums and private collections were produced in protohistoric times, largely in response to European demand. Very few "M" *kuru* were manufactured during historic times, although "E" specimens became abundant from about 1865. Dr Skinner (1969) attributes the latter to:

(1) the availability of a plentiful supply of fine nephrite, as a result of gold-sluicing in the Taramakau and Arahura Rivers;

(2) the ease with which pendants could be manufactured with metal discs and carborundum;

(3) the impact on European thought on traditional Maori beliefs relating to the sanctity of pendants.

To these may be added:

(4) the insatiable demand from both private collectors and the world's museums.

"It is clear," states Skinner, "that the demand for faked amulets in nephrite and in bone was met principally by the Auckland experts, the most skilled of whom was Trevor Lloyd . . ." Conly (1948) gives an account of early Dunedin fakers.

Precise determination of the spatial-chronological distribution of "M" straight *kuru* is an almost impossible task. In all likelihood such pendants largely mirrored the distribution of human populations engaged in trading activities with Europeans. That is, prior to 1820 they were largely concentrated in Northland, with "minor pockets" at the Thames, Tauranga, Whakatane, and the East Coast area (unless *kuru kapeu* dominated here). During the 1820's there was some blossoming of these minor pockets, but the most significant feature of this interval was the emergence of the Kapiti Island trading station, which attained prominence during the 1830's as the political dominance of the Bay of Islands region waned. The 1830's also witnessed the appearance of a multitude of new minor pockets all around the coast—but particularly the East Coast of the North Island from Hauraki Gulf south, but with isolated West Coast locations (e.g., Taranaki Coast, Wanganui)—and in the interior (principally the Waikato and Rotorua regions). During the 1840's the Wellington, Golden Bay, and Tasman Bay areas were added.

During protohistoric times non-straight *kuru*, or straight *kuru* differing markedly from those of table 1, were commonly produced in east-coast South Island (Skinner 1932: 302–309; Skinner 1933: 1–10, 310–320; Skinner 1959; Teviotdale 1939: 111–113; Thacker 1961: 10–11; and Trotter 1967: 240–241).

Although most museum "M" straight *kuru* were manufactured for trade a number of cultural and non-cultural variables entered into pendant manufacture and combined to determine the form of the finished products. Rouse (1939: 18–19) has enumerated these:

(1) Chance.
(2) Individual quirks of the artisan.
(3) Physical capacities of the artisan.
(4) Potentialities of the environment.
(5) Elements of Culture.
  (a) Types—
    (i) styles.
  (b) Modes—
    (i) techniques.
    (ii) designs.
    (iii) other specifications.

The influence of chance is apparent in the case of pendants E 2375 and E 54509, while environmental potentialities played a role in that the different fissility-toughness characteristics of bowenite, nephrite, and semi-nephrite must have related to ease of working. But factors 2, 3, and 5 were undoubtedly the most crucial ones, with their interaction leading to differences in metrical attributes of straight *kuru* from one trade location within New Zealand to another during the protohistoric period. And, in the course of time, as different artisans emerged and others died; as human population numbers and distributions altered (through warfare, tribal and intra-tribal amalgamation or segmentation, migration, varying natural birth/death rates, natural catastrophes, etc.), and different geographical areas waxed and waned in trading prominence; as styles altered and manufacturing techniques possibly changed, the metrical attributes of this increasing population of straight *kuru* must statistically have undergone diachronic change.

Thus, the following criteria must ideally be met if a sample of such pendants is to be considered truly random:

(1) All localities which at any time (prehistoric, protohistoric, or historic) possessed "M" straight *kuru* must be represented; and
(2) The number of pendants representing each such location must—
  (a) be proportional to the total numerical contribution made by that location to the total population; and
  (b) in chronological distribution reflect diachronic changes in numerical abundance.

Rarely are data so stringently defined as to satisfy these criteria. However, a random sample may be approximated on the basis of figure 5, in that about 70 per cent of the "M" straight *kuru* population were manufactured during the interval 1810–1840, and that these pendants were derived almost exclusively from Northland, Kapiti Island, the Thames, Bay of Plenty, and the East Coast regions.

Most of the Australian Museum sample is derived from the one collection built up during historic times, hence the majority of its pendants can be associated with protohistoric manufacture. But since there is no evidence of geographical distribution the randomness of this sample must be questioned.

TABLE 2. AUCKLAND MUSEUM STRAIGHT *KURU*

Register number	Cross section	Length (*l*)		Perf. dia.	Width (*w*)				Thickness (*t*)			*w*/*t*			Distal end	Remarks
		Total	To perf.		At perf.	0·33	0·66	Max.	0·33	0·66	At $w_{(max)}$	0·33	0·66	At $w_{(max)}$		
339	A-B1	125·7	9·2	3·0	11·9	12·8	12·4	12·9	8·4	8·4	8·3	1·5	1·5	1·6	E	Obtained 1893 from Tuitai, oldest Maori at Omawharo Native Settlement, Kaipara.
343	B1	96·0	10·2	4·9	14·4	17·1	17·9	18·1	16·4	17·5	17·5	1·0	1·0	1·0	C	Chatham Islands.
351	B1/2	63·9	7·7	3·8	13·5	17·4	21·1	21·3	5·7	5·2	5·0	3·1	4·1	4·3	C	
352	B1	59·6	7·0	3·4	12·2	13·5	13·3	13·5	9·0	10·4	9·0	1·5	1·3	1·5	C	
584	B1	62·8	7·3	4·4	11·4	13·1	13·0	13·3	9·2	9·5	9·5	1·4	1·4	1·4	C	East Cape.
639	B1	75·2	3·4	3·3	6·2	7·6	7·8	7·8	6·0	6·4	6·4	1·3	1·2	1·2	E	Burial Cave near Ohaewai.
3049	B1	43·3	6·7	3·2	10·0	11·3	11·6	11·9	8·7	8·8	9·0	1·3	1·3	1·3	P	Probably near Kaikohe.
3051	B1/2	68·2	7·4	4·5	11·9	13·4	15·3	15·9	5·8	6·9	7·3	2·3	2·2	2·2	C	Probably near Kaikohe.
3248	B1	96·3	8·8	4·6	10·8	12·4	12·0	12·4	6·5	7·5	6·5	1·9	1·6	1·9	E	
3350	B2	67·3	8·8	4·6	10·6	12·1	13·7	14·1	5·5	5·8	5·8	2·2	2·4	2·4	E	
3920.1	B1	59·7	3·7	3·7	9·8	11·4	10·6	11·4	4·5	5·1	4·5	2·5	2·1	2·5	E	Kawakawa.
3920.2	B1	72·9	4·9	3·0	9·2	9·9	9·7	9·9	5·8	6·1	5·8	1·7	1·6	1·7	E	Kawakawa.
3920.4	B1	74·1	8·3	4·2	11·1	11·2	10·4	11·2	11·0	10·2	11·0	1·0	1·0	1·0	H	
4328	B1	53·2	3·3	1·9	5·2	6·5	6·1	6·5	3·7	3·8	3·7	1·8	1·6	1·8	C	
5043	B1	121·8	8·3	5·0	12·4	15·0	16·1	16·2	7·0	7·3	7·3	2·1	2·2	2·2	P	
5535	B1	109·8	7·7	2·8	8·6	10·7	10·3	10·8	5·3	5·3	5·3	2·0	1·9	2·0	P	On the Summit of One Tree Hill.
5575	B1	93·9	10·2	4·6	11·3	12·4	11·2	12·4	8·3	8·2	8·3	1·5	1·4	1·5	H	
5623	B1	107·4	7·0	2·7	14·0	17·2	15·3	17·6	11·6	11·0	11·2	1·5	1·4	1·6	P	
5624	B1	86·0	5·6	3·3	10·4	9·7	8·3	10·6	5·9	5·1	6·4	1·6	1·6	1·7	E	
5626	B1	66·3	9·9	3·6	10·4	10·9	10·0	10·9	7·6	7·2	7·6	1·4	1·4	1·4	P	
5627	B1	43·6	7·0	3·4	8·5	8·6	8·0	8·9	4·2	4·8	4·9	2·0	1·7	1·8	H	
6130	B1	82·2	6·2	4·3	11·0	14·6	14·8	15·2	9·7	9·4	9·9	1·5	1·6	1·5	E	Reputedly used in *makutu*. Name: Te Parakore.
6260	B1	68·6	7·7	2·9	10·0	12·0	11·6	12·0	6·1	6·1	6·1	2·0	1·9	2·0	P	Burial ground, Mayor Island.
6410	B1	72·1	6·9	3·9	12·2	16·1	15·7	16·3	6·7	6·7	6·6	2·4	2·3	2·5	C	Found in a skull in a burial cave at Ohaewai
6684	B1	66·3	3·6	2·4	7·7	8·6	8·2	8·8	8·2	7·7	8·3	1·0	1·1	1·1	P	North Cape district.
7617	B1	70·9	7·4	3·7	10·3	15·0	14·1	15·1	8·6	8·5	8·6	1·7	1·6	1·8	P	Murdering Beach.
8291	B1	90·6	10·9	3·7	12·6	16·3	19·7	19·7	9·6	10·9	10·9	1·7	1·6	1·6	E	Urewera.
8296	B1	59·2	9·0	4·8	15·1	16·3	14·4	16·3	9·6	9·3	9·6	1·7	1·6	1·7	H	Urewera.
13664	B1	95·2	8·7	4·0	18·9	19·7	20·0	20·0	5·6	6·0	6·0	3·3	3·3	3·3	C	Rotorua.
13959	B1	74·5	8·2	4·4	11·8	12·6	12·1	12·6	6·6	6·4	6·6	1·9	1·9	1·9	P	Bay of Plenty.
13963	B1	64·5	5·2	4·0	13·2	15·4	16·1	16·1	6·8	6·4	6·4	2·3	2·5	2·5	E	Kaipara.
16133	B1	103·1	3·7	3·2	5·9	8·6	7·5	8·6	5·8	5·2	5·8	1·5	1·4	1·5	H	Totara North.
16138.1	B1	71·7	4·4	2·5	6·6	8·3	7·9	8·4	3·9	3·7	4·0	2·1	2·1	2·1	H	Kaipara.
16175	B1	111·6	4·0	1·8	6·2	7·7	7·8	8·2	7·4	7·4	7·7	1·0	1·1	1·1	E	North Cape.

TABLE 2. AUCKLAND MUSEUM STRAIGHT *KURU*—continued

Register number	Cross section	Length (l)		Perf. dia.	Width (w)				Thickness (t)			w/t			Distal end	Remarks
		Total	To perf.		At perf.	0·33	0·66	Max.	0·33	0·66	At $w_{(max)}$	0·33	0·66	At $w_{(max)}$		
16177	B1/2	63·5	7·1	2·9	14·0	19·5	19·7	20·4	6·4	6·5	6·6	3·0	3·0	3·1	E	North Cape.
16684	B2	128·4	10·0	6·2	15·5	19·7	16·8	19·7	5·4	4·4	5·4	3·8	3·8	3·8	E	Whakatane.
17491.2	B1	86·5	10·4	4·3	13·4	15·6	15·1	15·7	9·4	7·6	9·0	1·6	2·0	1·7	P	
19223.1	B1/2	73·8	6·1	4·4	9·5	10·4	10·3	10·4	3·9	4·2	3·9	2·7	2·5	2·7	E	Moturiki, Tauranga.
19555.3	B1	56·0	6·9	4·7	9·5	10·9	11·1	11·1	8·1	8·1	8·1	1·3	1·4	1·4	C	Oruarangi.
20080.1	B1	105·1	11·8	4·5	15·7	15·6	12·9	16·2	9 0	7·9	8·7	1·7	1·6	1·9	H	
20080.2	B1	134·8	6·5	3·8	10·9	9·9	7·9	11·2	9·3	8·3	8·5	1·1	1·0	1·3	E	
22391	B1	77·9	8·8	4·7	12·3	14·8	15·2	15·5	5·9	5·9	5·9	2·5	2·6	2·6	E	Lake Okataina.
22473.3	B1	58·0	5·3	3·9	10·6	12·9	12·8	13·0	4·1	4·3	4·4	3·1	3·0	3·0	C	? Marlborough Sounds.
22802	B1	99·6	4·8	4·2	7·6	10·5	10·7	10·7	5·7	5·3	5·3	1·8	2·0	2·0	P	
22841.2	B1	69·7	5·4	4·1	10·5	13·1	12·8	13·3	9·9	9·6	9·9	1·3	1·3	1·3	P	
22881	B1	80·8	9·2	5·2	11·4	12·1	10·1	12·1	5·9	5·3	5·9	2·0	1·9	2·0	H	
23490	B1/2	98·2	6·3	3·7	11·9	14·6	13·3	14·7	5·9	5·9	5·8	2·5	2·3	2·5	P	
29595.1	B1	63·6	5·2	4·1	9·8	11·2	11·6	11·6	6·1	6·0	6·0	1·8	1·9	1·9	C	
30747	B1	157·2	7·5	4·0	11·9	14·4	14·3	14·6	13·1	14·1	14·0	1·1	1·0	1·0	P	
30857	B1	96·3	5·5	1·9	9·3	10·3	10·3	10·3	5·2	5·1	5·2	2·0	2·0	2·0	E	
30857.3	B1	73·3	5·0	3·8	11·8	16·4	16·9	17·3	4·8	4·8	4·8	3·4	3·5	3·6	P	
31048	B1	39·5	5·8	3·3	13·1	13·1	13·1	13·2	6·8	6·8	6·8	1·9	1·9	1·9	C	
32473.4	B1	61·2	4·2	3·1	7 2	8·5	8·7	8·7	5·7	6·1	6·1	1·5	1·4	1·4	R	
32497	B1	80·6	9·5	4·2	10·4	11·9	13·4	13·7	4·7	4·5	4·4	2·5	3·0	3·1	C	Whangarei.
32870	B1	68·4	6·3	3·3	10·0	10·9	9·6	11·0	9·0	8·3	8·8	1·2	1·2	1·2	P	
33185	B1	108·1	5·4	3·6	9·6	14·2	14·2	14·9	12·4	12·5	12·8	1·1	1·1	1·2	E	Putiki.
34760.2	B1	57·9	4·2	3·0	9·1	11·6	10·9	11·7	9·6	9·2	9·8	1·2	1·2	1·2	P	Waiomio Valley.
34760.3	B1	48·0	5·2	3·5	11·8	11·8	10·9	12·0	9·4	9·1	9·2	1·3	1·2	1·3	H	Waiomio Valley.
34760.5	B1	117·6	5·6	2·8	7·7	9·6	8·8	9·6	6·1	5·6	6·1	1·6	1·6	1·6	P	Waiomio Valley.
34760.8	B1	60·6	7·6	3·3	9·3	10·5	9·9	10·5	4·2	4·1	4·2	2·5	2·4	2·5	C	Waiomio Valley.
36099.3	B1	61·4	6·9	3·2	10·6	12·4	11·0	12·4	10·0	9·4	10·0	1·2	1·2	1·2	H	
36100.2	B2	62·4	6·5	4·2	13·0	16·8	17·1	17·1	4·0	4·5	4·5	4·2	3·8	3·8	E	
36509.2	B1	144·6	13·0	4·0	16·0	15·6	15·4	16·6	5·9	5·9	5·8	2·6	2 6	2 8	P	? Taranaki.
36734.3	B1	144·1	4·7	3·1	5·9	6·7	6·5	6·8	6·3	5·7	6·3	1·1	1·1	1·1	H	
38148	B1	55·7	5·5	1·8	8·7	10·0	11·2	11·4	8·1	10·6	11·0	1·2	1·1	1·0	C	
38172	B2	132·9	8·0	4·1	21·8	23·2	24·1	24·1	6·0	5·8	5·8	3·8	4·2	4·2	C	
39018	B1	72·8	8·2	3·5	11·9	14·1	16·5	16·9	7·5	8·4	8·7	1·9	2·0	1·9	C	
39020	B1	44·4	5·7	2·8	13·3	16·4	14·4	16·5	4·1	4·0	4·1	4·0	3·6	4·0	P	
39022	B1/2	42·6	8·4	4·0	15·1	18·6	16·9	18·9	6·7	6·3	6·7	2·8	2·7	2·8	P	
39458	B1	63·5	4·4	3·1	7·4	13·2	13·6	14·3	10·5	11·7	11·8	1·3	1·2	1·2	H	

