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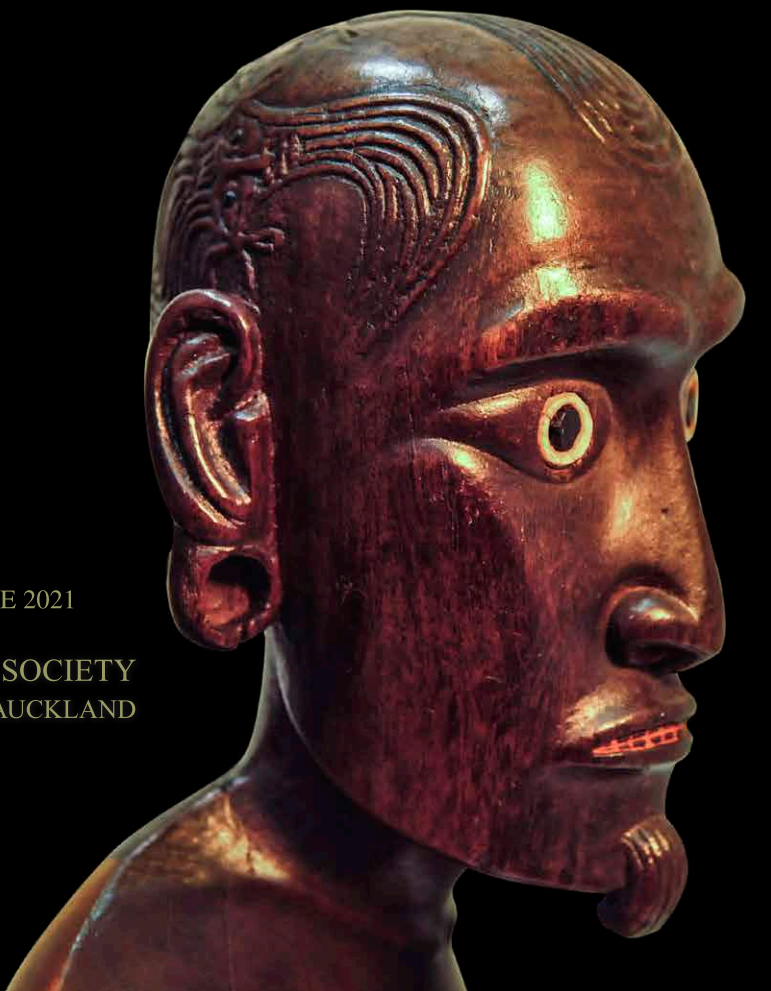

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Cover image: *Mōai taŋata* wooden figurine from Easter Island, curated in the Peter the Great Museum of Anthropology and Ethnography, St Petersburg (Inv. 402-2; acquired by Nicholas Miklouho-Maclay 1871). Red pigment is preserved on the teeth and in the nostrils; the glyph "Three Water Spirits" features tiny obsidian inlays. Photograph by Albert Davletshin, by the courtesy of Tatiana Sokolova (Senior Curator of the collection "Oceania, Australia and Indonesia").

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HATCHING IN THE HIEROGLYPHIC SCRIPT AND ICONOGRAPHY OF EASTER ISLAND (RAPA NUI): COMPARISON WITH MAYA AND NAHUATL SCRIPTS

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ABSTRACT: Most logosyllabic scripts opt for special word-signs denoting colour terms even though colours are abstract properties which are impossible to depict. Two strategies are attested in the invention of property signs for colour terms: prototypical objects can serve as an iconic source for the signs of corresponding colours, and "Colouring" can be applied in writing systems that make use of colour inks. In black-and-white systems, "Inking" of adjacent signs can be used as the sign for BLACK; in carved and incised texts "Hatching" is found instead of "Inking". The observed behaviour of the word-signs for colour terms may be due to cognitive factors—we do not think about colours as objects on their own but rather perceive them as properties of objects. In the Kohau Rongorongo script of Easter Island (Rapa Nui), "Hatching" behaves as a word-sign for colours: first, hatched signs have plain equivalents; second, hatched and non-hatched signs show different distribution in texts; third, hatched signs are less frequent than their plain equivalents; fourth, only a part of a sign can be hatched; and fifth, hatching can spread on adjacent signs in parallel texts. "Hatching" and "Cross-Hatching" seem to be different signs because they follow different patterns of distribution. Both "Hatching" and "Cross-Hatching" appear as indicators of colours in the art of Easter Island. Comparison of iconographic and epigraphic data allows us to tentatively identify the signs for RED, "Hatching", and BLACK, "Cross-Hatching", in the Kohau Rongorongo script.

Keywords: Kohau Rongorongo script, Easter Island, Rapa Nui, iconography, colour terms, theory of writing, decipherment, Maya script, Nahuatl script

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> Me‘e haka kē te ha‘u o te ŋāŋata tuai.
> He ha‘u maroke: huhuru ‘u‘u‘u‘uri, tetetetea, mememmea, pipipipipi, mo pu‘a o te taŋata, o te ŋa vi‘e, o te ŋa poki hoko riu, hoko ‘ate, hoko paina.
>
> (Various were hats of the ancient people.
> *Maroke* hats—ones with blackest, whitest, reddest, and most multicoloured feathers—were worn by the men, women, and youths who danced in the *riu*, *‘ate* and *paina* festivals.)
>
> (Englert 2002: 130, retranscribed and translated by Albert Davletshin)

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Easter Island (Rapa Nui) may be the greatest example of cultural isolation known to humankind. In this isolation, Rapanui people created one of the most sophisticated Neolithic cultures in Polynesia, as manifested by their monumental and portable sculptures, religious architecture, and yet-undeciphered script, Kohau Rongorongo. None of the Rongorongo signs depict European objects such as ships, hats and knives; this fact suggests that the Rapanui invented the script in pre-contact times. The significance of surviving Rongorongo texts can hardly be overestimated; as the script is the only known writing system of Oceania that pre-dates the arrival of Europeans, these texts represent a unique source of information about the pre-contact culture and language. The Easter Island script is pictorial, that is, its signs are recognisable images of objects and actions. Documented iconic systems of Oceania consist of a relatively small number of symbols, motifs and themes. On the contrary, the iconic system of Rongorongo is extensive and gives us an opportunity to glimpse how people in pre-contact Easter Island perceived, depicted and thought about the world around them. Rongorongo signs have never been the subject of a detailed iconographic study. Such a study can contribute to its future decipherment. In this paper I make a contribution to Rongorongo studies by demonstrating that hatching indicates colour in both Easter Island script and iconography.

I begin with a brief introduction to the Kohau Rongorongo script, emphasising its pictorial nature. I then consider how languages and logosyllabic scripts encode colours, in particular the Maya and Nahuatl scripts, which are highly pictorial. Then, I show that "Hatching" and "Cross-Hatching" in Kohau Rongorongo resemble the signs for colour terms of other pictorial scripts, iconically and in their behaviour. I also show that "Hatching" and "Cross-Hatching" mark colours in the Easter Island iconography. To conclude, I suggest that "Hatching" indicates the colour red and "Cross-Hatching" the colour black in both Easter Island iconography and script.

BASIC FACTS ABOUT KOHAU RONGORONGO

The easternmost inhabited island of Polynesia was discovered on Easter Sunday of 1722 by Jacob Roggeveen. The Catholic missionary Rev. Brother Eugène Eyraud was the first to report the indigenous script on Easter Island (Eyraud 1866; see also Altman and Schwartz 2003: 54). He was also the first non-Polynesian to spend more than a couple of days on the island: his first sojourn lasted from January to October of 1864. The first bishop of Tahiti, Florentin-Étienne Jaussen, became interested in Kohau Rongorongo and interviewed Metoro Ta'ua Ure, a Rapanui expatriate in Tahiti, who was known for being versed in the old script. The bishop established the reading order of Rongorongo texts (Jaussen 1893: 14; see also Thomson 1891: 516): the wooden tablets are read starting from the bottom left corner where the

signs stand upright proceeding from left to right; upon reaching the end of the line the tablet is rotated upside-down and the text continues with the next line which is the second from the top. The tablet is rotated again and the third line from the bottom is read, and so on. This reading order, unique in the world's writing systems, can be termed double boustrophedon. Jaussen also collected and preserved many of the surviving Rongorongo texts, and it is difficult to overestimate the value of the work he did.