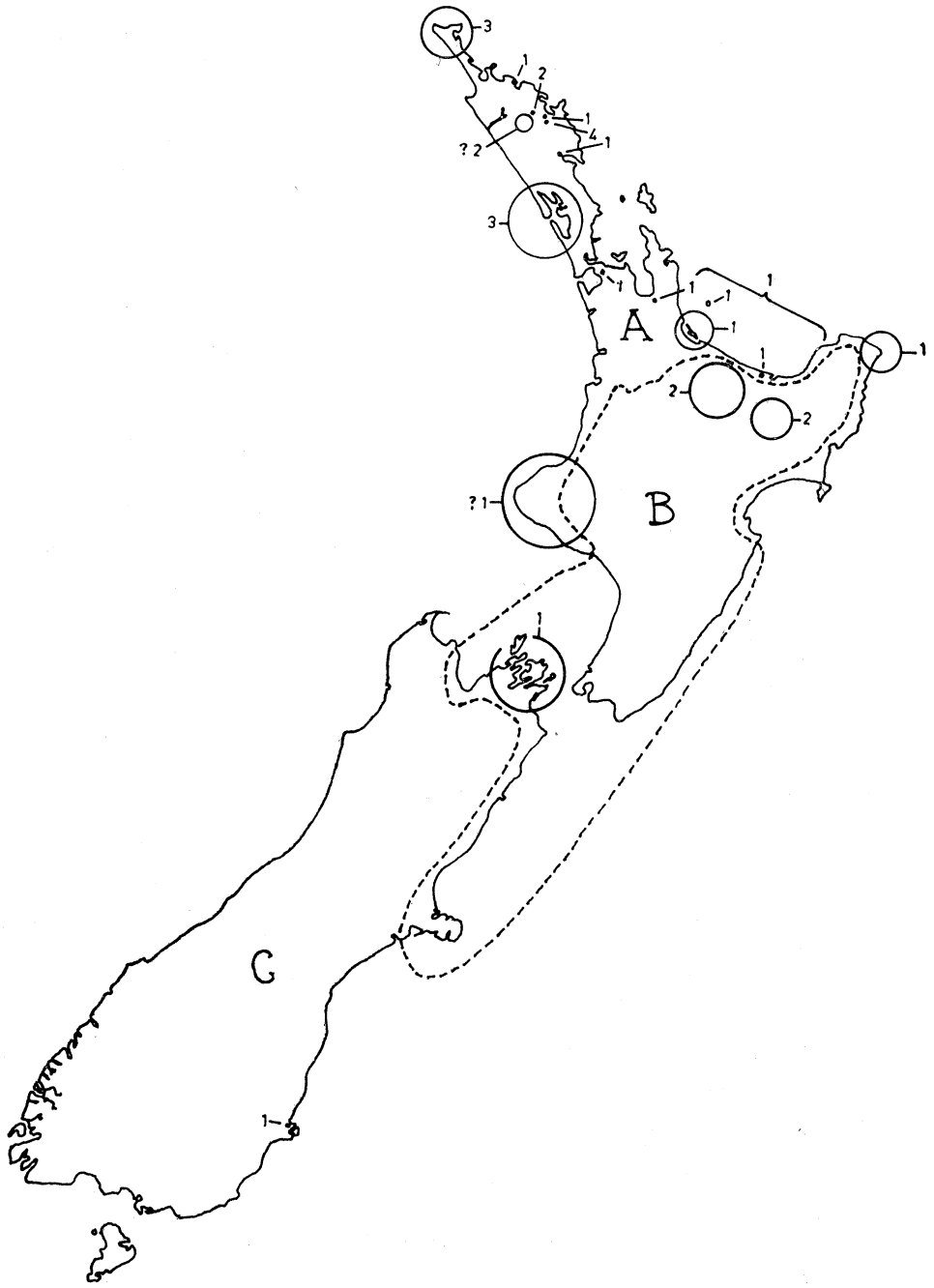


Fig. 6: **Distribution** of localized Auckland Museum pendants

(4) A Random Sample

In order to investigate the parameters of a random sample, and to determine the extent to which the Australian Museum pendants differ quantitatively, measurements were taken on 70 "M" straight *kuru* in the Auckland Institute and Museum (see table 2). Auckland pendants were also acquired during historic times so in most cases can be attributed a protohistoric origin. The geographical distribution of the 31 localized pendants is indicated in figure 6, showing a predominantly Northland-Bay of Plenty bias. Pendants' numbers in areas A, B, and C (25, 5, and 1, respectively) do not differ significantly at P = 0·05 from Cumberland's (1950: 19) corresponding 1838 population values ($\chi^2 = 1{\cdot}23$). Thus, there are grounds for assuming that the Auckland specimens approximate a random sample, and that they are a closer approximation than the Australian Museum sample is.

Table 3 compares the numbers of pendants of different cross-sectional types from Sydney ("M" *kuru* only) and Auckland. A χ^2 analysis, incorporating Yates's Correction, revealed no significant difference between the two samples at the 0·05 level.

TABLE 3. DISTRIBUTION OF CROSS-SECTIONAL VARIETIES IN TWO SAMPLES OF "M" PENDANTS

Cross-section	Sydney	Auckland
A-B1	2	1
B1	34	59
B2	6	4
B1/2	2	6

(5) Quantitative Analyses

To date straight *kuru* have not been subjected to quantitative analysis, those few descriptions that have appeared in print all being of a subjective nature. This situation is rectified in the present paper. Following is an examination of the nature and interrelationships of various pendant parameters, both for Sydney and Auckland samples. In each case B1 specimens are differentiated from those of B2, B1/2, and A-B1 cross-sections, and in the frequency histograms these last three are plotted together for the purposes of statistical analyses. In all Australian Museum scatter diagrams "M" pendants are distinguished from "E" and "?E" specimens, while these last two are represented collectively in the corresponding histograms. Unless otherwise stated conclusions that follow relate specifically to "M" B1 pendants only.

A histogram of length for Auckland Museum straight *kuru* is given in figure 7. This sample shows a negatively-skewed Gaussian distribution with the mode at about 70 mm and a mean of 80·4 mm, both of which are consistent with Monneron's (1769–70: 283) claim that *kuru* worn by the Doubtless Bay natives of 1769 were about 3 inches (76·2 mm) in length. Since straight *kuru* worn as neck pendants appear to show a similar length range to ear counterparts on the basis of Lindauer's paintings (Graham 1965: *passim*) only in the case of the occasional long, bulky, hence heavy straight *kuru* is it functionally necessary to allocate it to the neck rather than the ear. Thus, on the basis of length alone it is impossible to distinguish neck from

ear pendants. During 1769 and 1770 straight *kuru* were rarely, if ever, worn as neck ornaments (see Orchiston 1972b), and the limited evidence available suggests this practice only came into vogue in late protohistoric times, or during the historic period.

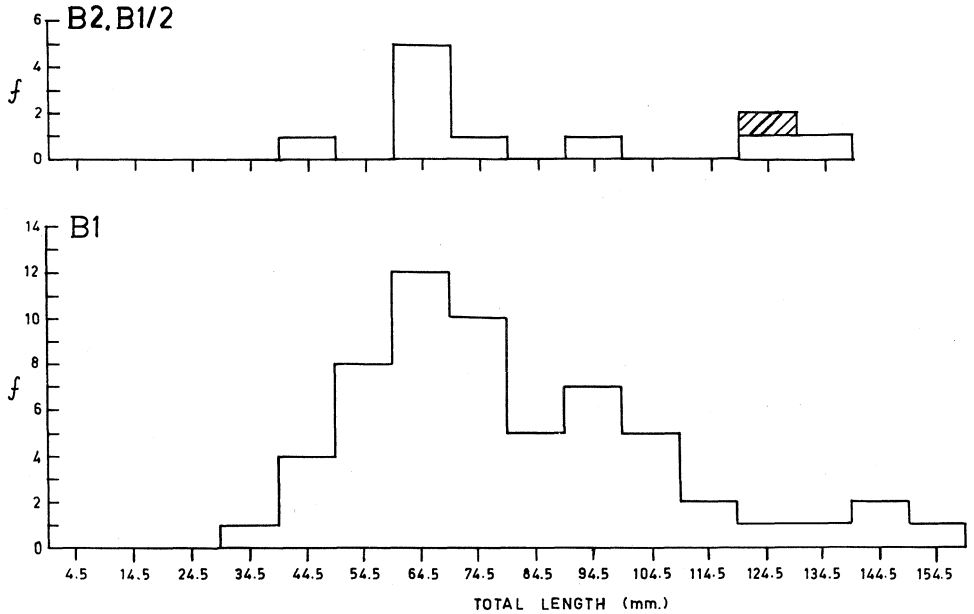


Fig. 7: Frequency histogram of length for Auckland Museum straight *Kuru*

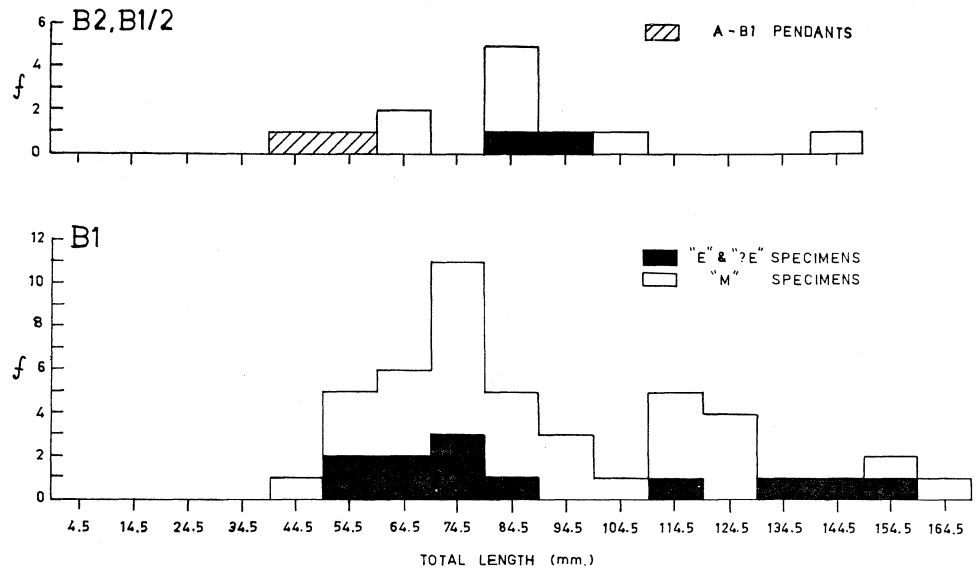


Fig. 8: Frequency histogram of length for Australian Museum straight *Kuru*

Length distribution for Australian Museum pendants is shown in figure 8, where bimodality, with maxima at about 75 and 120 mm, is apparent. In the light of the above comments this feature cannot be explained functionally, and probably should be attributed to sampling bias. The lower limit of pendant length is about 30 mm on both graphs and must be largely technologically determined in that pendants smaller than this were not easy to produce with the equipment available and the manufacturing techniques employed.

Despite the apparent variations in the "M" curves in figures 7 and 8 a crude median splits χ^2 analysis* showed no significant difference between the two samples at P = 0·05 (see table 4).

TABLE 4. χ^2 ANALYSIS OF B1 "M" PENDANTS FROM SYDNEY AND AUCKLAND

Parameter	χ^2
Length (total)	1·31*
Width (maximum)	8·27‡
$w/t_{(max)}$	0·01*
Perforation diameter	3·95†

* Not significant.
† Significant at $P = 0{\cdot}05$.
‡ Significant at $P = 0{\cdot}01$.

Auckland Museum pendant widths ($w_{(max)}$) are plotted in figure 9 and reveal a negatively-skewed Gaussian with the mode at about 12 mm. As for length, the lower limit of pendant width was determined technologically. The Australian Museum sample differs significantly both visually (figure 10) and statistically (table 4) from the Auckland sample. The mean was calculated as 15·8 (cf. the Auckland value of 12·8 mm). These differences again must be attributed to sampling bias. As expected, a high correlation (r = +0·84 and r = +0·94 for Auckland and Australian Museum pendants respectively, both significant at the 0·001 level) was found between maximum width and width at the perforation.

*A "median splits" χ^2 analysis is a test whereby the similarity of two histogram shapes can be compared by doing a χ^2 test on the numbers of cases on either side of the median using the median location of the random sample as reference.

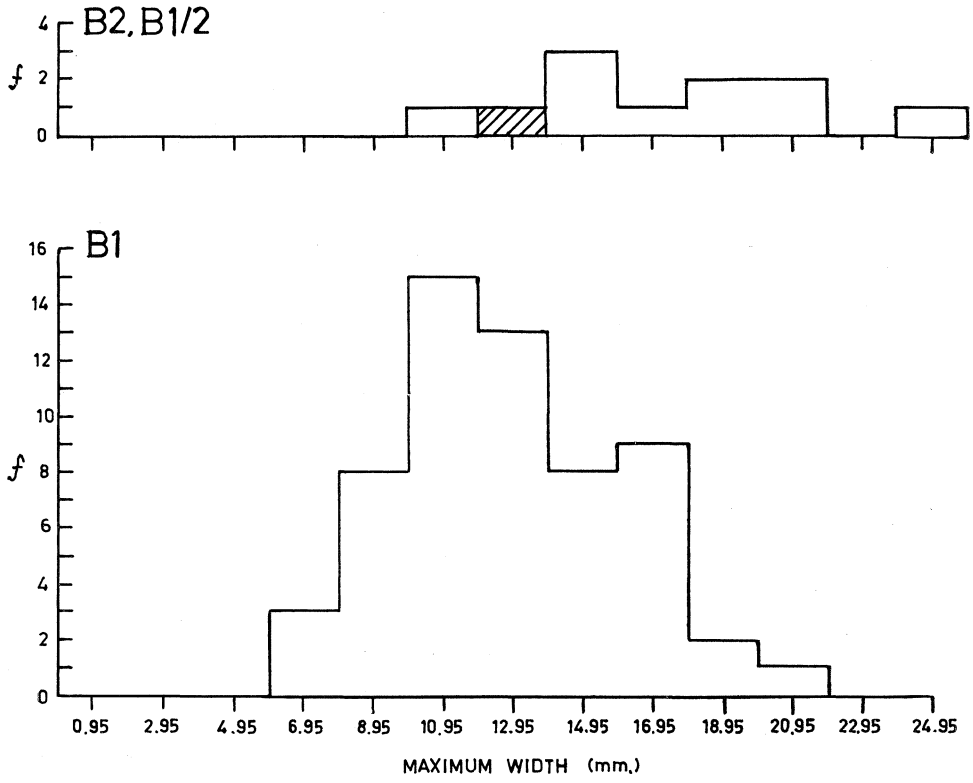


Fig. 9: Frequency histogram of width for Auckland Museum straight *Kuru*

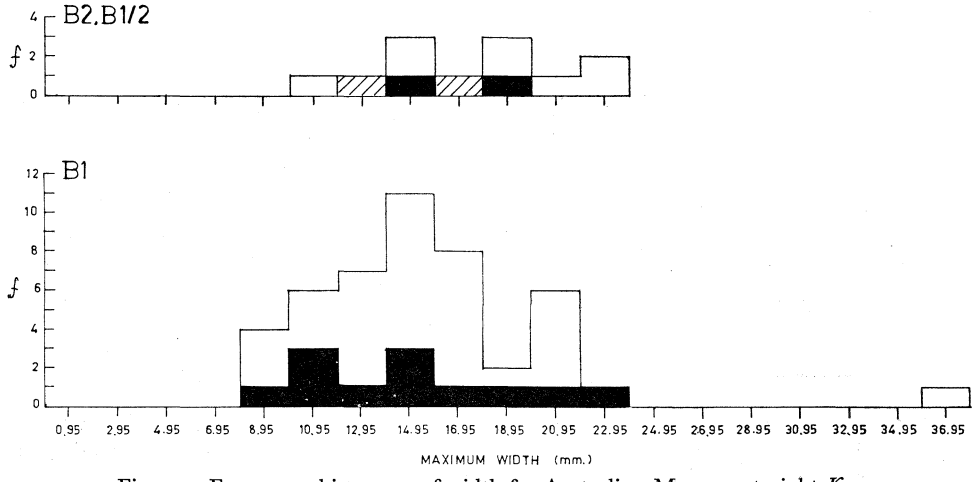


Fig. 10: Frequency histogram of width for Australian Museum straight *Kuru*

No correlation was found for either sample when length was plotted against maximum width (figures 11 and 12). In the latter plot pendant E 54472 (at top right) appears as the only likely metrically-defined neck *kuru.*

In figures 13 and 14 the change in width throughout length is indicated for each pendant by plotting Δw (both $w_{(max)} - w_{(0\cdot66)}$ and $w_{(max)} - w_{(0\cdot33)}$ separately) against maximum width. It can be seen that although very few pendants are parallel-sided (i.e. $\Delta w = 0$) many show only a small deviation. In both samples there is a general trend towards greater variation in width with increasing maximum width.

Figures 15 and 16 show maximum width plotted against thickness (at maximum width) for each pendant. No correlation was found at P = 0·05 for either sample.

Width/thickness ratios (w/t) give a numerical indication of the major and minor axes of pendants at three different locations. In figures 17 and 18 maximum width has been plotted against $\Delta w/t$ (both $w/t_{(max)} - w/t_{(0\cdot66)}$ and $w/t_{(max)} - w/t_{(0\cdot33)}$) to show that most pendants exhibit little change in cross-section throughout their lengths (i.e. $\Delta w/t \rightarrow 0$), and where variations do occur these are irrespective of maximum width.

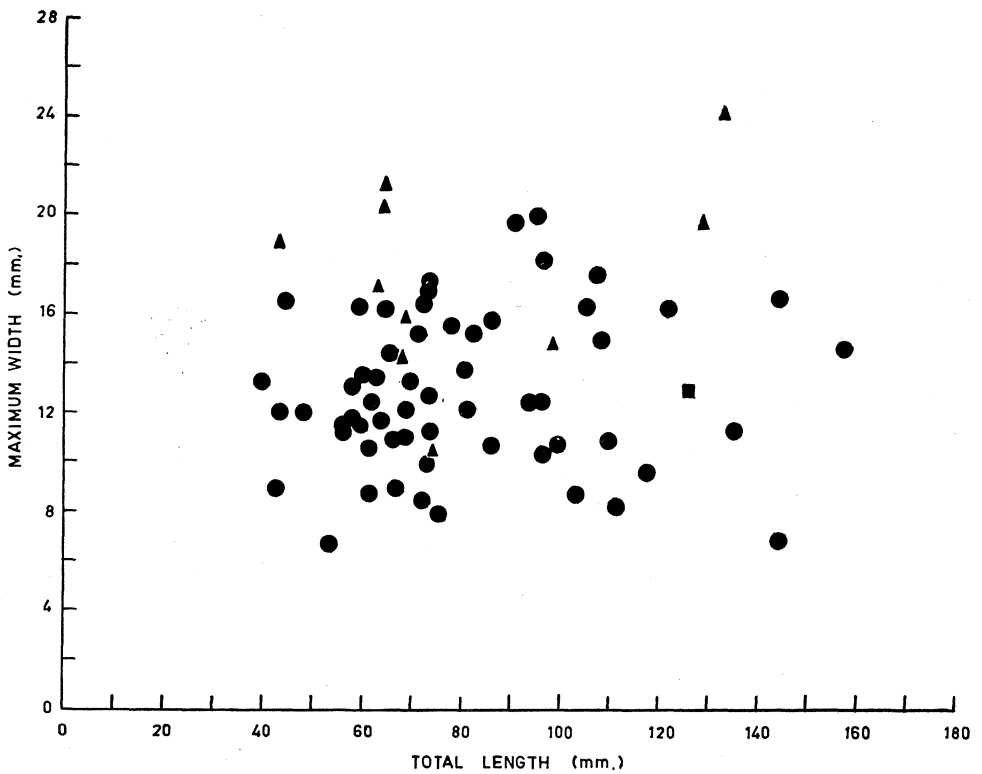


Fig. 11: Scatter diagram of length vs width for Auckland Museum straight *Kuru*

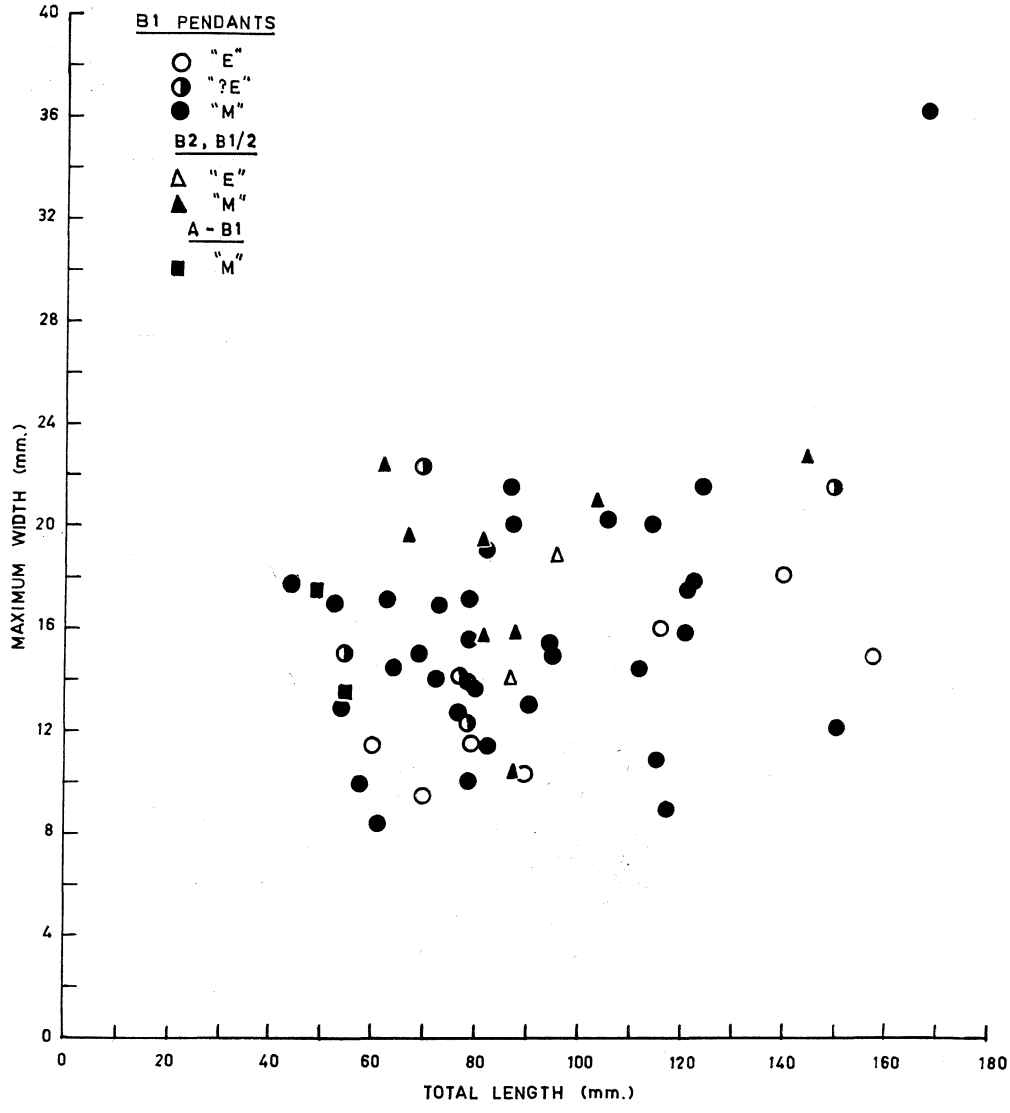


Fig. 12: Scatter diagram of length vs width for Australian Museum straight *Kuru*

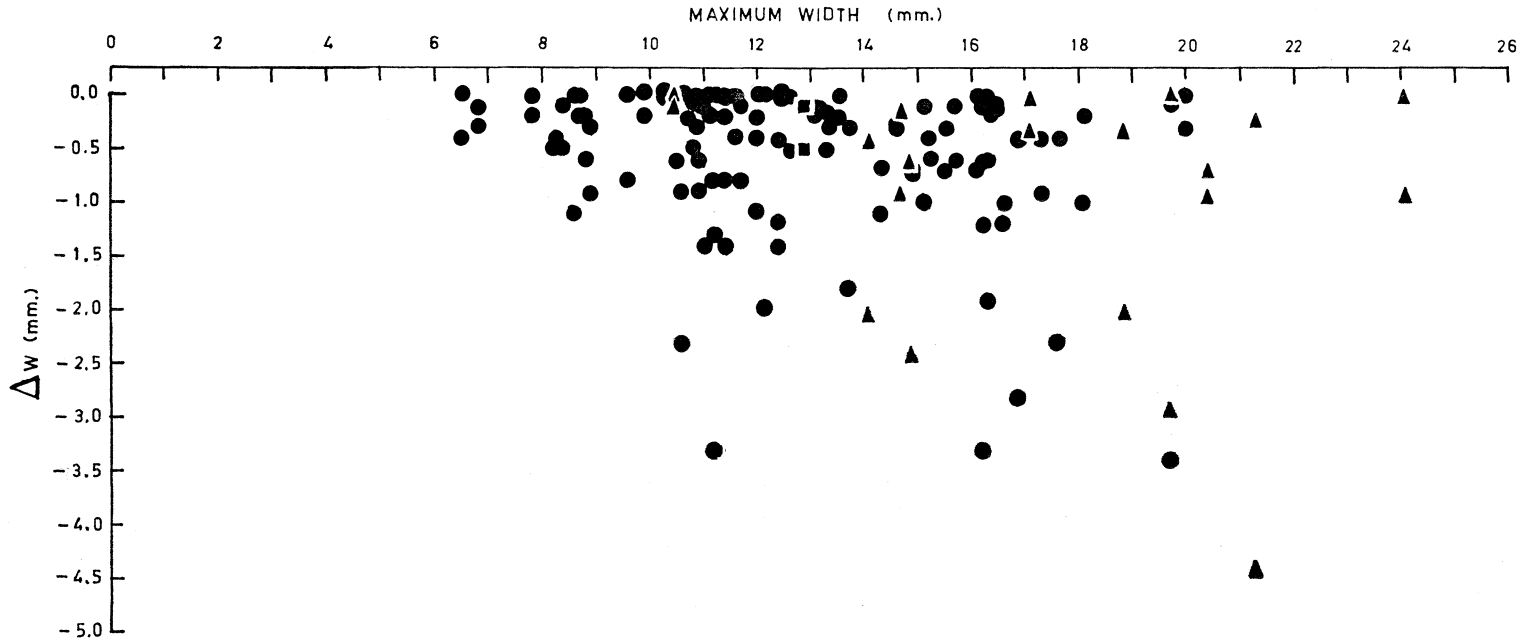


Fig. 13: Plot of Δw vs width for Auckland Museum straight *Kuru*

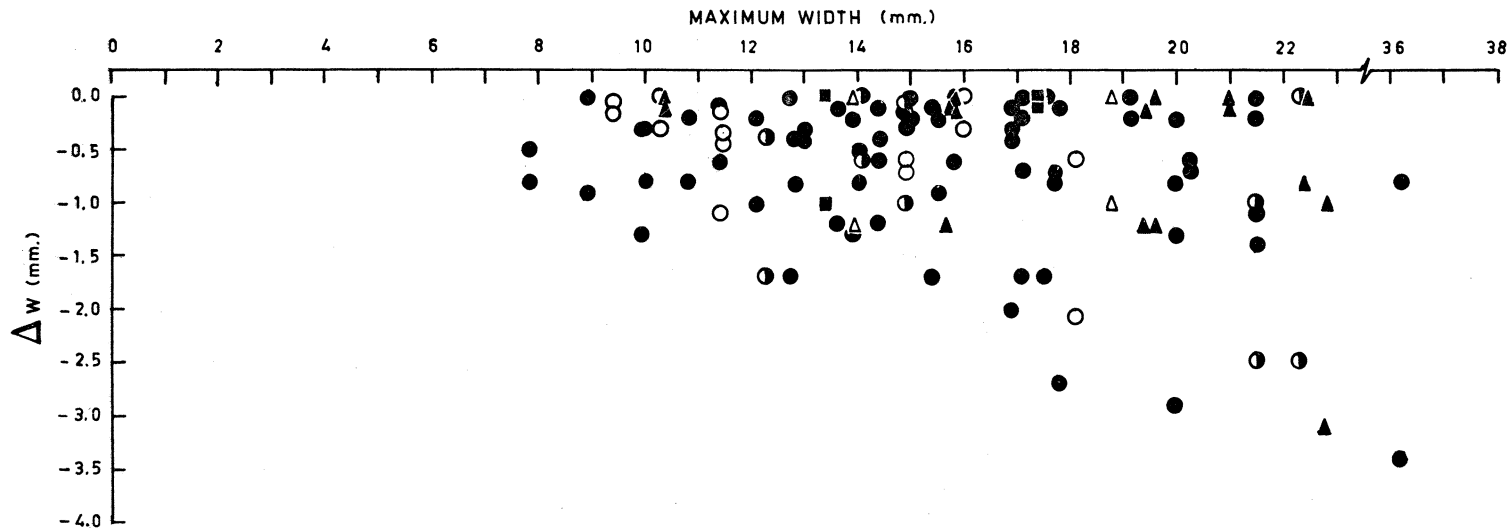


Fig. 14: Plot of Δw vs width for Australian Museum straight *Kuru*

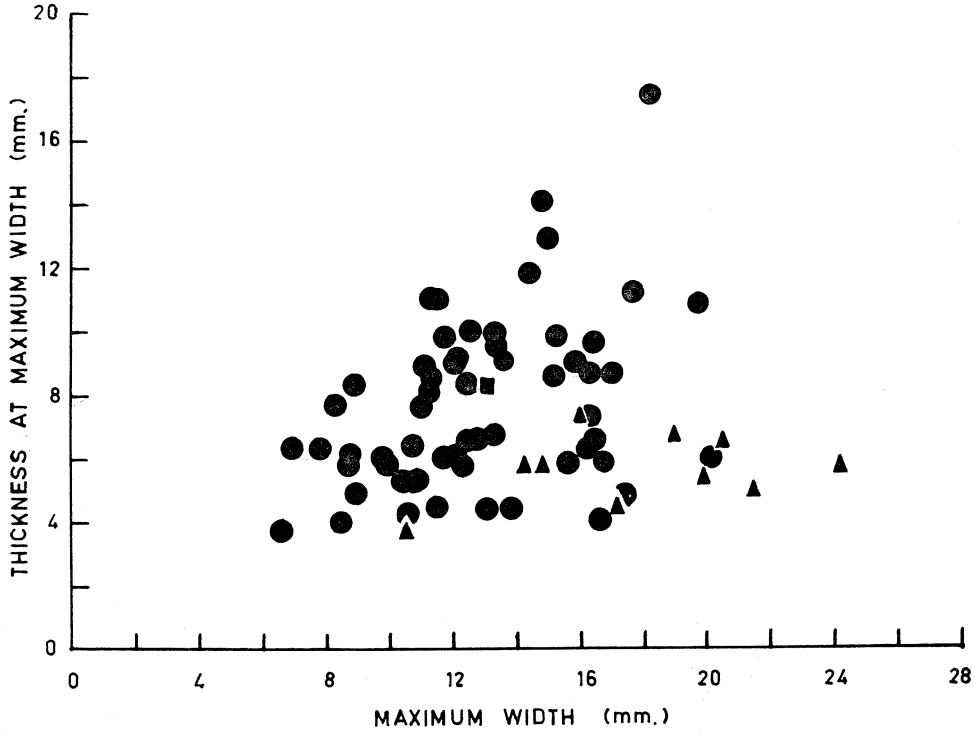


Fig. 15: Scatter diagram of thickness vs width for Auckland Museum straight *Kuru*

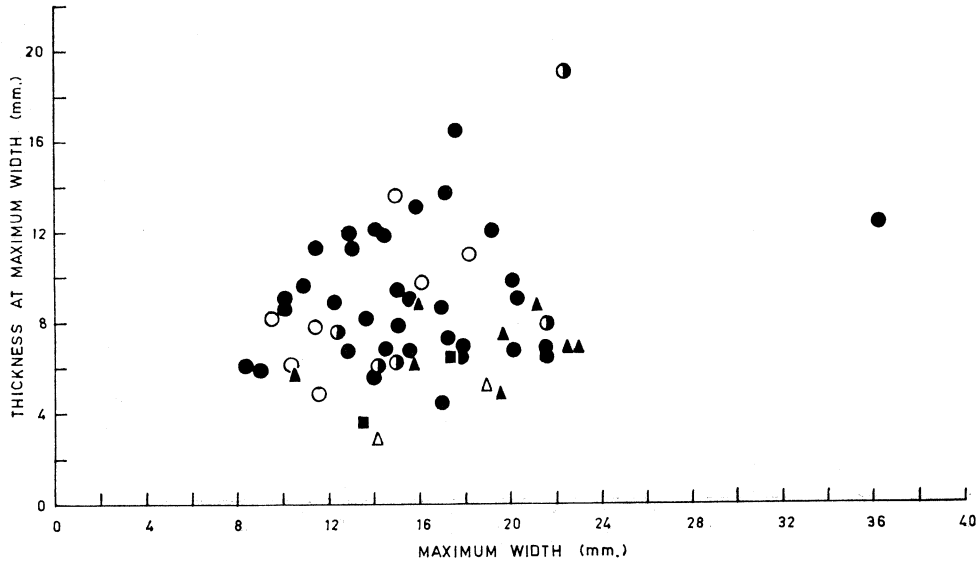


Fig. 16: Scatter diagram of thickness vs width for Australian Museum straight *Kuru*