Some of the inscriptions are of significant length and some are in a good state of preservation. The total length of the Rongorongo texts is about 12,000 glyphs. Here glyphs are writing units separated by spaces, including both ligatures and individual signs. The length of the texts in signs is longer than in glyphs. The number of independent signs in the Kohau Rongorongo script considerably exceeds the number of syllables in the Rapanui language (54 syllables in total). This implies that it is a logosyllabic system, that is to say, a writing system with at least two functional types of signs—phonetic signs or syllabograms (those that indicate syllables) and word-signs or logographs (those that spell words and indicate their lexical meanings). Combinatorial properties of signs support the identification of the script as a logosyllabic writing system. There are two different types of Rongorongo signs according to their combinatorial properties. Signs of one type form sequences of the kind ABAB, BABA, AAAA and AAA in combinations with other signs; here A stands for one sign and B for another (Davletshin 2012a). Such sign sequences resemble reduplicated words, which abound in Polynesian languages. Signs of the other type do not form such sequences and tend to be used not as parts of sign groups but in isolation (Davletshin 2016). It is probable that signs of the first type are phonetic signs and signs of the second type are word-signs. Sometimes the same (presumably) phonetic sign is optionally attested following another sign, presumably a word-sign; these phonetic signs function as phonetic complements for word-signs (Davletshin 2012b). The "Crescent" sign and its multiple combinations—"Two Crescents", "Three Crescents", "Four Crescents", "Five Crescents"—represent basic numerals (Davletshin 2012b). Several phonetic signs function as grammatical markers (Davletshin 2012d, 2019). Rongorongo texts are extremely structured (Butinov and Knorozov 1956; Guy 2006; Horley 2007; Melka 2008; Pozdniakov 1996). Accuracy was important, as attested by scribes who carefully corrected occasional errors in their texts (Horley 2009).

Rongorongo signs are recognisable images of objects and actions (Fig. 1). In this respect, Kohau Rongorongo is similar to such pictorial writing systems as Hieroglyphic Egyptian and Hieroglyphic Luwian of the Old World and Maya and Nahuatl scripts of Mesoamerica. It stands in contrast with lineal scripts such as Cuneiform Persian, Modern Chinese and the Cyrillic Alphabet

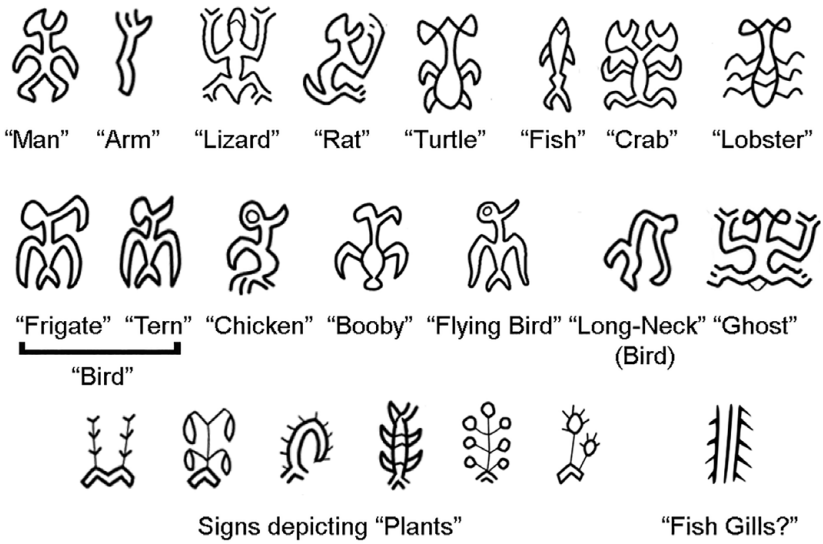

Figure 1. Kohau Rongorongo is a pictorial script. Compiled by the author using drawings by Paul Horley, with permission.

among others, where signs are abstract combinations of strokes, curved lines, dots and wedges. In many cases iconographic interpretation of the signs is only possible due to parallels in the art of Easter Island, and in many others it is impossible to understand what the signs depict. Some elementary designs, lines, circles, etc. are abstract and may be interpreted in multiple ways. Three kinds of internal evidence are of importance in iconographic analysis of pictorial signs. Firstly, graphic variations of the same design can give clues to its iconic interpretation; for example, the designs "Frigatebird" and "Tern" are used interchangeably, so they likely refer to a generic term for "bird". Secondly, graphic elements shared by different signs tend to have the same referent; for example, "roots" and "leaves" are similarly represented in different signs depicting "plants". Thirdly, logical reasoning is more effective in interpretation than visual resemblance; for example, an "Animal With Legs and a Tail" which is different from the "Lizard" is likely to correspond to the "Rat" because it was the only terrestrial mammal on the island, the sign depicting a "Bird" not "Flying" but "Walking on the Ground" is "Chicken", the "Crab Without Claws" is "Lobster", and so on.

Boris Kudrjavtsev (1949; see also Olderogge 1949) discovered a long text that was written on three different tablets: the Large St Petersburg Tablet, the Small St Petersburg Tablet and the Large Santiago Tablet. Another parallel text was identified later (Butinov and Knorozov 1956: 77). These discoveries made it possible to establish the reading order of lines on these tablets and discern graphic variants, ligatures and word boundaries. Comparison of the parallel texts reveals a number of editions and rewordings, suggesting that scribes were not merely copying but rather were recording narratives, either from memory or from the words of a performer. Further comparison shows that sometimes two similar graphic designs possess two different reading values because they do not substitute for each other in parallel texts. At the same time, some different graphic designs possess the same reading value because they substitute for each other (Davletshin 2017). Comparison of parallel texts indicates productive use of connected writings of signs, also called ligatures. Rongorongo ligatures are extremely complex; they frequently result in an altered reading order and are created by means of three different methods—superimposition of two or more signs, conflation, and stacking on the vertical axis with blank space between them. A special marker is used to indicate a ligature when a sign is written instead of a hand of a human or a wing of a bird (Fig. 2).

Few contextual interpretations have been proposed so far. One text fragment structurally resembles a genealogy (Butinov and Knorozov 1956; Davletshin 2012a). Two lengthy texts probably represent lists of personal

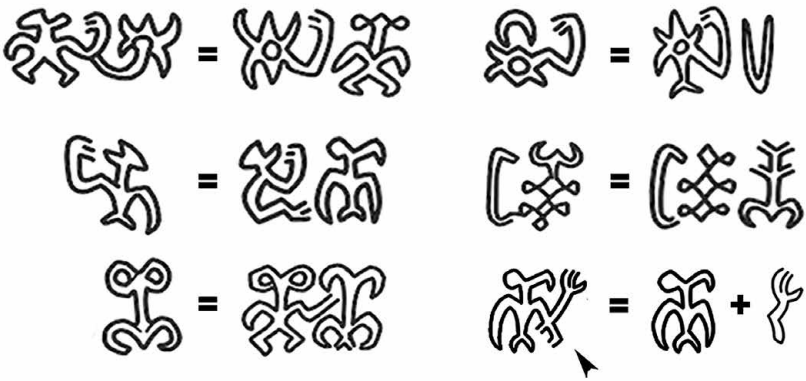

Figure 2. Different types of ligatures identified through comparison of parallel texts. Arrow indicates the marker of ligatures. Compiled by the author using drawings by Paul Horley, with permission.

names, some of which include titles (Davletshin 2012a). One text fragment has been interpreted as a record of the lunar calendar (Barthel 1958: 242–43; Horley 2011a; but see Davletshin 2012b). A passage at the beginning of one tablet is versified (Guy 1982; Métraux 1940: 400–405), and numerous other literary devices are attested in the script (Davletshin 2012c, 2013).

Data and Abbreviations Used

In this paper, I use drawings by Paul Horley (2009, 2010, 2011b), which were compared with drawings by Mikhail Kudrjavtsev (published in Olderogge 1949), Bodo Spranz (published in Barthel 1958), Steven Fischer (1997), and my own drawings and photographs taken at the Peter the Great Museum of Anthropology and Ethnography, St Petersburg, and at the British Museum, London. I use capital letters when referring to Barthel's designations of the Kohau Rongorongo texts (Barthel 1958):

A (Tahua Tablet)
B (Aruku Kurenga Tablet)
C (Mamari Tablet)
D (Échancrée Tablet)
E (Keiti Tablet)
F (Chauvet Fragment)
G (Small Santiago Tablet)
H (Large Santiago Tablet)
I (Santiago Staff)
L (Small London Reimiro Wooden Gorget)
M (Large Vienna Tablet)
O (Berlin Tablet)
P (Large St Petersburg Tablet)
Q (Small St Petersburg Tablet)
R (Small Washington Tablet)
S (Large Washington Tablet)
T (Honolulu Tablet 3629)

Lowercase letters "r" and "v" stand for the sides, *recto* and *verso*, when the beginning of the text is identified; when it is not, lowercase letters "a" and "b" are used to differentiate between the sides. Designations of lines on the Santiago Staff (I) are given after Horley (2011b). Numbers following lowercase letters indicate the corresponding line, and numbers following the colon sign ":" refer to the corresponding glyph, counting from the beginning of the line where the sign in question occurs. The multiplication sign "×" indicates substitutions between two parallel texts. For example, "Pr3:4 × Qr2:42" should be read as "a sign found in position 4 of line 3 on the recto

of the Large St Petersburg Tablet and a sign found in position 42 of line 2 on the recto of the Small St Petersburg Tablet substitute for each other", and therefore their reading values are equivalent, at least partially. The question mark "?" after a position in a line (Sb7:22?) shows that the identification of the graphic design in question is problematic because of its poor state of preservation or for other reasons.

I use the method of iconic formulae to identify graphic designs and assign them descriptive nicknames (Davletshin 2017). These are given in double quotation marks. The nickname "Turtle" does not mean that the sign should be read as "turtle" in Rapanui, only that the sign looks like a turtle; in other words, it means that in the Kohau Rongorongo script the graphic design depicting a turtle is associated with a certain reading value. To the extent possible, I am inclined to apply descriptive nicknames consistent with iconographic analysis of the signs in question, but, to date, many signs have not received satisfactory iconographic interpretations, in which cases nicknames are of a provisional nature. When a depicted object cannot be identified and the nickname is arbitrary, I use the asterisk sign "*" to indicate this, for example, "*Arrow".

In transliteration I follow conventions established in Mesoamerican epigraphy (e.g., Fox and Justeson 1984): reading values are given in boldface, word-signs in capitals and phonetic signs in lowercase. Transcriptions are given in italics and translations in single quotation marks. If necessary, I indicate lexical readings in English which are given in CAPITALS; for example, in the Maya script the sign **SAK** "Flower" stands for the word *sak* 'white' and bears its lexical meaning WHITE. Here "Flower" is the iconic formula for the particular graphic design which is assigned the reading value **SAK**. The question mark "?" after the phonetic reading of a sign, e.g., **MEAMEA**?, indicates that the proposed reading value is suggestive but has not been shown to be maintained in several contexts and thus cannot be considered proven (see Knorozov 1956: 210).

COLOUR IN LANGUAGES AND LOGOSYLLABIC WRITING SYSTEMS

Colours are physical properties of objects associated with the wavelength of the light that is reflected from them. This reflection is governed by an object's physical properties, such as light absorption and reflection spectra. All human languages have colour terms which are used to designate visually perceived properties of physical objects. The so-called Swadesh 100-word list of basic lexicon is used in comparative linguistics to estimate the relative similarity of two or more languages by the number of shared lexical cognates and includes five colour terms: 'black', 'green', 'red', 'white' and 'yellow' (Swadesh 1952). This means that the terms for basic colours are stable, that is to say, they are known to be replaced by new words relatively slowly in

the history of languages. The terms 'black' and 'red' are known to be more stable in comparison with 'green', 'white' and 'yellow' (Tadmor *et al*. 2010). Accordingly, every elementary teaching course of a foreign language introduces colour lexicon.

The structure of colour terms in languages differs. For example, a Polynesian language, Nukeria, spoken on an atoll in the Bougainville autonomous region of Papua New Guinea, possesses the words *maatea* 'white', *riparara* 'black', *uri* 'dark colour (grey, brown, green, blue)', *mmea* 'red' and *vaiano* 'yellow' (author's fieldwork data from 2013). In the Tzotzil language in the Mayan family, there are five basic terms and close to a thousand colour compounds which discriminate semantically among variables including hue, brightness, saturation, relative size and discreteness, opacity, texture and shape of the object (Bricker 1999). Brent Berlin and Paul Kay (1969) proposed that the basic, unanalysable and non-derived colour terms in a language, such as 'black', 'brown', 'red', etc., are predictable by the number of colour terms attested. All languages have terms for 'black (dark-cool)' and 'white (bright-warm)'. If a language has three colour terms, the third is 'red'; if four, it has 'yellow' or 'green'. Berlin and Kay interpreted this observation from an evolutionary point of view and posited different stages in the development of languages: Stage I languages have terms for 'dark-cool' and 'light-warm', Stage II languages for 'black', 'white', 'red', etc. This study became influential, but it also attracted a lot of criticism from different points of view (Levinson 2000; Lucy 1997; Saunders 2000; Wierzbicka 2005). I prefer to interpret their observation synchronically, specifically that every language opts for one of several possible ways to conceptualise visually perceived properties. I also think that the ecological environment can influence perception and encoding of colours, as, for example, the sun on an atoll makes it difficult to distinguish among dark colours (see Nukeria colour terms above).

Colour terms are frequently derived from the name of an object of that colour, such as the words orange and salmon in English, while others are abstract, like red and black. Importantly, colour terms are based on visual prototypes; for example, English speakers associate the concept red with blood, green with fresh grass, and blue with a clear cloudless daytime sky and with the sea (Wierzbicka 2005). People who cannot distinguish certain colours from birth still manage to use corresponding colour terms quite well. It is no wonder that colour terms, including those for basic colours, frequently originate from the names of their prototypical objects. The Rapanui language of Easter Island possesses one non-derived term, *ʻuriʻuri* 'black', and a number of derived terms—*ʻehuʻehu* 'light grey' related to *ʻehu* 'mist', *heŋaheŋa* 'pink' from *heheŋa* 'to dawn', *kihikihi* 'dark grey' for

'lichen', *meamea* 'red' from *mea* 'fish gills', *moana* 'sea' and 'blue', *rito mata* 'fresh banana leaf' and 'green', *ritorito* 'bright, whitish' also related to *rito* 'banana leaf', *teatea* 'white' related to *'ōtea* 'dawn', and *tōua māmari* 'egg yolk ' and 'yellow' (for lexical data on Rapanui see Englert 1978; Du Feu 1996: 198). In Rapanui, it is impossible to express the notion of 'redness' without mentioning 'gill-like thing', nor the notion of 'yellowness' without saying 'egg yolk'.

Colour in Logosyllabic Writing Systems

As we have seen, all logosyllabic scripts possess phonetic signs and word-signs. Phonetic signs allow us to write all possible words in the language of the script, but word-signs embrace only a part of the lexicon, some basic, topically prominent and common words. In pictorial scripts, a significant proportion of graphic designs has to do with the meaning assigned to them. Phonetic signs tend to derive from the initial syllable of the name of the objects they depict, by the process known as acrophony; word-signs are iconically related to the words they transmit and depict corresponding objects and actions. It is impossible to depict abstract notions such as 'warmness', 'coldness', 'shortness', etc. A logical solution in such cases is to spell an abstract word phonetically, by means of syllabic signs. Because of this, one does not expect to find special word-signs for colours in a logosyllabic system. Nevertheless, Modern Chinese has four special signs for basic colours: 白 **BÁI** WHITE, 黑 **HĒI** BLACK, 黄 **HUÁNG** YELLOW and 青 **QĪNG** GRUE (which is an umbrella term for green and blue). Maya Hieroglyphic script possesses word-signs for all five basic colour terms attested: white, black, red, yellow and grue. The situation is similar in Hieroglyphic Egyptian (Schenkel 2015).

In all likelihood special signs for colour terms exist, because colour terms belong to basic concepts of language: they are salient, are frequent and draw the attention of the speaker and thereafter of the scribe. In a logosyllabic system, a word-sign is at an advantage. Phonetic spellings are ambiguous, do not distinguish among homonyms and can be read in various ways, in particular if a writing system systematically underrepresents consonants in syllable-final position. Conversely, a word-sign not only indicates the pronunciation of a word but also provides its lexical meaning. Remarkably, the signs for colours are frequent in Maya inscriptions, every one attested in hundreds of examples, but no phonetic substitutions for any of them are known, and just a couple of final phonetic complements have been discovered so far, for the signs WHITE, RED and GRUE. The exception is **K'AN** YELLOW, which is often complemented by the syllable **na** in final position; initial phonetic complements for the sign have not yet been attested.