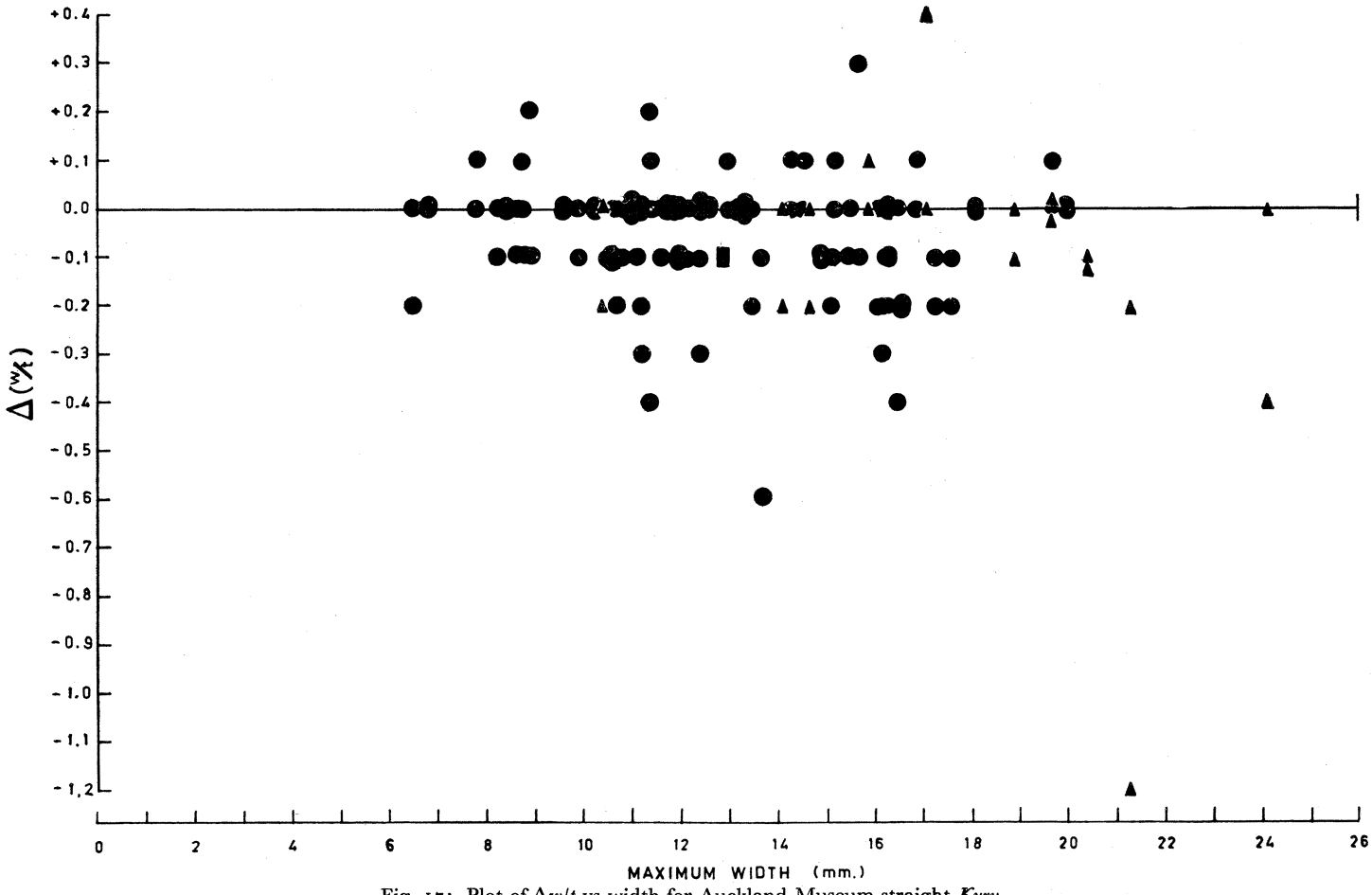


Fig. 17: Plot of $\Delta w/t$ vs width for Auckland Museum straight *Kuru*

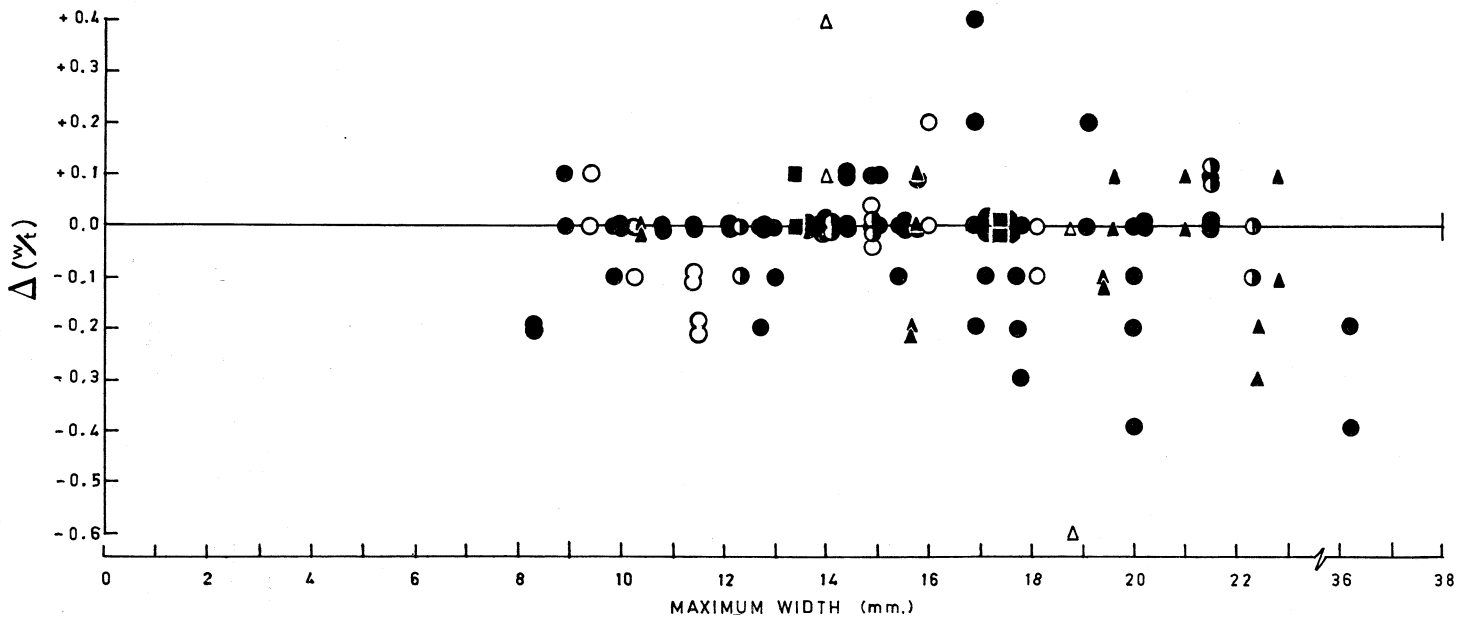
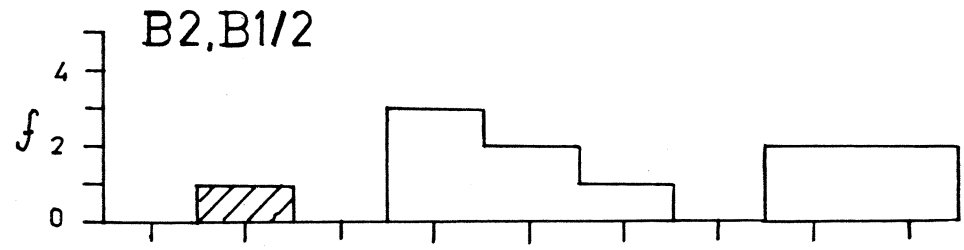


Fig. 18: Plot of $\Delta w/t$ vs width for Australian Museum straight *Kuru*



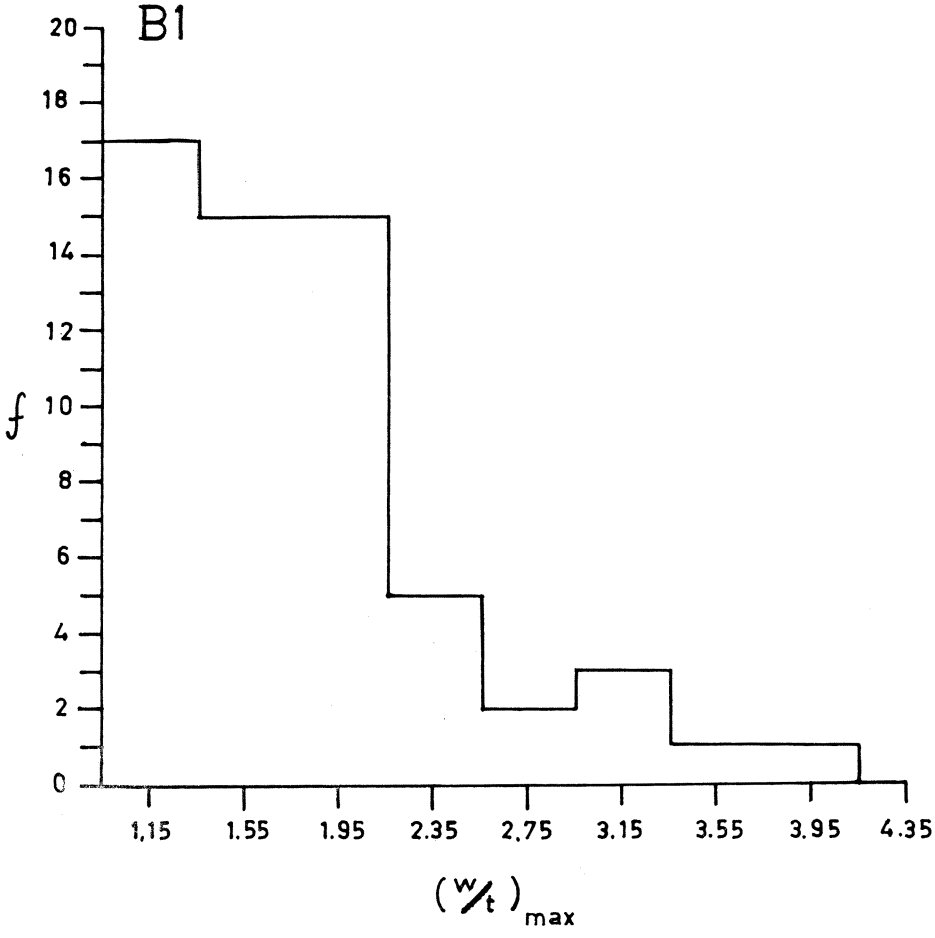


Fig. 19: Frequency histogram of *w/t* for Auckland Museum straight *Kuru*

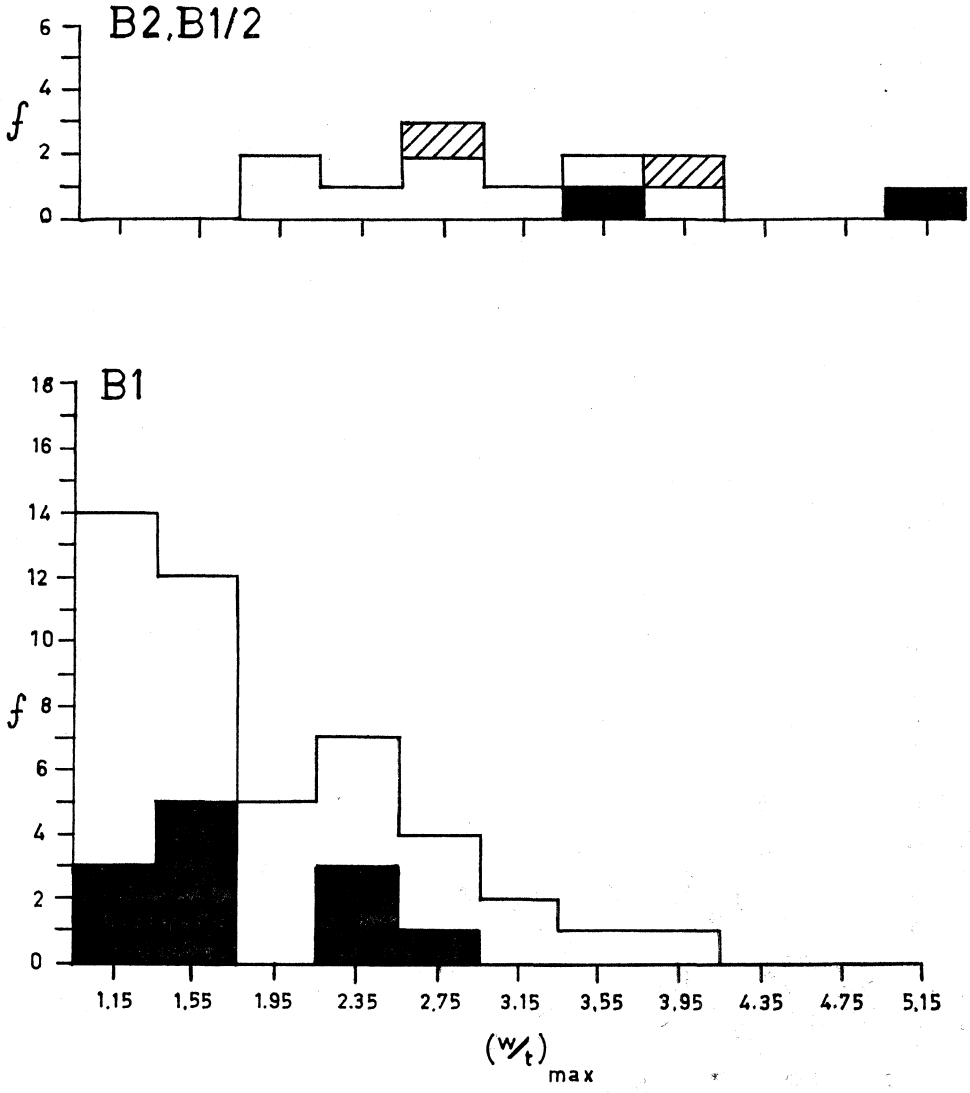


Fig. 20: Frequency histogram of *w/t* for Australian Museum straight *Kuru*

Having established that there is little change in pendant cross-sections at the three positions measured, figures 19 and 20 give histograms of $w/t_{(max)}$. Despite the differing one-tailed Gaussian fits a median splits χ^2 analysis failed to show any significant difference between the two samples at P = 0·05.

In figures 21 and 22 $w/t_{(max)}$ is plotted against maximum width; correlations exist for both samples (r = +0·39 and +0·62 respectively, significant at P = 0·01 and P = 0·001). This suggests that with the manufacturing techniques at their disposal and implements available the Maoris generally found it difficult to produce narrow pendants with anything other than near-circular cross-sections.

In that pendant suspension perforations are functional their sizes and positioning should have been influenced not only by cultural norms but also by some of the variables discussed above.

Figure 23 shows a frequency histogram of internal perforation diameter where a positively-skewed Gaussian with a mode at about 3·7 mm is represented. This differs markedly (see table 4) from the Australian Museum plot, a negatively-skewed Gaussian, in figure 24. The abrupt lower cut-off points on both graphs reflect technological and functional factors: that holes of smaller diameter were not easily produced with Maori drills, but even if they were they would have been too small to permit passage of even the finest native cordage.