An intriguing question is: How is it possible to depict an abstract property of colour in order to invent a word-sign for it? The Chinese signs for colours are difficult to interpret because the script is lineal and the origin of its signs is hidden in the mists of time (see Karlgren 1957). Maya script strongly supports the idea that the origin of the word-signs for colours is due to their prototypical objects (Fig. 3, cf. Tokovinine 2012: 287–88; Houston *et al*. 2009; Stone and Zender 2011). The sign **SAK** WHITE depicts a "(Kind of) Flower", which looks similar to the flowers of the gourd family (*Cucurbitaceae*), which can be yellow or white. A rare sign for **'IK'** BLACK is "Black Spot". The most common one is "Black Spot in a Container", probably, "Paint on a Scribe's Palette". Remember, too, that soot and ink are prototypes for black. The main variant of **CHAK** RED depicts a "Peeled Bone"; the less common variants are "Peeled Lower Jaw" and "Peeled Skull". These three graphic designs are different in outward appearance, but all seem to refer to the idea of blood, which is seen on bones recently peeled of flesh; blood is the prototypical object for red. One sign for **YAX** GRUE depicts a "(Kind of) Shell"; another depicts a "(Kind of) Sharp-Edged Shell". Both designs optionally include "Jade" qualifiers, which are attested as iconic

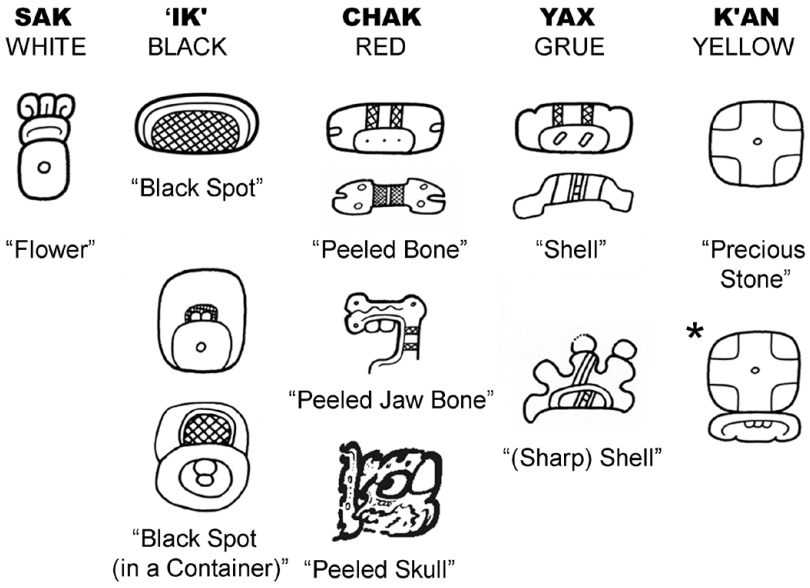

Figure 3. Word-signs for basic colour terms in Maya script. An asterisk indicates the probable complete form of the word-sign YELLOW. Compiled using drawings by Alexandre Tokovinine, with permission (see Tokovinine 2017).

markers of shiny surfaces. The graphic design of **YAX** can be related to the concept of GRUE in two ways. It might refer to the iridescent blue and green lustre of a nacre shell, but it can also be associated with water, which is the prototypical object for the colour blue. I opt for the latter interpretation. Finally, **K'AN** YELLOW depicts a "Precious Stone". The identification of the graphic design as "Precious Stone" is based on comparison with the signs for "Sun" and "Star" in Maya script and the signs for "Sun", "Jade", "Turquoise" and "Gold" in Nahuatl script; the Maya design alludes to light, glitter and shimmering, in the same way as the European symbol "Four-Pointed Star" does. Taking into account that the graphic design refers to something shiny and is used to represent the word 'yellow', it is tempting to interpret the "Precious Stone" as "Amber". In a personal communication to the author (2018), Stephen Houston suggested that the **na** syllable might not be the phonetic complement but a part of the complex sign YELLOW. Indeed, the sign appears with the **na** syllable among "precious things", in purely iconographic context, on the Margarita Panel in Copán. An unusually high frequency of the apparent complement is a good argument in favour of a complex sign too. The **na** syllable depicts "water" (Kettunen and Helmke 2013). Being a fossilised resin, amber can be described as 'liquid stone'. Iconic interpretation of graphic designs in Maya script is not always straightforward and should be taken with a pinch of salt. However, it is remarkable that all Maya signs for colour terms can be potentially interpreted as images of prototypical objects for corresponding colours.

In a few examples, the sign **'IK'** BLACK is reduced to a single cross-hatched spot, which is inscribed into a sign in the vicinity (Fig. 4A). In rare cases, it is just the "Cross-Hatching" of an adjacent sign (Fig. 4B). Importantly, sometimes only half of a sign, in the corresponding spelling, is hatched, and sometimes "Hatching" spreads over several signs. This cross-hatching is attested in carved and incised inscriptions; in painted texts, inking is found instead of hatching. Cross-hatching is an artistic convention used to convey inking on a solid surface, using a chisel, when it is impossible to paint. Many Maya signs incorporate inked/hatched graphic elements in their designs (Fig. 4C). These are understood to be black: the "Dog Head" and "(Boa) Snake Head" signs feature an inked spot around their eyes, the "Jaguar Head" and "Jaguar Tail" signs show characteristic black spots, the "Cave" and "Tomb" signs are inked inside to show the darkness of these places, etc. "Black Inking" is a perfect way to convey the black colour, and "Hatching" is its natural substitute in carved and incised texts. Maya script makes use of only two colours: black and red. Red is rarely attested and has its own meaning (see e.g., Martin 1997). Most of the painted inscriptions are produced with black paint. That is why iconic rendering of other colours is impossible; Maya script is thus forced to resort to images of prototypical objects as word-signs for colours.

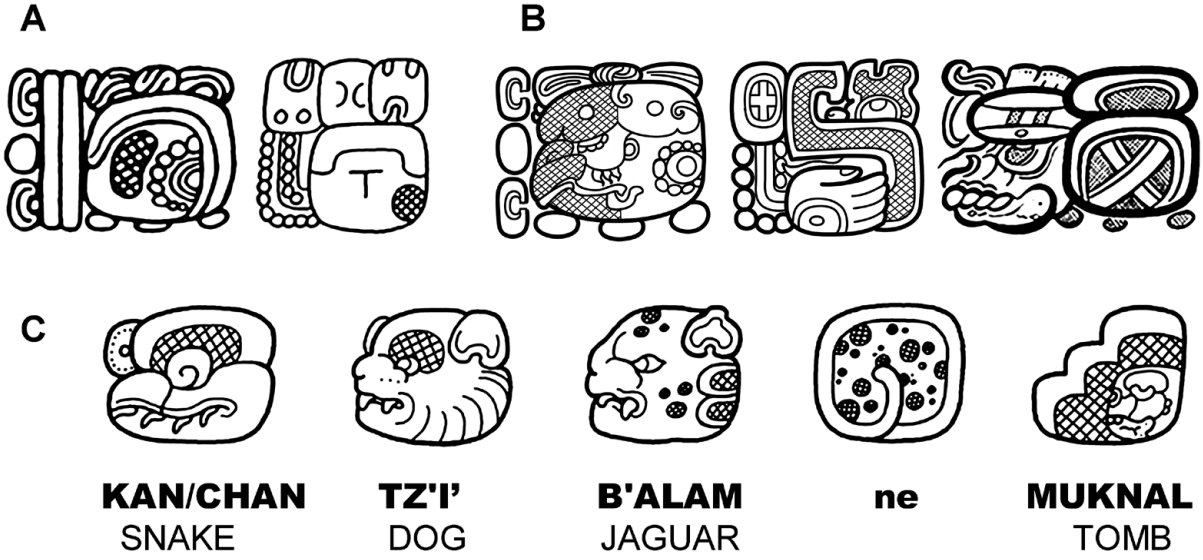

Figure 4. "Hatching" in Maya script. A. "Hatched Spot" as sign for BLACK in ligatures: Tikal Temple I, Lintel 3, B3, detail of Seibal Stela 10. In the second example the sign **'IK'** BLACK seems to be used as phonetic complement for the sign **'IK'** WIND in a rebus writing. B. "Hatching" of adjacent signs as sign for BLACK: Tikal Temple IV. Lintel 2, A10 and F2. Drawings by the author after photographs by Dmitri Beliaev, courtesy of the Museum der Kulturen Basel. Palenque Tablet of 96 Hieroglyphs, G2. Drawings by Simon Martin, used with permission. C. "Hatching" as indicator of the colour black in the Maya signs "Snake Head", "Dog Head", "Jaguar Head", "Jaguar Tail" and "Skull in a Dark House". Unless stated otherwise, based on drawings by Alexandre Tokovinine, used with permission.

Another logosyllabic writing system of Mesoamerica, the Nahuatl script, includes a series of colour word-signs, based on the iconic principle (for general information on Nahuatl script, see Aubin 1849; Lacadena 2008). Most of the Nahuatl documents make use of at least two colours, black and red, of which black is the basic colour (Matrícula de Huexotzinco, Vergara Codex, etc.). A few of them also use blue, green and yellow (Mendoza Codex, Telleriano-Remensis Codex, etc.). The sign **TLIL** BLACK is related to Classic Nahuatl *tlīl-lĭ* 'soot' and *tlīl-tĭk* 'black' and depicts a "Black Spot". The sign **PAL** PAINT is related to *păl-lĭ* 'black clay used to dye hair' and *tlăpăl-lĭ* 'ink, dye, something dyed' and depicts a "Black Triangle" (Fig. 5; for lexical data on Classical Nahuatl see Karttunen 1983).[1] Often **TLIL** and **PAL** are just "Inking" of the adjacent signs; in such cases it is impossible to distinguish between them. **TLIL** and **PAL** behave in the same way as "Hatching/Inking" in Maya script. Surprisingly, the documents that make use of many colours show colour word-signs based on an iconic principle: **KOS** YELLOW, related to *kŏs-tĭk* 'yellow'; **TLAW** RED, *tlătlāw-kĭ* 'red' and *tlāw(ĭ)-tl* 'ruddle'; **TEXOH** BLUE, *texoh-tĭk* 'blue (of sky)'; and **XOW** GREEN, *xŏxōw-ĭk* 'green, blue-green, unripe' (Fig. 5). Nahuatl colour terms are often reduplicated. These word-signs for colours are written as "Yellow Colouring", "Red Colouring" and "Blue Colouring" of nearby signs. The signs are also attested in their non-ligature forms, which are "Yellow Spot", "Red Spot" and "Blue Spot"; such graphic designs can be considered as basic. Sometimes "Colouring" spreads over nearby signs (see *Tlătlāwkĭtĕpēk* "place-name, At Red Hill", written using the signs "Red Spot" and "Hill", with "Red Colouring" of the sign "Hill"). The Mendoza Codex does not make use of the colour white. Interestingly enough, the scribe of the Mendoza Codex left uncoloured the sign for "Hill" in order to write WHITE **ISTAK** of *Ĭstăktlāllŏhkān*; "Hill" is painted green throughout the document (Fig. 5).[2] This particular behaviour of the word-signs for colours, including black and white, is easy to understand: we do not think about colours as objects on their own but perceive them as properties of other objects. Some Nahuatl graphic designs are associated with certain colours; for example, the syllabogram **a**, "Flowing Water (with Shells)", depicts "Water" blue and "Shells" yellow; **MIX** MIST is blue; **TEPE** HILL is green; and **ES** "Blood" is red. Hieroglyphic Egyptian and Hieroglyphic Luwian do not use "Colouring" and "Inking/Hatching" as signs for colour terms.

Similar conventional systems of hatchings were developed during the Renaissance to denote heraldic colours on flags and coats of arms by means of dots and lines of different directions and types (Fox-Davies 1909: 75–76). This technique is still employed in cases where, for either aesthetic or practical reasons, colours are not reproduced.

Figure 5. Word-signs for colour terms in Nahuatl script. “Black Spot” and “Black Triangle” (first row from top, from left to right): **TLIL-ko-a** *Tlīlkōātl* ‘personal name, Black Serpent’ (CSMA 58v) and **to-PAL-SIWA** *Topalsĭwātl* ‘personal name, Conceited Woman’ (CVRG 25r). “Inking” as sign for BLACK (second row): **TLIL+ke** *Tlīlkēn* ‘personal name, Black Cloth’ (CSMA 5r), **TLIL+TEPE** *Tlīltĕpēk* ‘place-name, At Black Hill’ (CMDZ 16v), **to+PAL-SIWA** *Topalsĭwātl*, see above (CVRG 5r), and **KWETZPAL+PAL** *Kwĕtzpăl* ‘personal calendric name, Lizard’ (CVRG 30r). “Red Colour” as sign for RED (third row): **TLAW+PAN** *Tlāppăn* ‘place-name, On Ruddle’ (CMDZ 39r), **TLAW-TEPE** *Tlătlāwkĭtĕpēk* ‘place-name, At Red Hill’ (CMDZ 8r) and **TLAW+TEPE** ‘*Idem*’ (CMDZ 51r). Other signs for colour terms (fourth row): **XOW-TEPE-tla**

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Xŏxōwtlān ‘place-name, Where the Green Thing Abounds’ (CDMZ 23r), **TEXO-PAN** *Texohpăn* ‘place-name, On Sky Blue Pigment’ (CMDZ 43r), **a-AMA+KOS-tla** *Āmăkŏstītlăn* ‘place-name, Close to Yellow Amate Tree’ (CMDZ 23r), **ISTAK-TLALLOK** *Ĭstăktlāllŏhkān* “place-name, White Paradise” (CMDZ 15v). The plus sign (+) is used to indicate ligatures of the type conflation. Abbreviations and copyrights: CSMA: Santa María Asunción Codex © National Library of Mexico, National Autonomous University of Mexico, Mexico City; CMDZ: Mendoza Codex, Bodleian Library, University of Oxford, after Cooper Clark (1938); CVRG: Vergara Codex © Bibliothèque Nationale de France, Ms. mex. 37-39, Paris, https://gallica.bnf.fr. Information on the documents in question can be found elsewhere (Berdan and Anawalt 1992; Williams and Harvey 2007; Williams and Hicks 2011).

To sum up, colours are visually perceived, abstract properties, and because of this, they are impossible to depict in a black-and-white system. Nevertheless, most logosyllabic systems opt for special word-signs denoting primary colour terms, because colour terms are basic in cognition and discourse and because word-signs are at an advantage in comparison with their phonetic spellings. Two strategies are attested. First, a prototypical object can serve as a source for the graphic design associated with a colour term. Second, “Such-and-Such Colouring” can be used in writing systems which make use of corresponding colours; here “Inking” is analysed as “Black Colouring”. If texts are incised or carved, “Inking” can be transformed into “Hatching” by means of synesthetic associations.

HATCHING IN THE KOHAU RONGORONGO SCRIPT

In the Rongorongo script, a dozen graphic designs show hatching, sometimes cross-hatching (Fig. 6). There are four observations related to the signs in question. First of all, hatched signs have plain unfilled equivalents; it is possible to find such pairs of signs as “*Staff” and “Hatched *Staff”, “Bird” and “Hatched Bird”, “Claw?” and “Hatched Claw?”, “Fish” and “Hatched Fish”, “Crescent” and “Hatched Crescent”, etc. Sometimes only a part of a sign is hatched. In total, 12 graphic designs have been found hatched; they are attested in 169 examples enlisted in the Appendix (see also Table 1). Hatched signs are less frequent than their plain equivalents, with one exception. Rarely do hatched and plain signs substitute for each other in parallel texts, and only in a few particular contexts. In total, 60 examples of hatched signs which correspond to hatched signs in parallel texts have been found. All examples of substitutions of hatched signs for their plain equivalents can be seen in Figure 7, five contexts in total. This observation implies that hatched and plain signs possess similar, but not identical, reading values. Finally, a sequence of signs, which is attested eight times, shows one example of the “Hatching” spreading over the preceding sign (Aruku

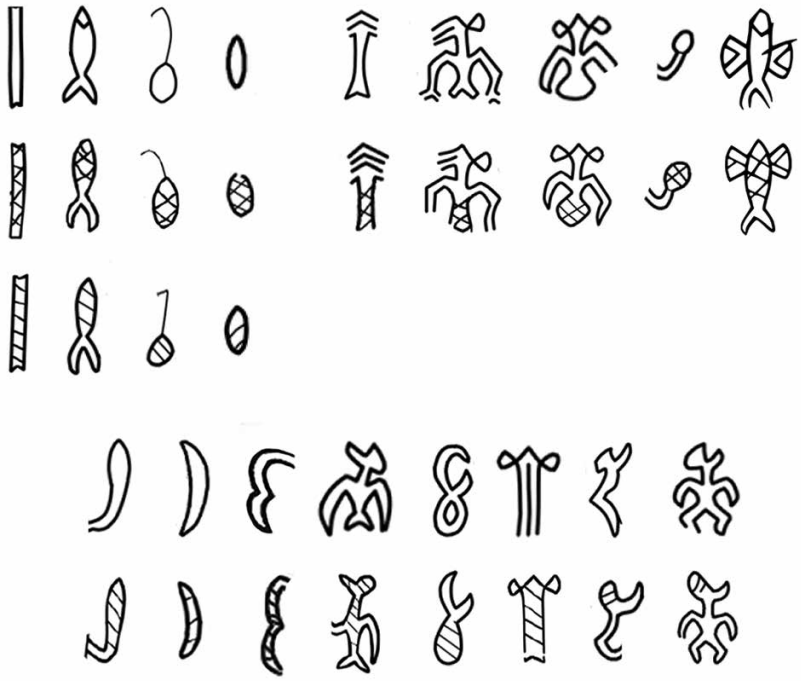

Figure 6. Hatched and cross-hatched graphic designs and their plain equivalents in Kohau Rongorongo. Compilation by the author of drawings by Paul Horley, used with permission.

Kurenga verso, Line 6) and one example of it spreading over the following sign (Large St Petersburg Tablet verso, Line 4; see Fig. 7). A similar situation can be seen in the parallel texts when the "Hatching" spreads forward in two cases (Small St Petersburg Tablet recto, Line 7 and Large Santiago Tablet recto, Line 7; see Fig. 7). These observations imply that "Hatching" is an independent sign, with its own reading value, and this sign is found written in ligatures with other signs. In one case, the "Hatching" of "Hatched Pendant?" disappears (Small St Petersburg Tablet recto, Line 4; see Fig. 7). It is possible that "Hatched Pendant" and "Pendant" are two versions of the same sign, because it is the only sign where the hatched variant is more frequent than the plain one (Table 1). However, taking into account examples of other hatched signs, it seems more reasonable to propose that the sign "Hatching" is missing on one of the three copies; three texts are very close but not absolutely identical copies of each other. Other examples of a sign omitted in one of the parallel texts are known.