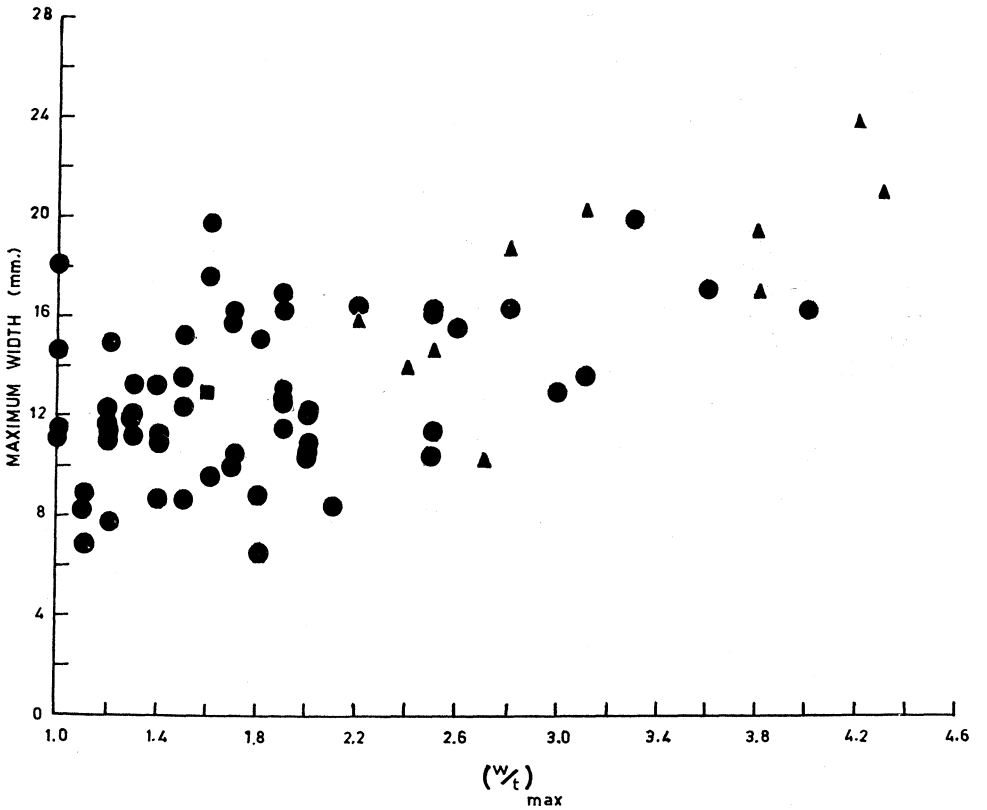


Fig. 21: Scatter diagram of w/t vs width for Auckland Museum straight *Kuru*

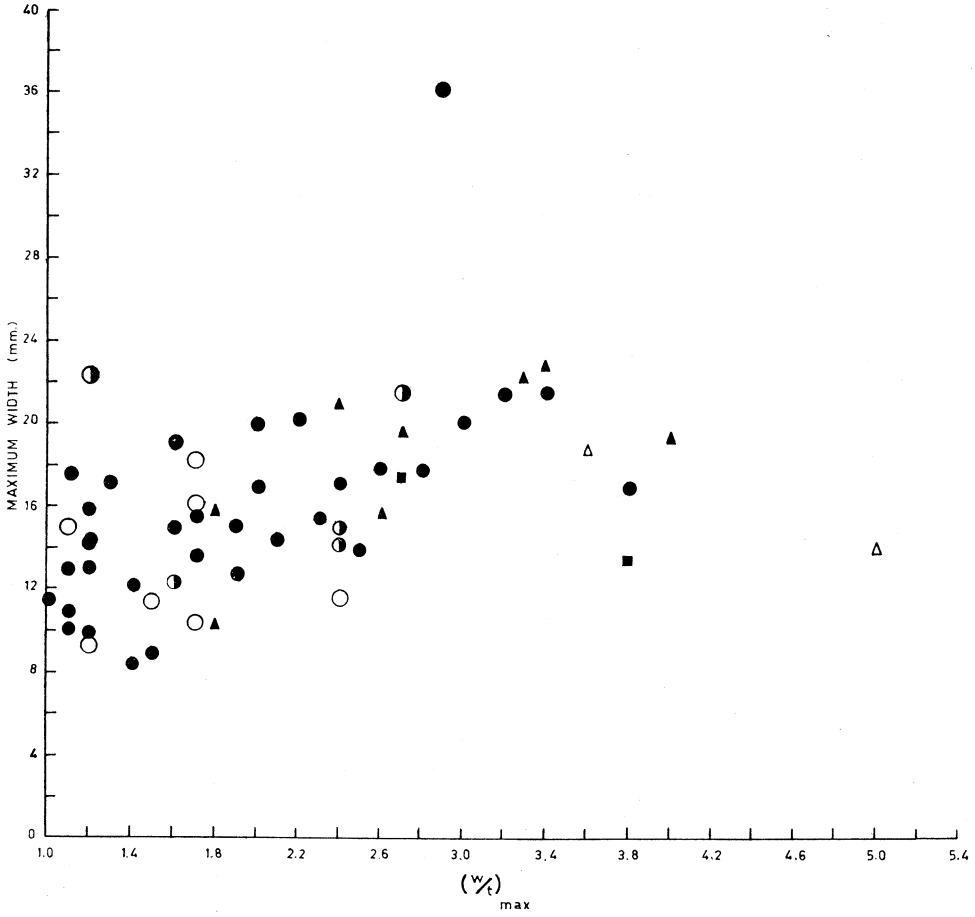


Fig. 22: Scatter diagram of *w/t* vs width for Australian Museum straight *Kuru*

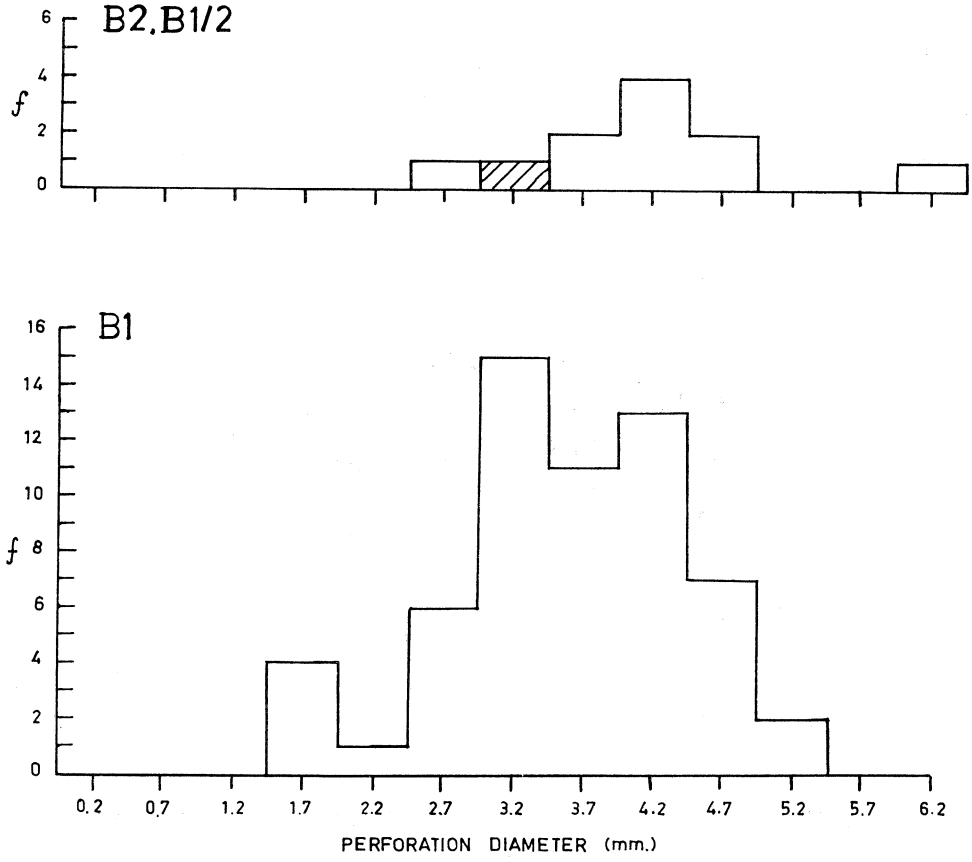


Fig. 23: Frequency histogram of perforation diameter for Auckland Museum straight *Kuru*

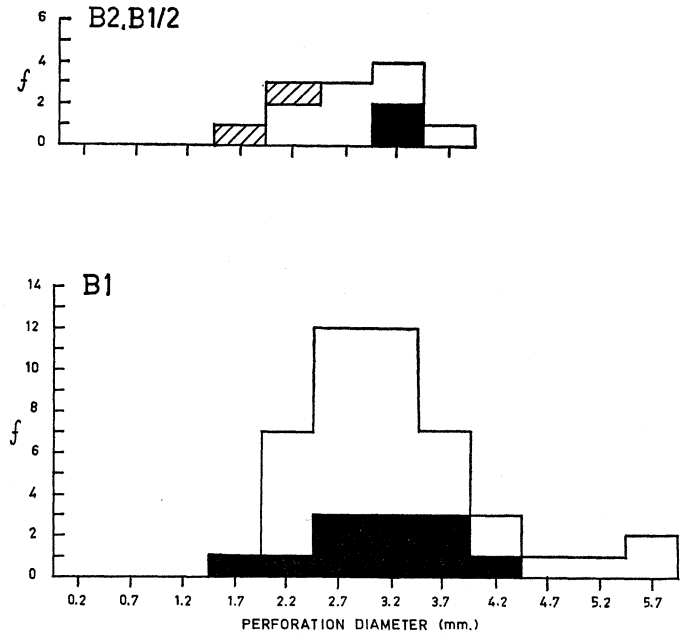


Fig. 24: Frequency histogram of perforation diameter for Australian Museum straight *Kuru*

Perforation diameter has been plotted against maximum width in figures 25 and 26. In the former there is a vague suggestion that perforation diameter increases lineally with width until $w_{(max)}$ reaches about 12 mm and then levels off, remaining predominantly between 3 and 5 mm. No such correlation is hinted at in the Australian Museum scatter diagram.

Figures 27 and 28 show perforation diameter plotted against butt to perforation length. Linear correlations of r = +0·52 and +0·48 (significant at P = 0·001 and P = 0·01, respectively) were calculated. Butt to perforation length was not found to be correlated with total pendant length.

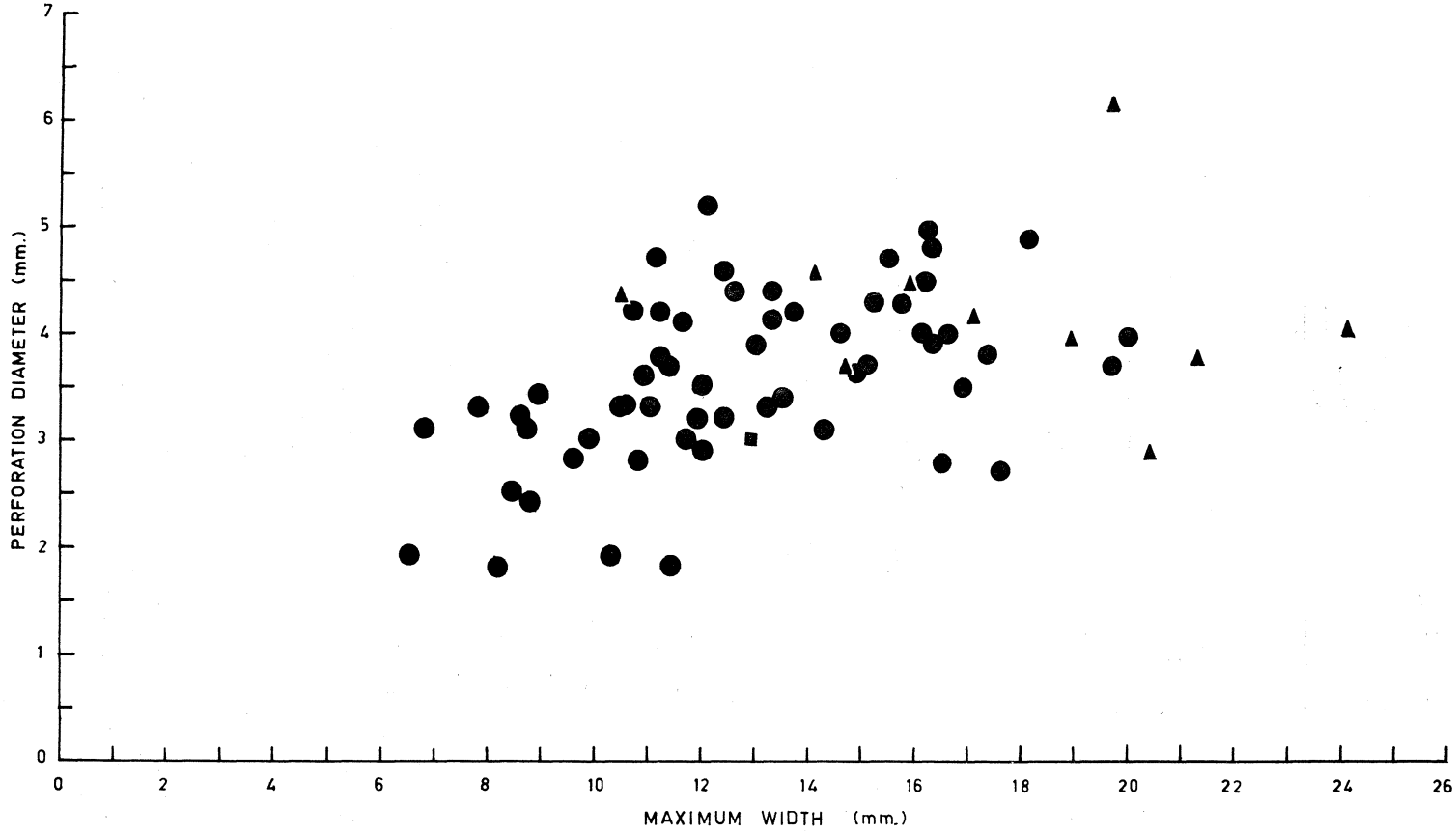


Fig. 25: Scatter diagram of perforation diameter vs width for Auckland Museum straight *Kuru*

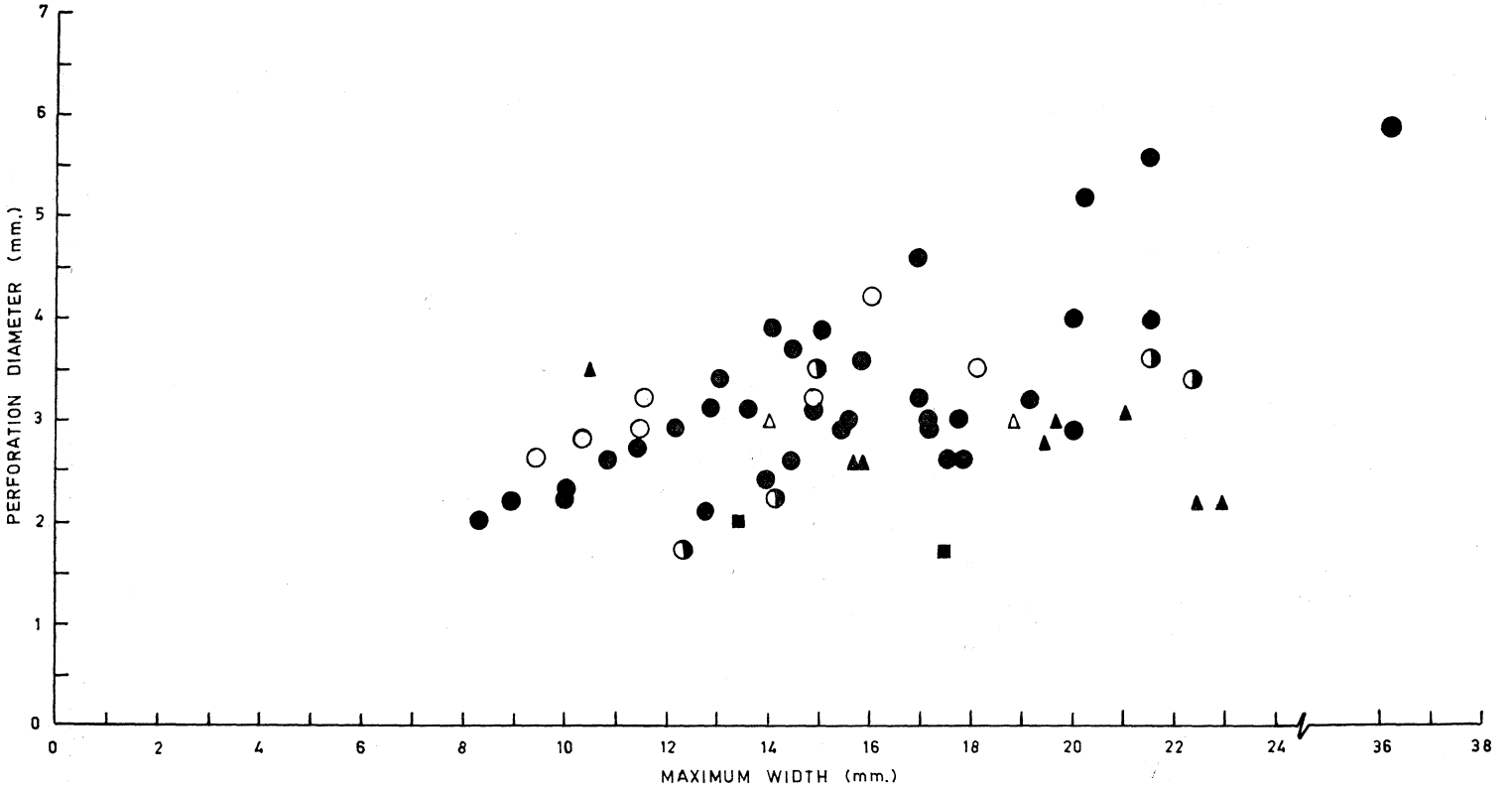


Fig. 26: Scatter diagram of perforation diameter vs width for Australian Museum straight *Kuru*

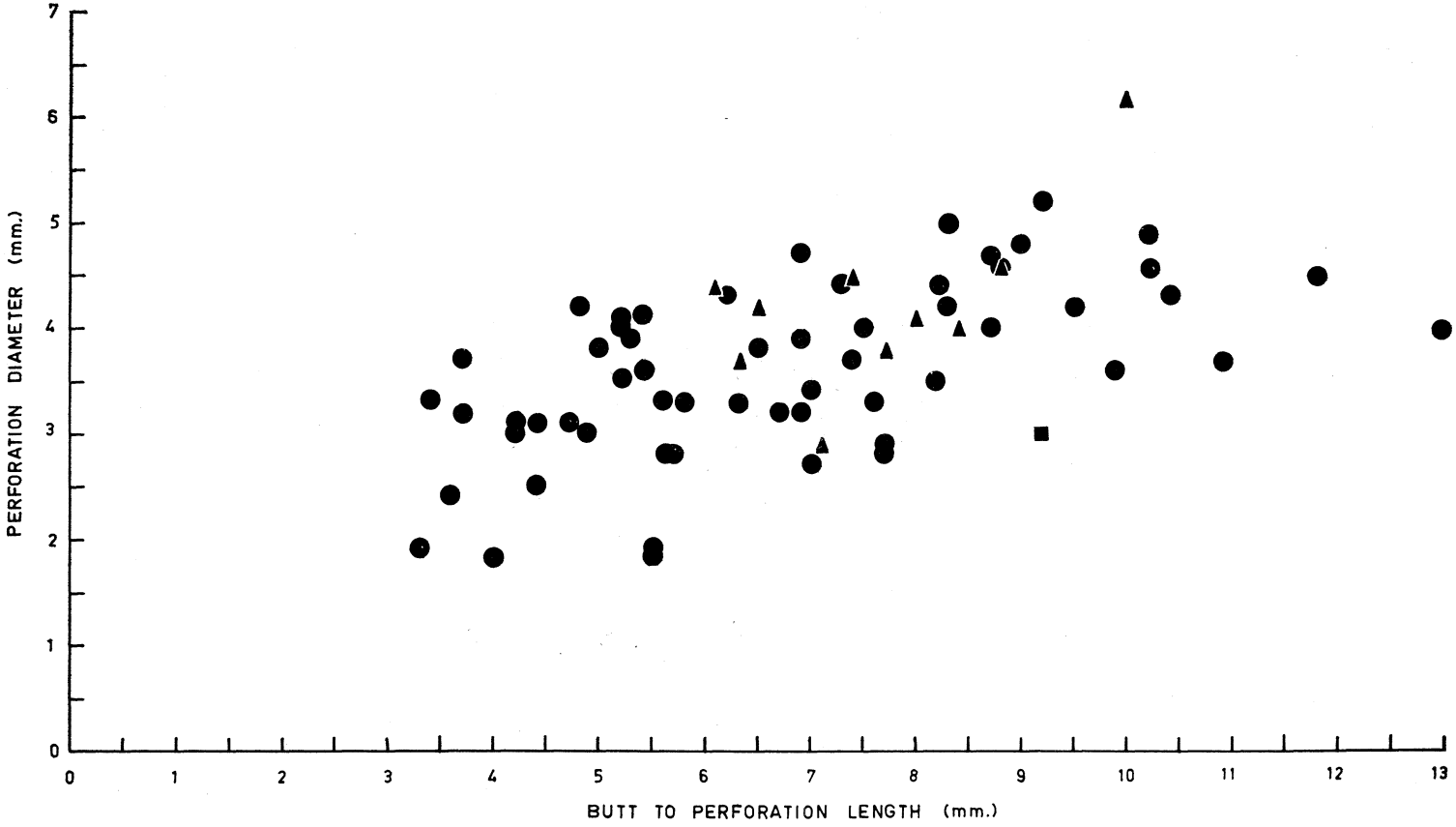


Fig. 27: Scatter diagram of perforation diameter vs butt-perforation length for Auckland Museum straight *Kuru*