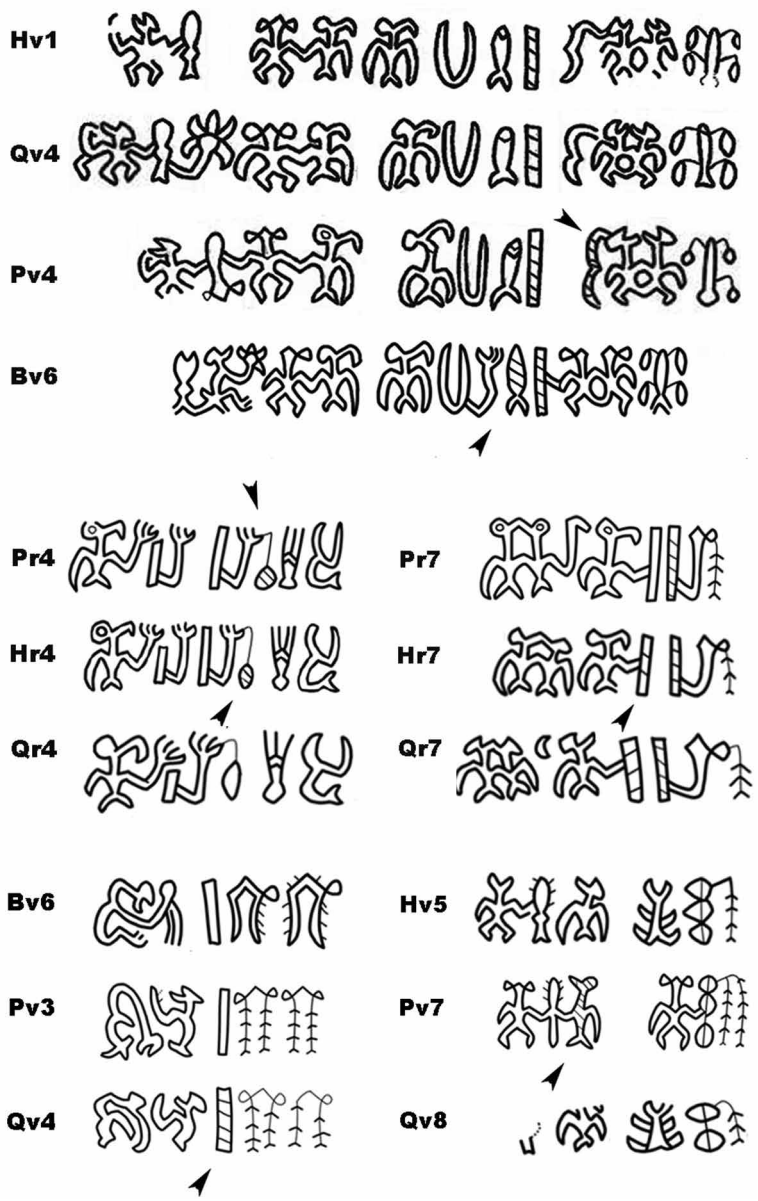

Figure 7. Substitutions of hatched signs and their plain equivalents for each other. Arrows indicate substitutions. Compilation by the author of drawings by Paul Horley, used with permission.

Table 1. Frequencies of "Hatched" and "Cross-Hatched" signs in Rongorongo.

Graphic designs	Hatched	Cross-Hatched	Non-Hatched
"*Arrow"	–	1	159
"*Band"	2	–	96
"Bird"	1	–	546
"Bud?"	–	1	227
"Chief"	–	1	108
"Claw?"	1	–	5
"Crescent"	11	–	228
"*Egg"	1	1	35
"Fish (Head Upward)"	6	9	216
"Flying Fish"	–	1	2
"Man with Open Mouth"	1	–	251
"Pendant?"	14	3	11
"*Post"	1	–	187
"*Staff"	128	5	818
"*Stick"	2	–	121
"Woman"	–	1	59
"Worm"	1	–	22

The behaviour of the sign "Hatching" reminds us of Mesoamerican scripts, in particular Maya and Nahuatl, where the word-sign BLACK can be written as inking of adjacent signs. Importantly, sometimes only a half of a nearby sign is hatched and sometimes "Hatching" spreads over several signs. With the possible exception of "Hatched Pendant?", there are no signs that include the graphic element of "Hatching" as part of their designs as in Maya writing, where the "Dog" and "Snake" signs are depicted with a black spot around their eyes. Rongorongo signs are carved from hard wood in a small size and are full of fine, intricate details; they are about 1.5 cm tall, and on the Large Santiago Tablet, they are smaller, just about 1 cm. This may be the reason why Rongorongo signs do not include "Hatching" as part of their graphic designs. This observation could also explain the examples where "Hatching" covers only a part of a sign.

"Hatching" and "Cross-Hatching" are either different versions of the same graphic design or two different signs. "Cross-Hatching" is rare (Fig. 6 and Table 1). In total, nine graphic designs have been found cross-hatched; they are attested in 24 examples (see Appendix). Four of the nine are also attested hatched, that is to say, it is possible to find such pairs as "Cross-Hatched *Staff" and "Hatched *Staff", "Cross-Hatched Fish" and "Hatched Fish", etc. Five cross-hatched graphic designs do not have hatched counterparts but do show their plain equivalents. "Cross-Hatching" is not attested in the parallel texts, and this makes it impossible to test whether two designs have the same significance. "Cross-Hatched *Staff" (five examples) is very rare in comparison with "Hatched *Staff" (128 examples), but "Cross-Hatched Fish" (nine examples) is more frequent than "Hatched Fish" (six examples). Finally, the Tahua Tablet, Mamari Tablet, Santiago Staff and Honolulu Tablet 3629 include both cross-hatched and hatched designs. These three observations suggest that "Hatching" and "Cross-Hatching" have different patterns of distribution. Thus, we must consider that the two designs might have different meanings in the script, probably related to two different colours.

The majority of the examples for "Hatching" are attested in "Hatched *Staff" (128 of 168 examples). This remarkable distribution begs explanation. One can suggest that "Staff" works as a phonetic complement for "Hatching". "Staff" is the most frequent sign in Rongorongo texts and behaves as a syllabic sign; its reading value is probably **ki**? (Davletshin 2019). However, it is unlikely that "Staff" works as a phonetic complement for "Hatching" because phonetic complements are relatively rare in Rongorongo texts (Davletshin 2012b), and "Hatched *Staff" is very frequent. Significantly, "Cross-Hatched *Staff" is also attested. I suggest that "Hatched *Staff" is a basic form of the Rongorongo sign for a colour in the same way as "Black Spot" and "Red Spot" are basic signs for BLACK and RED in Nahuatl script. In Maya and Nahuatl scripts, the basic forms for colour signs "Black Spot", "Red Spot", etc. are more frequent than their ligature variants "Inking", "Red Colouring", etc. I admit that two contexts, where "*Staff" substitutes for "Hatched *Staff", disfavour this interpretation (Fig. 7).

HATCHING IN THE EASTER ISLAND ICONOGRAPHY

Art historians feel a degree of delight in the fact that many objects from pre-contact Rapanui culture survive today (Heyerdahl 1976; Kjellgren 2001; Klein 1988). More than 900 colossal statues were found either *in situ* or relocated (Van Tilburg 2006). Multitudes of wooden carvings are hosted in museums and private collections all over the world. Most of them are figurines, but there are also ceremonial paddles, clubs, pendants and gorgets

(Dederen 2013; Esen-Baur 1989; Forment 1991; Horley and Lee 2012; Orliac and Orliac 1995, 2008). Thousands of rock-art motifs were documented on the island (Lavachery 1939; Lee 1992). Finally, seven objects made of *tapa* 'barkcloth' are known (Esen-Baur 1989: 285–91, nos 104–7; Kaeppler 2003; Kjellgren 2001: 58–63, nos 24–27). Importantly for the present study, a few cave paintings are known, and some objects of art show traces of red, black and white, among them colossal statues, stone slabs, and wooden and barkcloth figurines (Lee 1992: 186–92; Lee and Horley 2008, 2009, 2013). The majority of them are painted red, although some represent objects that are not naturally red, such as birds and faces (e.g., Lee 1992: pl. 24–28). This reminds us of the fact that red is a sacred colour in Polynesia, associated with chiefs and gods. It is noteworthy that visitors in 1770 stated that "principal" men painted their bodies bright red (Corney 1908: 98).

Two statues in Rano Raraku feature "Cross-Hatching" on their necks and "Hatching" around their lips, and one "Cross-Hatching" on its forehead (Fig. 8). "Hatching" around the lips and above the eyes can be interpreted

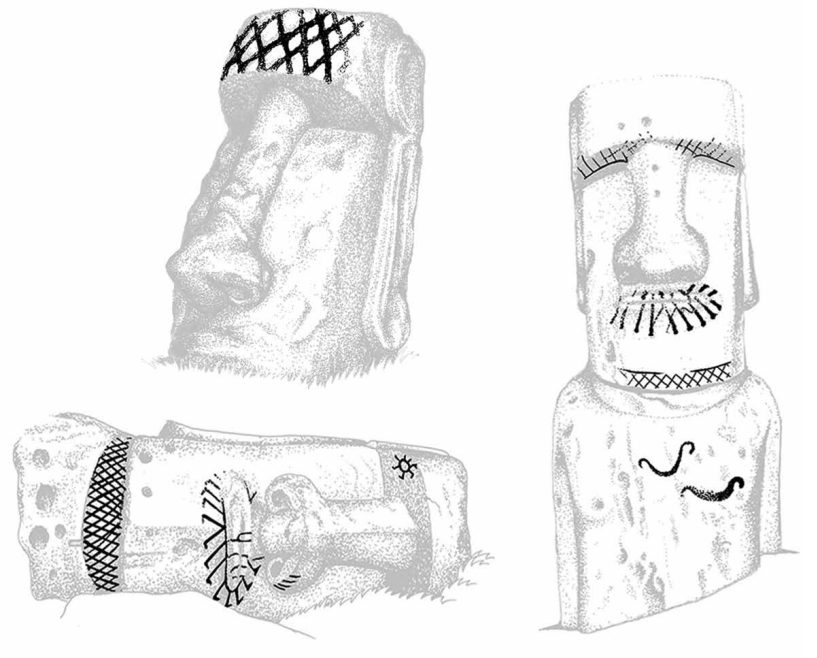

Figure 8. Three colossal stone statues in the quarry at Rano Raraku (RR-260, RR-A-075 and RR-278, according to Cristino Ferrando *et al*. 1981). Drawings by Paul Horley, used with permission.

as moustache and eyebrows; nevertheless, it is known that eye and mouth regions were tattooed (Métraux 1940: 242). Islanders used red, yellow, white and dark dyes to paint their faces and bodies during ceremonies and social gatherings: the red-brown dye *ki'ea* was prepared from weathered and mineralised tuff (Métraux 1940: 236–37). It is unclear whether the "Cross-Hatching" on the neck refers to tattooing or corporal painting. Several statues preserve traces of brown undulating lines on their necks (see Lavachery 1935: figs 209, 210). They are similar to the painted black designs of two tapa figurines and a neck tattoo, the latter documented by the drawing of Tepano's face (Stolpe 1899: fig. 5). Early travellers reported that islanders tattooed their faces, foreheads and necks (Métraux 1940: 237–48). This strongly suggests that "Cross-Hatching" on the statues refers to black tattooed skin. It is unquestionable that in these cases "Cross-Hatching" refers to a colour, either black or, less likely, red.

Many wooden figurines feature "Parallel Lines" which indicate head hair, goatees and eyebrows. The same design is also found on some ceremonial paddles, which are conventional representations of human faces and bodies (Laurens 2008: 52, no. 23). Sometimes eyebrows are shown by a "Chevron" design (Esen-Baur 1989: 230–31, nos 47–48). "Parallel Lines" are similar to "Hatching" but lines go in a slightly different direction on the left and right eyebrows. "Parallel Lines" are also attested on fish fins (Heyerdahl 1976: pl. 125). These are either carved or incised.

A wooden human figurine in the Quai Branly Museum (Dederen 2013: 327; Esen-Baur 1989: 194, no. 15) has "Cross-Hatching" indicating three hair knots on the top of its head, and another one in the Bremen Museum (Dederen 2013: 201) has "Cross-Hatching" covering its head as "Hair" design. A human figurine in the Auckland Museum (Dederen 2013: 137) shows a cross-hatched head band where "Cross-Hatching" probably indicates colour, because such a narrow band is unlikely to be made of fishnet material. A wooden figure in the Vienna Museum of Ethnology (Esen-Baur 1989: 258, no. 71; Heyerdahl 1976: pl. 132) naturalistically represents a masked booby (*Sula dactylatra*, Rapanui *kena*).[3] It shows "Concentric Circles" around its eyes and "Hatching" on its wings and tail, in the same way adult masked boobies are white with pointed black wings, a pointed black tail and a dark grey facemask. An alternative explanation is that "Hatching" of the wings and tail indicates flight feathers; indeed another carving of a masked booby (Heyerdahl 1976: pl. 133) supports this interpretation because it shows different designs for short non-flight feathers on its belly and for flight feathers on its tail and wings. The "Cross-Hatching" for head hair implies the colour black.

A slightly different design, "Parallel Curved Lines", cover four wooden pendants in the form of turtle heads (Heyerdahl 1976: pl. 126a, 130) and three wooden pendants in the form of fish heads (Butinov and Rozina 1958: 317,

fig. 5; Kjellgren 2001: 65, no. 32, collection of Arman and Corice Arman). It has been suggested that these pendants depict *mahimahi* fish (Butinov and Rozina 1958: 316) and tuna (Kjellgren 2001: 165). Taking into account the typical shape of the head, teeth shown and dorsal fin starting above the eye, I am inclined to interpret these images as heads of moray eel. In the case under discussion, "Parallel Curved Lines" seem to indicate colour because nothing in the anatomy of turtles and moray eels can explain parallel lines on their heads and bodies. The fish head pendant in the St Petersburg Kunstkamera Museum still preserves traces of bright red dye.

Many Easter Island figurines possess carved symbols on the top of their heads (Figs 9–10). They are believed to be either ornamental or symbolic (Forment 1991, 1993; Métraux 1940: 252–53; Orliac and Orliac 2008: 110–14). I suggest that these carved designs represent an elaborated, decorative font of the Kohau Rongorongo script (Davletshin 2020). First, carved symbols have their graphic equivalents in the texts on the tablets (see, for example, the signs "Ghost" and "Bird" in Fig. 1). Second, they are combined with each other and show substitution patterns. Third, some carved symbols tend to appear on figurines of the same type, serving as hieroglyphic tags. The design "Three Water Spirits" is associated with the so-called *mōai taŋata* 'male figurines' (e.g., Esen-Baur 1989: 193, no. 14).[4] The design "Ghost" is attested on the *mōai kavakava* 'figurines with ribs', which depict male ancestral spirits (e.g., Esen-Baur 1989: 181–84, nos 2–5); these are carved with emaciated bodies, drawn-in bellies and carefully shown ribs and spines. The "Vulva" design is restricted to the *mōai moko* 'lizard figurines' (e.g., Edge-Partington 1904; Forment 1981: 146, no. 165). The iconic interpretation of the design in question is supported by the Rapanui consultants (Young 1904). In other words, carved symbols on wooden figurines function as self-referential texts, known in scribal traditions all over the world (see, for example, Houston *et al*. 1989). Some of these symbols are frequent and probably indicate generic terms of the supernatural beings represented in wooden sculptures; others are unique and may indicate personal names of the depicted spirits and gods. Importantly for the present study, these graphic designs can be interpreted, and some of them sometimes bear "Parallel Curved Lines", "Hatching" and "Cross-Hatching".

"Parallel Curved Lines" form part of the designs "Three Water Spirits", "Ghost" and "Octopus" (Fig. 9). One example of the "Bird" motif shows "Cross-Hatching" in the body and wings (Fig. 10H; Dederen 2013: 473), while two other examples show "Cross-Hatching" only in the wings (Fig. 10I; Dederen 2013: 39; Kjellgren 2001: 53, no. 15). A few "Bird" designs show individually carved "Feathers" (Fig. 10E–G,I; see also Dederen 2013: 39–40; Kjellgren 2001: 53, no. 15; Orliac and Orliac 2008: 110, fig. 64; Phelps 1976: 88). Some examples feature "Parallel Curved Lines" filling