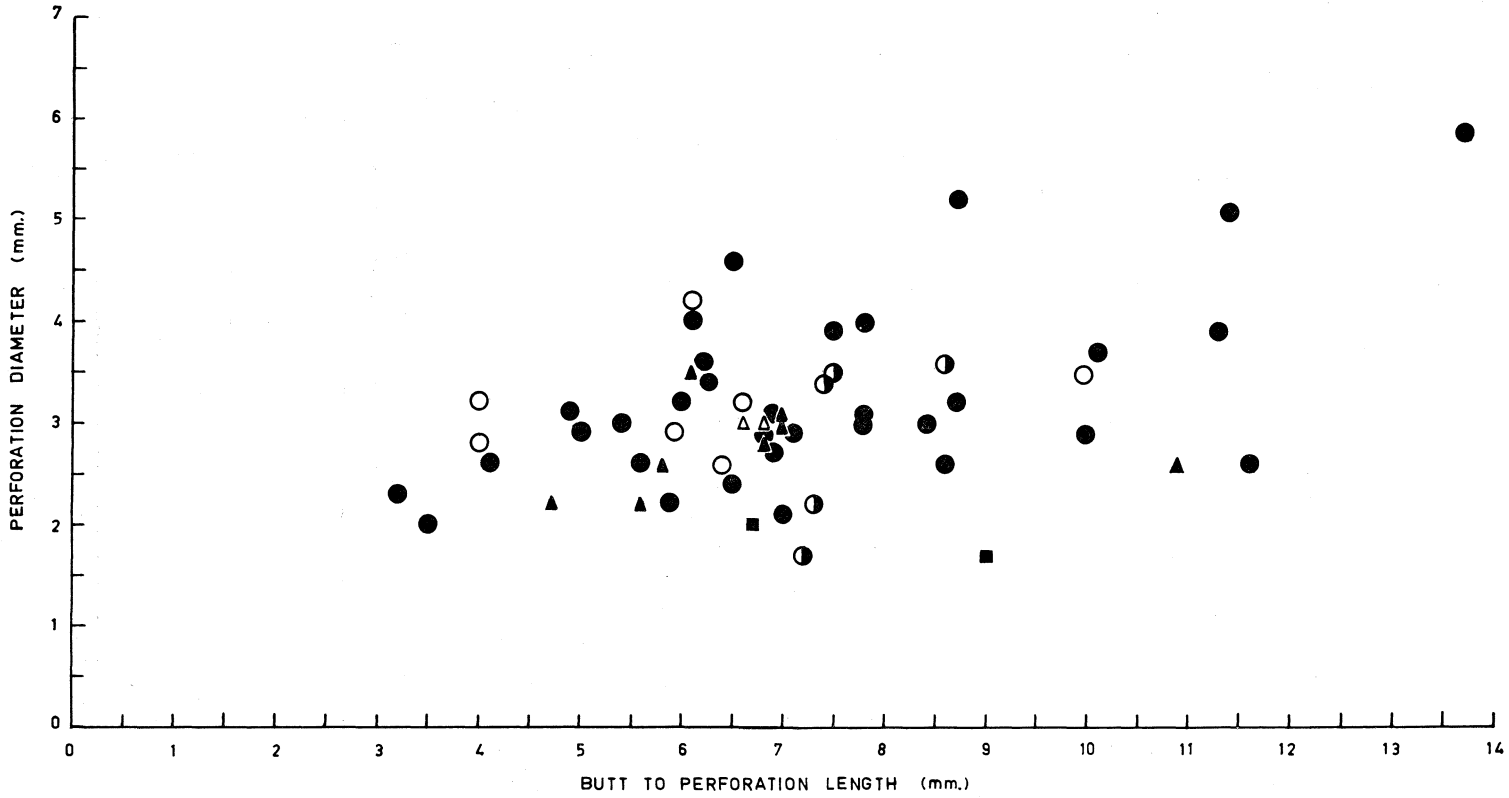


Fig. 28: Scatter diagram of perforation diameter vs butt-perforation length for Australian Museum straight *Kuru*

Finally, occurrence frequencies of various distal end forms exhibited by the different cross-sectional types are listed in table 5. The Auckland and Australian Museum samples do not differ significantly at P = 0·05.

TABLE 5. DISTRIBUTION OF DISTAL END SHAPES IN TWO SAMPLES OF B1 "M" PENDANTS

Distal shape	Sydney	Auckland
R	0	1
C	5	14
E	9	13
P	17	19
H	3	12

The above investigations have revealed several differences between the Sydney and Auckland samples to the extent that the former cannot be regarded as random. This is due to bias in the geographical or chronological distribution of these pendants; both factors may be relevant.

Some 35 per cent of the B1 straight *kuru* in the Australian Museum are of the "E" or "?E" category, and have been represented in the foregoing histograms and scatter diagrams. Median splits χ^2 analyses of combined "E-?E" specimens in figures 8, 10, 20, and 24 and corresponding Australian and Auckland Museum "M" pendants are given in table 6. The "E-?E" specimens do not differ significantly from either of the two "M" samples. However, this is not the case in some of the scatter diagrams (figures 12 and 26), where "E" pendants alone revealed statistically significant correlations (see table 7). Moreover, the correlations found for "M" pendants in figures 22 and 28 were not reflected by "E" specimens, whilst "?E" pendants do not show correlations in any of the scatter plots. Despite these differences "E-?E" pendants should generally be seen as successful reproductions of a protohistorically-defined conceptualised type.

TABLE 6. χ^2 ANALYSIS OF SYDNEY B1 "E-?E" PENDANTS AND B1 "M" SPECIMENS FROM SYDNEY AND AUCKLAND

Parameter	χ^2	
	Sydney	Auckland
Length (total)	0·38 *	0·065*
Width (maximum)	0·005*	1·53 *
$w/t_{(max)}$	0·23 *	0·20 *
Perforation diameter	0·04 *	1·86 *

* Not significant.

B2 and hybrid B1/2 specimens are mere varieties of the B subtype and hence, in general, should not differ markedly from B1 pendants. This is borne out in the scatter diagrams where B2, B1/2 correlations for Auckland and Australian Museum specimens correspond to those found for B1 pendants (see table 7), except in the case of figure 28. Because of their distinctive cross-sectional forms B2, B1/2 pendants are indistinguishable from B1 specimens at low w/t values, hence the expected differences in figures 19 and 20 (see also table 8). In view of these w/t ratios, and the correlations shown in figures 21 and 22 (cf. table 7), the differences observable in figure 9 (cf. table 8) are to be expected.

TABLE 7. CORRELATION COEFFICIENTS FOR PLOTTED SCATTER DIAGRAMS

Plot	Sydney				Auckland	
	B1			B1/2, B2	B1	B1/2, B2
	"M"	"E"	"?E"	"M"	"M"	"M"
Length (total) vs width (maximum)	...	+0·82*	...	...	...	...
Thickness (at $w_{(max)}$) vs width (maximum)	...	...	...	...	...	...
$w/t_{(max)}$ vs width (maximum)	+0·62‡	...	...	+0·69*	+0·39†	+0·74†
Width (perforation) vs width (maximum)	+0·94‡	+0·93†	+0·98†	+0·84†	+0·84‡	+0·76†
Perforation diameter vs width (maximum)	...	+0·79*	...	...	*n*	...
Length (butt to perforation) vs length (total)	...	...	...	...	...	...
Perforation diameter vs length (butt-perf.)	+0·48†	...	...	...	+0·54‡	+0·64*

... No correlation.
n ?Non-linear correlation.
* Correlation at $P = 0{\cdot}05$.
† Correlation at $P = 0{\cdot}01$.
‡ Correlation at $P = 0{\cdot}001$.

TABLE 8. χ^2 ANALYSIS OF B1 AND (B2, B1/2, A-B1) PENDANTS FROM AUCKLAND

Parameter+	χ^2
Length (total)	0·004*
Width (maximum)	6·80 ‡
$w/t_{(max)}$	5·92 †
Perforation diameter	1·63 *

+ Yate's Correction applied in each case.
* Not significant.
† Significant at $P = 0{\cdot}05$.
‡ Significant at $P = 0{\cdot}01$.

(6) The Status of the *Kuru Papa*

Best (*op. cit.*) states *kura papa* are "flat" but nowhere describes them in detail. Does "flat" relate to frontal (plan) appearance, or to a rectangular or sub-rectangular cross-section? Since these pendants were probably described as "worn" the first alternative is more likely. Therefore, the greater the w/t ratio the greater the probability of a flat plan appearance. L'Horme's description (*op. cit.*) of this subtype mentions it as like a playing counter, suggesting that an upper length/width ratio limit existed. This value is not quoted by any authorities and the only basis to work on is the $l/w_{(max)} = 5{\cdot}0$ value derived from the 1769 observations of L'Horme *et. al.* (see Kelly 1967: plate 1). Thus *kuru papa*, if a separate subtype amongst the Auckland and Australian Museum samples, should show up as a distinct cluster within the area $w/t \geqslant 2{\cdot}5$ and $l/w \leqslant 5{\cdot}5$ when these two parameters are plotted against one another. As figures 29 and 30 show, there are undoubtedly a few pendants in either sample that must be classified as *kuru papa* on the basis of the above criteria, but no clustering is apparent and many marginal cases exist about the specified limits. All this suggests that the Australian and Auckland Museum "*kuru papa*" do not constitute a separate subtype but rather should be seen as terminal specimens, possessing small l/w ratios, within the continua subtypes of figure 3.

From L'Horme's description and associated graphical records (Kelly 1967: plate 1; Milligan 1958: plates 1 and 2) it would appear that the *kuru papa* existed as a late prehistoric straight *kuru* subtype, at least at Doubtless Bay. However, these pendants are neither common nor distinctive in (protohistorically-derived) collections, which must stem from their undesirability or unavailability as trade items. Because of their rarity the *kuru papa* cannot be considered a valid protohistoric-historic Classic Maori pendant subtype. Best's ascription of *type* status to it is probably based on Surville voyage documentation.

Why this prehistoric pendant subtype did not imitate other straight *kuru* in protohistoric trade response is not known, for it was presumably just as easily manufactured, and was present in an area where Maori-Pakeha trafficking was established early, at a time when the normative features of "desired" curiosities were not yet standardized. This, incidentally, raises the question of why pendants of A and A-B1 cross-sections did not supersede B1 and B2 specimens as preferred protohistoric trade items, since they would have been much easier and faster to manufacture. The answer must lie in the significance of Maori mental concepts of the desired shape of straight *kuru;* these were retained because straight *kuru* were not only trade items but were also utilized by the Maoris in the traditional manner. Only with the change to European equipment was there any significant production of A *kuru*, but "traditional" B pendants, likewise simple to manufacture, remained the favoured variety.

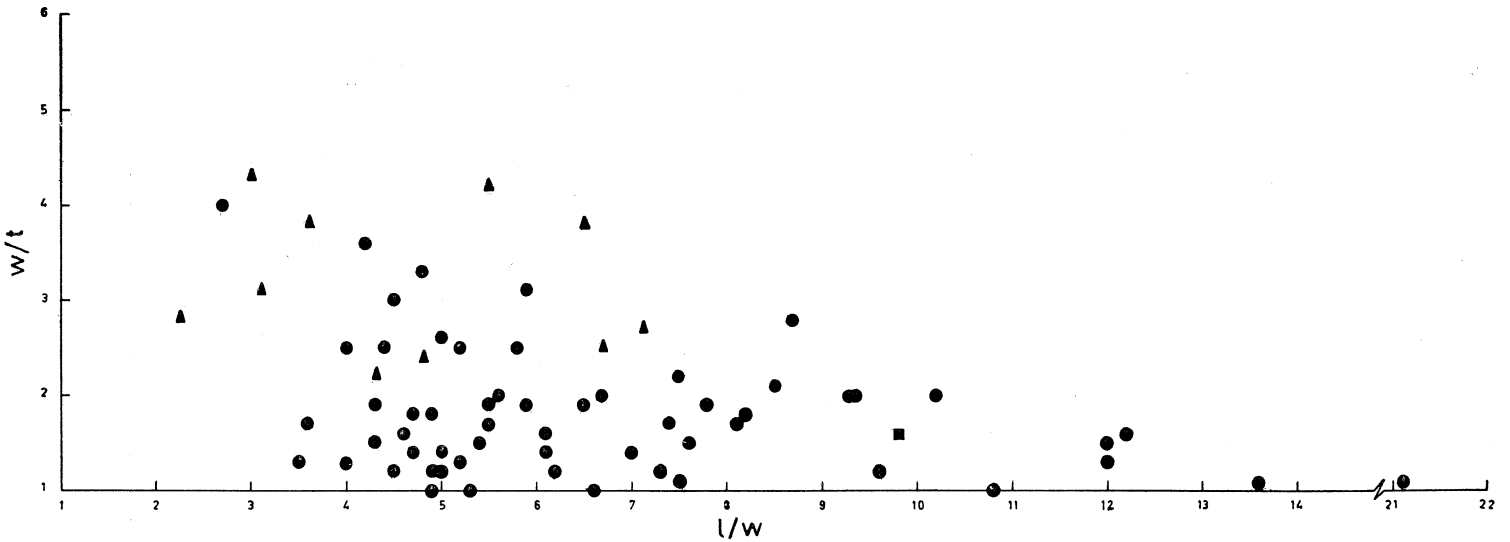


Fig. 29: Scatter diagram of w/t vs $1/w$ for Auckland Museum straight *Kuru*

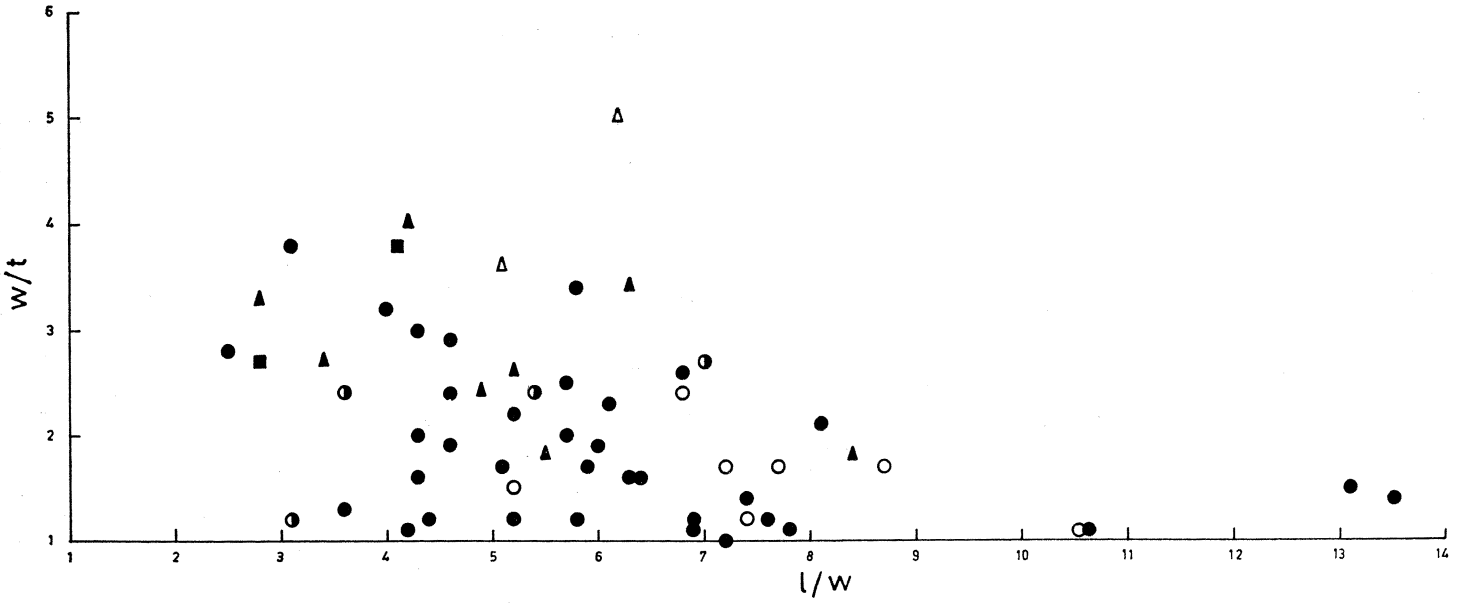


Fig. 30: Scatter diagram of w/t vs $1/w$ for Australian Museum straight *Kuru*

OTHER ELONGATED PENDANTS

Sixteen elongated pendants in the Australian Museum which do not conform to the straight *kuru* A and B subtype criteria are now considered. Five of these are *kuru kapeu* (also called *tautau*), and closely resemble straight *kuru* but for their characteristic curved distal ends (in hockey-stick fashion). The remaining pendants are anomalous.

(1) Descriptions of the Pendants

Metrical and other details of the five *kuru kapeu* are given in table 9. In the column entitled "Material" N is for nephrite or semi-nephrite and B bowenite.

Eleven *kuru* differing significantly from those of tables 1 and 9 above are listed in table 10, and a number of them illustrated in figure 31. Pendants E 54517 to E 54526 are from the Dixson Collection. Both E 1461 and E 2405 are characterized by pointed distal ends, in contrast to all the "M" pendants of table 1. The thickness changes, giving rise to varying cross-sectional ratios, are also a notable feature of these two *kuru*. Pendants E 2406 and H 334 are remarkable for their changing widths, thicknesses, and hence cross-sections, as shown in figure 31. E 54523 and E 54524, both fashioned in an attractive pale greenstone, are virtually identical in all respects, as is also the case for E 54525 and E 54526. However, all four pendants are markedly atypical in form as figure 31 shows. The final pendant shown is H 156 (cf. the photograph and line drawing in Thorpe 1924: 181), a beautiful "Cook Relic" specimen obtained from John Macrell. The Museum register lists this as an eardrop worn by a chief and presented by him to Captain Cook. Attached to a two-ply flax cord tied to the proximal end is a 65-cm length of thin twisted flax fibre (see figure 31, inset A).

(2) Discussion

The *kuru kapeu* is undoubtedly a prehistoric pendant type, as it was recorded in the East Coast-Hawkes Bay area in October 1769, when, in all probability, it was confined to male *rangatira* (Orchiston 1972b: Location 3 and 8 accounts). A tangiwai *kuru kapeu* with proximal end suspension grooving instead of a perforation has been reported (Rolston 1947: 260) from a Horowhenua swamp *pa*. On the basis of other artifact finds there (Rolston 1944) this pendant must be assigned a prehistoric date.

Genuine ("M") *kuru kapeu*, although present in museum collections, are not nearly as abundant as straight *kuru*, which suggests that during protohistoric times they did not react as vehemently to Maori-Pakeha trading activities. Possibly the reason for this is that straight *kuru* were much easier, hence less time-consuming, to manufacture. Nevertheless, production of this type may have continued during the protohistoric period as specimens have been reported from Oruarangi (Fisher 1941: 24–25, and plate 6), Pa Bay (Thacker 1961: 11), and Murdering Beach (Skinner 1915: figure 9), for example.

TABLE 9. AUSTRALIAN MUSEUM *KURU KAPEU*

Register Number	Length (l)		Perf. dia.	Width (w)		Thickness (t) at $w_{(max)}$	$w/t_{(max)}$	Material	Manufacture	Acquisition	
	Total	To perf.		At perf.	Max.					Method	Date
E 32709	63·0	4·5	1·7	7·0	11·9	4·3	2·8	N	M	E*	1929
E 54519	152·5	6·0	3·3	13·5	17·3	4·9	3·5	N	?E	D	1951
E 54520	145·5	6·4	2·2	10·2	17·5	6·9	2·5	B	?E	D	1951
E 54521	106·7	5·2	4·4	11·6	12·4	6·8	1·8	N	M	D	1951
E 54522	81·0	8·5	5·7	11·3	11·8	5·8	2·0	N	?E	D	1951

* From Auckland Museum.

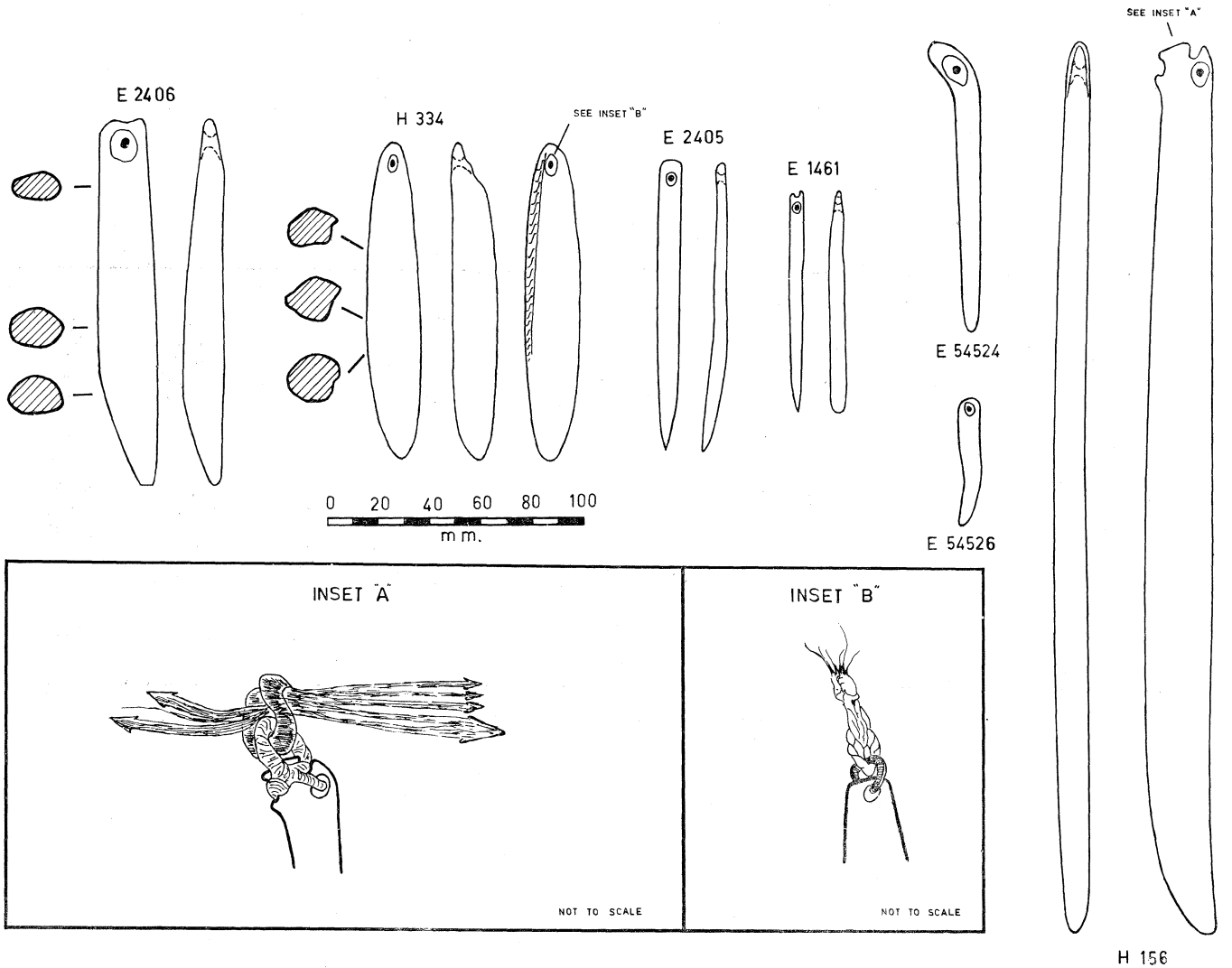


Fig. 31: Some examples of Australian Museum anomalous elongated *Kuru*

TABLE 10. AUSTRALIAN MUSEUM ANOMALOUS ELONGATED *KURU*

Register Number	Length	Cross-section	Material	Manufacture	Acquisition		Remarks
					Method	Date	
E 1461	>80·7	A	N	?E	P	1887	Broken at former perforation—see figure 31.
E 2405	105·8	A-B1	B	?E	P	1889	See figure 31.
E 2406	134·0	Irreg.	N	?E	P	1889	See figure 31.
E 52010	79·4	A	N	E	P	1946	R distal end. Variable thickness—very thin at proximal end. Identical width throughout entire length.
E 54517	155·3	A	N	E	D	1951	Atypical change in width. Identical thickness throughout entire length.
E 54523	107·4	B1(var)	N	E	D	1951	Almost identical to E 54524.
E 54524	106·3	B1(var)	N	E	D	1951	See figure 31.
E 54525	48·7	A-B1	B	E	D	1951	Almost identical to E 54526.
E 54526	46·0	A-B1	B	E	D	1951	See figure 31.
H 156	332·4	B1	B	M	D	1894	See figure 31.
H 334	117·3	Irreg.	N	M	D	1894	See figure 31.

One of the most notable features of table 10 is the prevalence of "E" and "?E" specimens. None of the shapes represented by these pendants, with the possible exceptions of E 2406 and H 334, is characteristically prehistoric or protohistoric. As tables 1 and 2 have shown, pendants of A cross-section are virtually non-existent in protohistorically-derived collections.

H 334 is one of the "Cook Relics" purchased by the Government of New South Wales from the Reverend Cannon Bennett. If an authentic Cook-era pendant, it in all probability came from Queen Charlotte Sound during either the second or third voyage.

H 156 is unique: although the author has visited all the major New Zealand museums in 1969, 1970, and 1971, and viewed large numbers of Maori pendants, nothing quite like it was seen anywhere. Contrary to Skinner's (1933: 6) claim, H 156 differs from his pendant No. 37 in that the latter has a curved distal end—almost in *kuru kapeu* fashion—and the suspension arrangement consists of one groove and a perforation. No Cook period locality attribution is possible for this pendant.

RARER PENDANTS

Considered in this section are nineteen pendants which differ radically from all the above specimens. Most of these can be allocated to well-defined types that are noted for their rarity (when contrasted with straight *kuru*).

(1) Descriptions of the Pendants

These pendants, mainly from the Dixson Collection, are listed in table 11. Pendants E 54464 to E 54453 are featured in plates 22–24, and the remainder illustrated in figure 32. E 54470 has tentatively been listed with the *pekapeka*, as this is where its closest affinities lie. Similarly, E 54463 is identified as a *hei matau* form. Pendants

TABLE 11. AUSTRALIAN MUSEUM RARER PENDANTS

Register Number	Type	Material	Manufacture	Acquisition		Remarks
				Method	Date	
E 54464	*Koropepe*	N	M	D	1951	
E 54465	*Koropepe*	N	M	D	1951	
E 54466	*Koropepe*	B	E	D	1951	
E 54548	*Koropepe*	B	E	D	1951	
E 54460	*Pekapeka*	N	M	D	1951	
E 54461	*Pekapeka*	B	?E	D	1951	
E 54462	*Pekapeka*	B	?E	D	1951	
E 54470	*Pekapeka* form	N	M	D	1951	Belonged to Nene's wife.
E 54467	*Poria*	N	M	D	1951	
E 54468	*Poria*	N	M	D	1951	
E 54463	*Hei matau* form ..	N	?E	D	1951	
E 54453	*Rei puta* form	N	M	D	1951	
E 484	Triangular pendant ..	N	M	P	1887	Lost by a chief of Pepin Island.
E 1459	Triangular pendant ..	N	M	P	1887	Parapara.
E 54469	Triangular pendant ..	N	M	D	1951	Belonged to Nene's wife.
E 54502	Triangular pendant ..	N	M	D	1951	
H 63	Triangular pendant ..	N	M	D	1895	
None	Triangular pendant ..	N	M	?	?	
E 489	Anomalous	N	M	P	1887	

E 484 to the unregistered specimen, all triangular to oval pieces of polished greenstone, constitute an as yet unnamed type here termed "triangular pendant". All the *koropepe*, *poria*, *pekapeka*, and triangular pendants have been bifacially worked, the reverse faces generally mirroring those illustrated. E 54460 and E 54470 are composed of the same source material: an attractive pale greenstone with yellowish streaks and blotches throughout.

(2) Discussion

Koropepe (snake-like amulets—see plate 22) were worn as ear ornaments (Best 1952: 229), and only made an appearance as greenstone artifacts in protohistoric or historic times (Orchiston 1972b). Indeed Skinner (1969) would go so

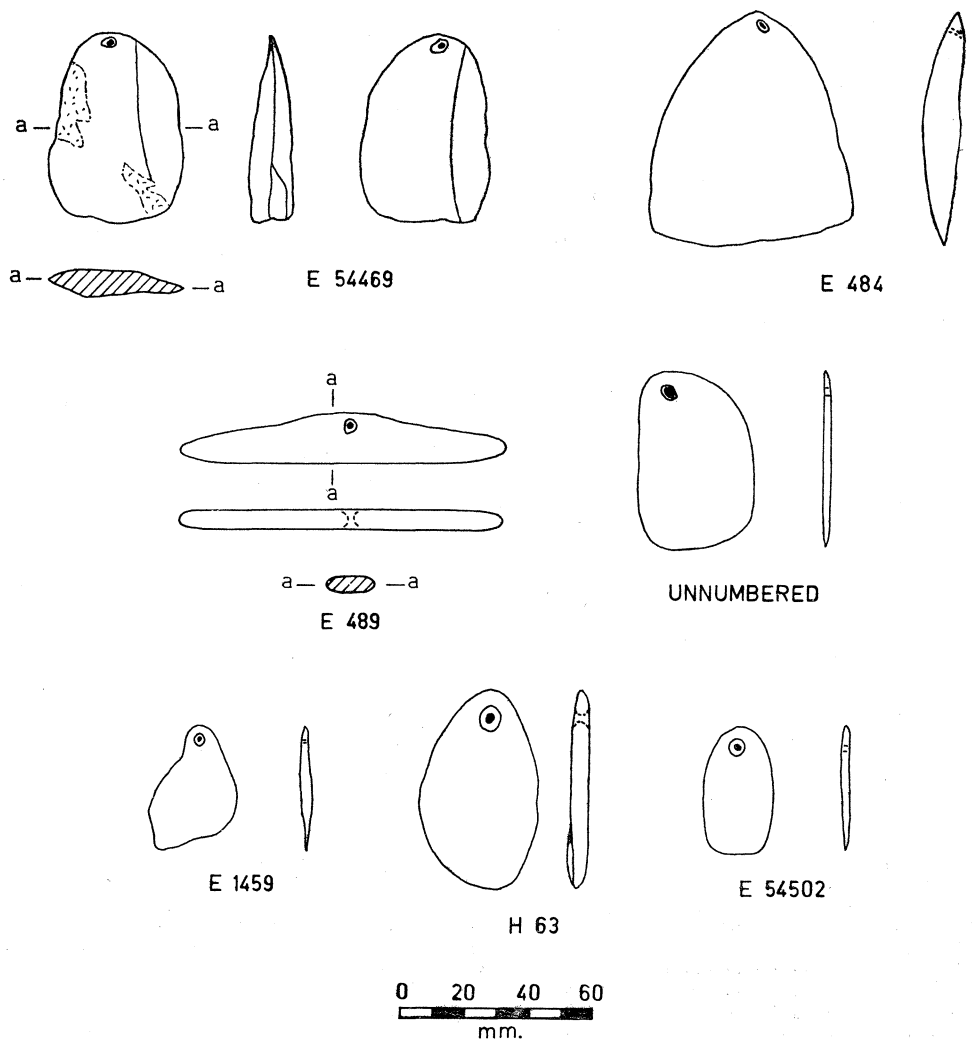


Fig. 32: Some examples of Australian Museum rarer pendants

far as to claim that all greenstone specimens were manufactured during the historic era, and that they were produced by Trevor Lloyd, of Auckland. The two "M" specimens in the Australian Museum thus demonstrate the degree of perfection fakers were able to achieve, also a feature of other faked rarer pendant types. E 54548, although manufactured with European implements, is interesting in that its eyes contain sealing wax, which was only introduced during the protohistoric period—by 1827 at the Bay of Islands (Wright 1950: 182).

Pekapeka (see plate 23), if present as a prehistoric type, were extremely rare, and only rose from obscurity in protohistoric times (Orchiston 1972b), their geographical distribution being restricted to the North Island with a strong Northland bias (Skinner 1935: 20). The three Sydney specimens closely resemble examples figured by Oldman (1935: Figure 20) and Skinner (1933: 8, No. 41 from Kaikohe). It is claimed in the Museum register that *pekapeka* form E 54470, together with E 54469 (a "triangular pendant"), was formerly the property of Nene's wife, and that these were taken from her remains. Tamati Waka Nene (an important protohistoric-historic periods chief from Hokianga—see Graham 1965: 36–37) had two wives and probably these pendants relate to Ihapera who died in 1837, rather than to Mata (Martha).

Poria, or parrot rings, were generally manufactured in bone, and greenstone examples (see plate 24) only made an appearance in protohistoric times (Orchiston 1972b). Once again the "M" classification of these ear pendants should be seen as indications of the artisans' skills.

No evidence is available on the prehistoric time-depth of the *hei matau* (fish-hook pendant), regarded by Buck (1962: 286) as either a neck or ear ornament depending on size. However, this type was certainly being produced at an early date in the protohistoric period (see Orchiston 1972b). These pendants are most abundant in South Canterbury, Otago, and Southland, although occasional North Island specimens do exist. E 54463, the Australian Museum example (see figure 24), differs somewhat from the *hei matau* figured by Hamilton (1908: 17–18, 20), Oldman (1935: 246, and figure 20), Skinner (1933: 315–316, plate B), and Webster (1948: 66–69), and viewed by the author in New Zealand museums, but morphologically it is more divorced from the Northland variety than those of other areas.

The *rei puta*, a whale-tooth neck pendant, was observed in Northland during the 1770's (see Orchiston 1972b), and turns up subsequently in protohistoric sites (e.g., Oruarangi—Fisher 1934: 276 and plate 62). But since it was always manufactured in whale ivory the Sydney specimen (plate 24) must be assigned a protohistoric or more likely historic date. Nevertheless, this artifact is a realistic copy and somewhat resembles the specimen from Orepuke figured by Hamilton (1908: the right-hand one on page 121; cf. Skinner 1943: 133, 142). Greenstone *rei puta* of the quality of the Sydney example are rare—a cursory examination of a number of New Zealand museum collections revealed only one similar specimen.

Triangular pendants, thin oval or triangular shaped pieces of polished greenstone (see figure 32), were observed as neck ornaments worn by *rangatira* at and near Hawkes Bay in October 1769 (Orchiston 1972b: location 6, 9, and 10 accounts). Their manufacture was continued during the protohistoric period, as evidenced by Murdering Beach specimens (Webster 1948: 72–73), for instance. H 63, another "Cook Relics" pendant, if authentic, probably came from Queen Charlotte Sound during the second or third voyage (Orchiston 1972a, 1972b).

E 1459 is attributed to Parapara where Heaphy (1848a, b, c) recorded a *pa*, "fishing station", and a small settlement, in 1848 (see figure 33). A field survey by the author in November 1969 showed the spit to be the only other location around the Inlet with archaeological sites, but since these belong to the Archaic Maori era there are some grounds for assigning this pendant to one of Heaphy's protohistoric sites. The origin of E 54469 has already been referred to above.

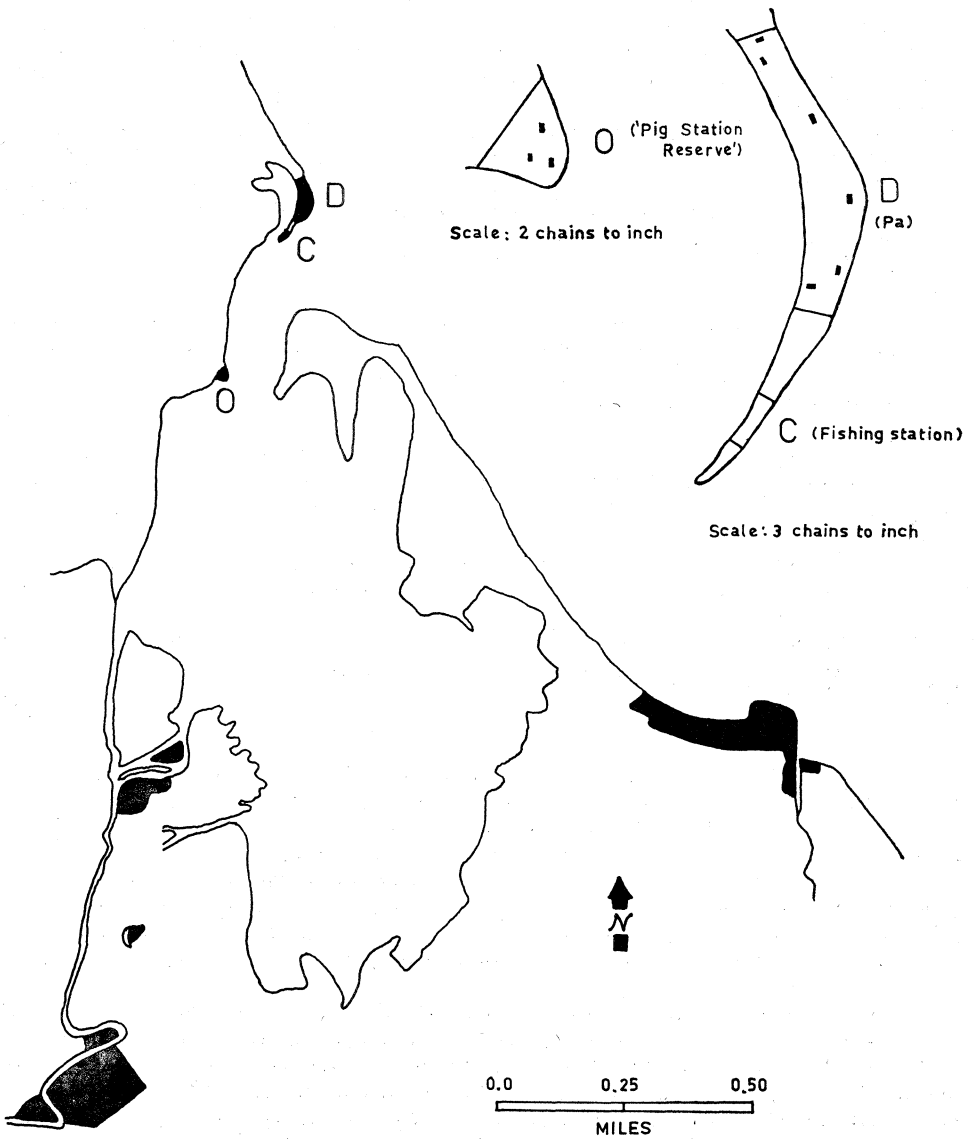


Fig. 33: Protohistoric Maori sites at Parapara (after Heaphy 1848a. Details of Reserves C, D, and O after Heaphy 1848b, and 1848c, respectively)

E 489 is an anomalous specimen that does not belong to any recognized type. It bears a superficial resemblance to a bone ear pendant figured by Parkinson (1784: f128, specimen No. 12) but nowhere mentioned in the text of any of the early protohistoric sources.

CONCLUSIONS

Greenstone pendants, as an important component of Maori material culture, generally feature prominently in museum displays. Types represented and on exhibition in the Australian Museum are the *tiki*, perforated chisel, triangular pendant, straight *kuru*, *kuru kapeu*, *poria*, *pekapeka*, *koropepe*, and *hei matau*.

The straight *kuru* is the most commonly represented greenstone type in the Australian Museum. Pendants of this form were not common in 1769–1770 but their number increased enormously during protohistoric times, primarily in response to European demands. It is to this period that most of the "M" straight *kuru* in the world's museums belong. These were mainly traded through North Island centres. The *kuru papa*, a flattened form of straight *kuru*, was present in 1769 at Doubtless Bay but did not continue as a subtype in protohistoric times. During early historic times there was a transfer to European implements in pendant manufacture, and with it came mass-production of straight *kuru* with A cross-sections, but B specimens were also easy to produce and, as "traditional" straight *kuru*, remained the preferred variety. Statistically, these latter "E" pendants differ little from their prehistoric-protohistoric "M" counterparts.

During late protohistoric times or in the historic period the wearing of straight *kuru* as neck pendants was introduced. Generally, these were metrically indistinguishable from those worn at the ear.

The recent trend towards quantitative studies of specific Maori artifacts (Crosby 1966; Hjarno 1967; Shawcross 1964a, b) has been continued in this paper. Metrical attributes of a random sample of 70 "M" straight *kuru* from the Auckland Institute and Museum have been investigated and relationships between various parameters explored. Technological and functional factors influenced or limited pendant length, width, and perforation diameter, all of which, when plotted in histogram form, show skewed unimodal Gaussian curves. Positive linear correlations were found between maximum width and w/t, and between perforation diameter and butt to perforation distance. There is no correlation between pendant length and maximum width. Australian Museum "M" straight *kuru* were subjected to identical examination and, on the basis of statistical analyses, and their scatter diagrams and frequency histograms, were found to differ significantly from the Auckland Museum random sample. Geographical and/or chronological factors are responsible for this sample bias.

Other pendant types considered in this paper are the *kuru kapeu* (5 examples), *hei matau* (1), *pekapeka* (4), triangular pendant (6), *koropepe* (4), *poria* (1), and *rei puta* (1). As greenstone types these last three only appeared during late protohistoric times or in the historic period. None of the other types listed was common, if at all present, in 1769–1770, and specimens currently in museums are predominantly protohistoric in origin. Faked specimens of all of these types were manufactured with European implements during historic times and it is to this category that all such Australian Museum pendants, except two *pekapeka*, some of the *kuru kapeu*, and most of the triangular pendants, must be allocated. The excellent workmanship put into some fakes is apparent in the cases of the *rei puta*, and two of the *koropepe*.

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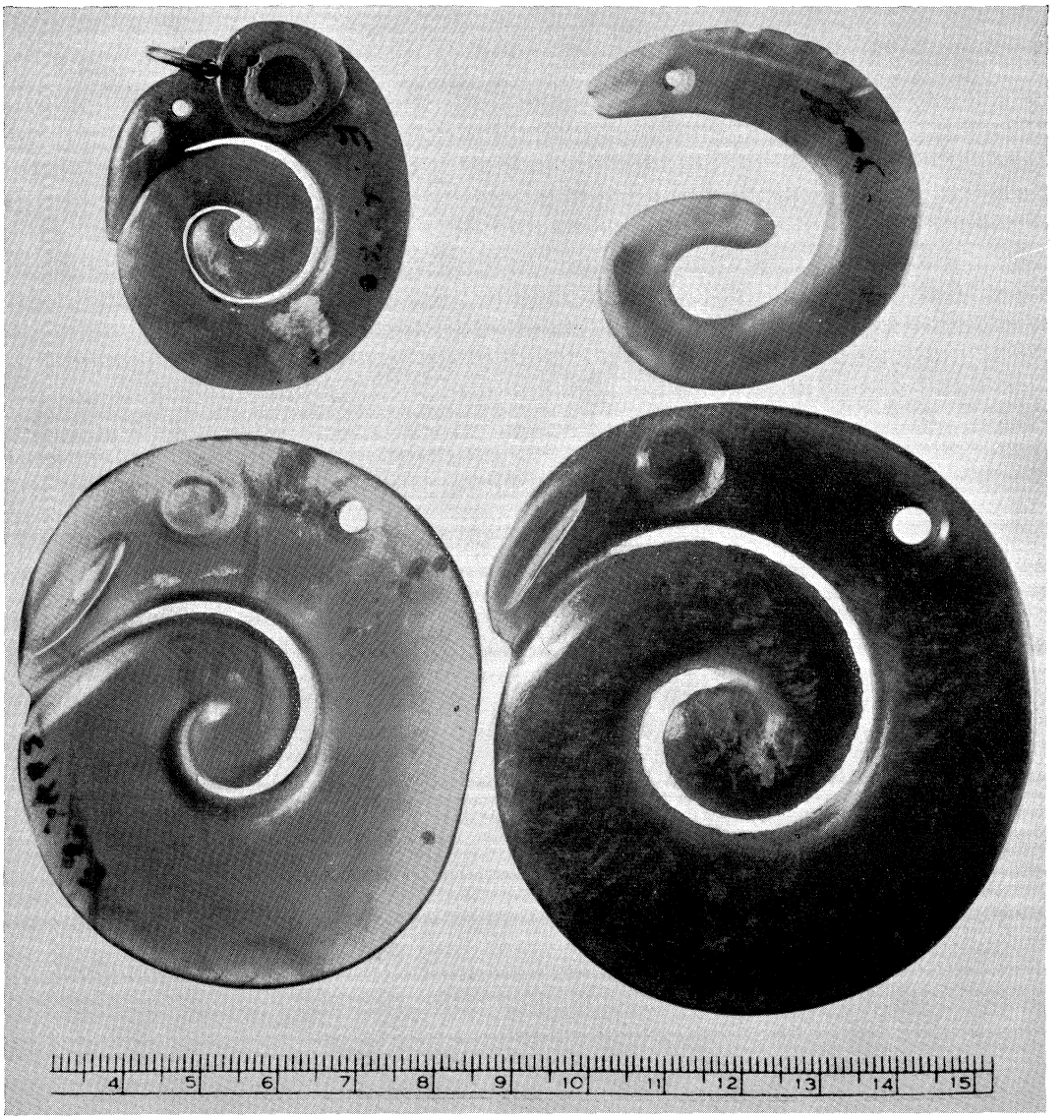

Koropepe: upper left, E 54548; upper right, E 54466; lower left, E 54465; lower right, E 54464

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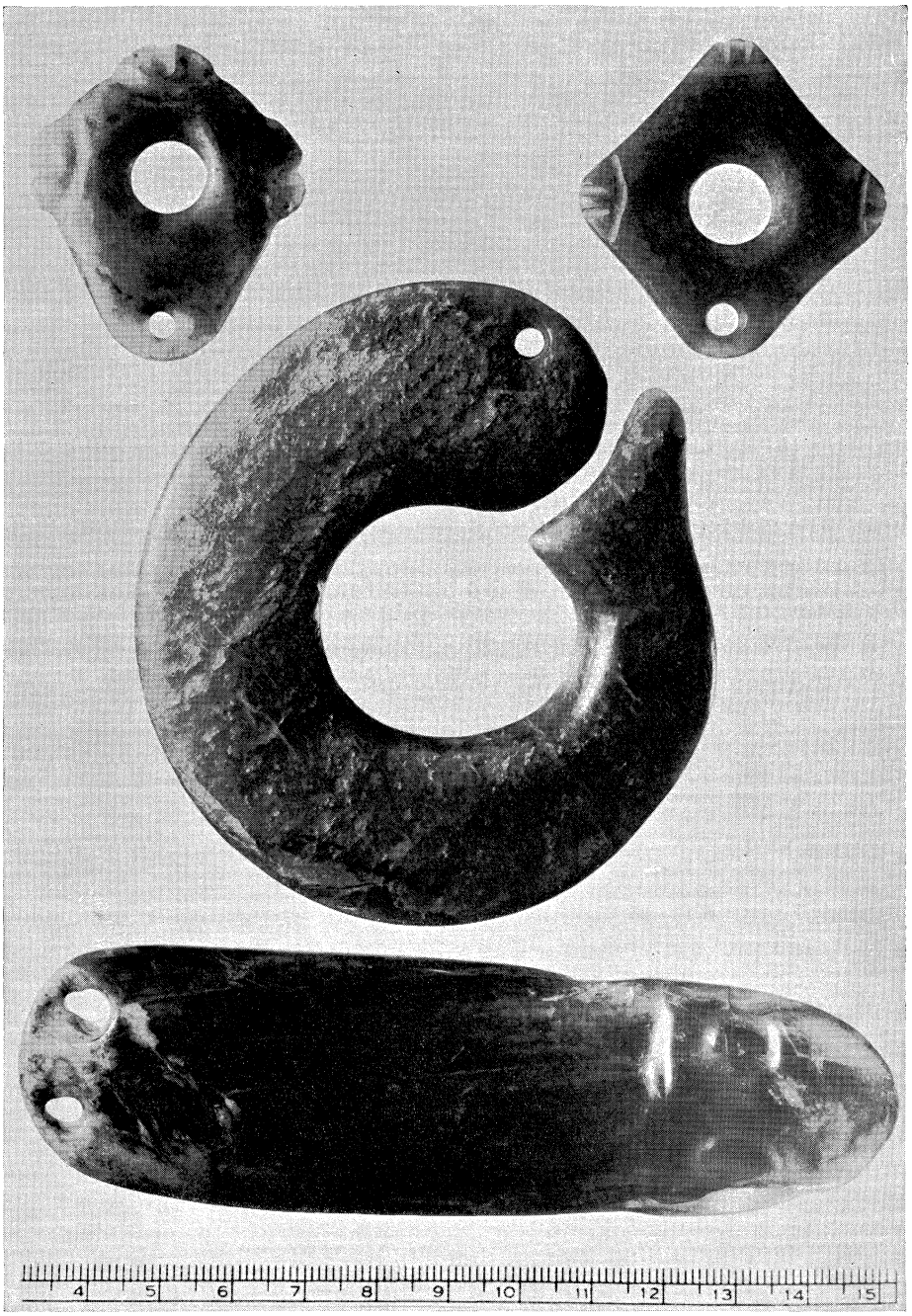
Pekapeka: upper left, E 54460; upper right, E 54461; lower left, E 54462; lower right, E 54470



Poria: upper left, E 54467; upper right, E 54468. *Hei matau* form, centre, E 54463. *Rei puta* form, bottom, E 54453