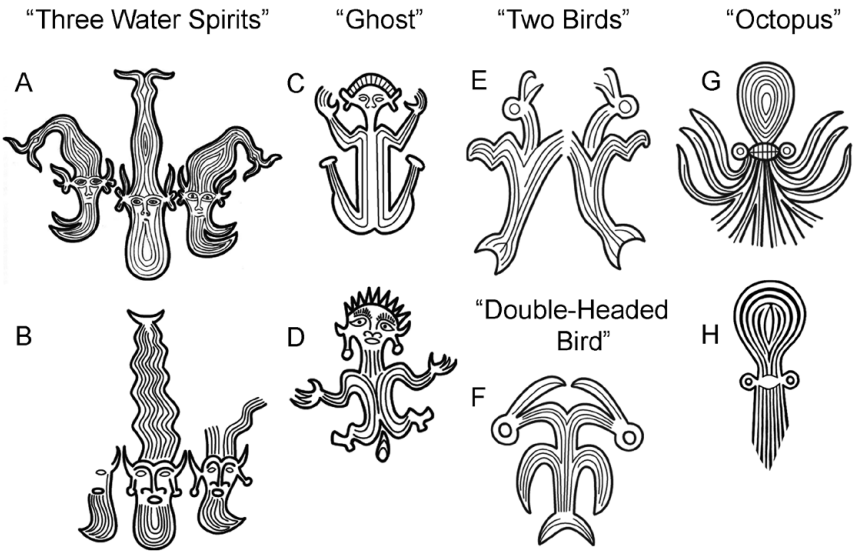

Figure 9. "Curved Parallel Lines" in carved symbols on Easter Island figurines. A. Male figurine in the Peter the Great Museum of Anthropology and Ethnography, St Petersburg (Inv. 402-2). B. Male figurine in the British Museum (Inv. EP24). C. *Kavakava* figurine in the Ladrière Collection. D. *Kavakava* figurine in the British Museum (Inv. 3287). E. *Kavakava* figurine in the Canterbury Museum, Christchurch (Inv. E. 150.1132). F. *Kavakava* figurine in the Loti-Leiris Collection (Inv. 89 L 235). G. *Kavakava* figurine in a private collection. H. Lizard figurine in the Fuller Collection of Pacific Artifacts (Inv. 273235). Drawing by the author (after Force and Force 1971: 75). Unless stated otherwise, compiled by the author using drawings by François Dederen, with permission (see also Dederen 2013).

up the body of the "Bird" (Fig. 9E,F). "Parallel Curved Lines" may refer to the colour red in the carved symbols on wooden figurines because black is a rather unexpected colour for water spirits and ghosts of the dead. One can suggest that "Parallel Curved Lines" are used to emphasise the outlines of symbols on the carved surface. This is unlikely because the turtle- and fish-head pendants are completely covered with "Parallel Curved Lines" (see above). Carved symbols on wooden figurines sometimes show traces of red pigment, and "Parallel Curved Lines" may function as its substitute.

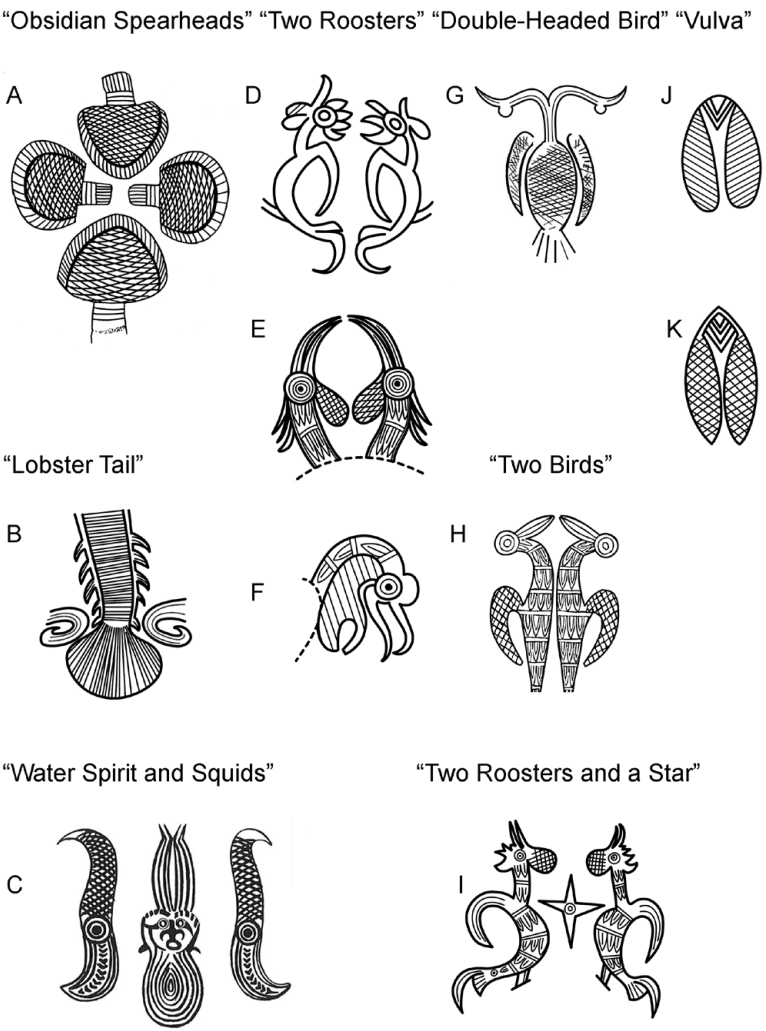

Figure 10. "Hatching" and "Cross-Hatching" in carved symbols on Easter Island figurines. A. *Kavakava* figurine in the Peabody Essex Museum, Salem (Inv. E-24299). Rafał Wieczorek's drawing, used with permission. B. Kavakava figurine in the Five Continents Museum, Munich (Inv. 193). C. Male figurine in the Musée National de la Marine in Rochefort (Inv. 39 X 29 D). D. Lizard figurine in the Royal Museum of Fine Arts

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of Belgium (Inv. ET 45.51). Drawing by the author (after Forment 1981: 146). E. *Kavakava* figurine in the New Brunswick Museum (Inv. X230). F. Female figurine formerly in the Hooper collection. Drawing by the author (after Orefici 1995: 145). G. *Kavakava* figurine in a private collection. H. Kavakava figurine in the Vandenabeele Collection. I. Atypical male figurine in the Collection of Carolyn and Mark Blackburn (see Blackburn 1999). J. Lizard figurine in the Auckland War Memorial Museum (Inv. 14554). Drawing by the author after images at https://www.aucklandmuseum.com/. K. Lizard figurine in the Royal Museum of Fine Arts of Belgium (Inv. ET 45.51). Drawing by the author. Unless stated otherwise, based on drawings by François Dederen, used with permission (see also Dederen 2013).

In two cases, "Hatching" (Fig. 10D,F) marks rooster wattles. Only a part of the wattle is hatched on the lizard figurine from the Royal Museums of Fine Arts of Belgium, in Brussels (Inv. ET 45.51; see Esen-Baur 1989: 203–4, no. 22; Forment 1981: 146, no. 165). "Hatching" completely covers the wattle on the female figurine that was in the Hooper and Monzino collections (Christie's 1979: 58). In two other cases, the wattle is cross-hatched (Fig. 10E,G; see Dederen 2013: 39, fig. 21C and 40, fig. 25A). These examples suggest that the two designs are interchangeable, but some roosters have black or very dark wattles. In the case of the Brussels figurine, a lack of space might result in the replacement of "Cross-Hatching" with "Hatching". The same kind of ambiguity can be seen in the "Vulva" design (Fig. 10J,K): one of them is hatched (Edge-Partington 1904) while the other is cross-hatched (Esen-Baur 1989: 203–4, no. 22; Forment 1981: 146, no. 165). This design is found on the barkcloth figurines, where it is painted black, as a tattoo. It is also carved anatomically correctly on some female figurines (Esen-Baur 1989: 189, no. 10; Kjellgren 2001: 50–51, nos 11–12).

The only example of the "Lobster Tail" design (Fig. 10B) is hatched, suggesting that "Hatching" indicates the colour red (Esen-Baur 1989: 179, no. 1). A unique version of the "Three Water Spirits" design—"Water Spirit with Two Squids"—shows "Cross-Hatching" in the squids (Fig. 10C; Dederen 2013: 486). A rare motif of "Obsidian Spearheads" features "Cross-Hatching" in two cases (Fig. 10A; see also a *kavakava* figurine in the Hooper collection, Dederen 2013: 333). "Cross-Hatched Obsidian Spearheads" is a strong argument in favour of the interpretation of "Cross-Hatching" signifying black. Not only black but also red obsidian exist on Easter Island, but the latter is rarely attested in archaeological contexts. The edges of the "Obsidian Spearheads" (Fig. 10A) are hatched; if "Hatching" refers to red, it can indicate blood in this particular example; otherwise, it indicates the sharpness of the obsidian blades. One can speculate that in a few cases, where "Cross-Hatching" is attested on objects red in colour, the intention of

the artist was to show that the object is black. In this respect, it is important that, in Rapanui, the word *ʻuriʻuri* 'black' also means 'dark' and 'bruised'. The same is true of its cognates in other Polynesian languages (Greenhill and Clark 2011). The aforementioned symbols of female genitalia are carved on the underchins of lizard-shaped figurines; they might refer to tattoo designs, and tattoos are black. It should be mentioned that these symbols are carved on curved surfaces, which complicates photographic documentation. Frequently, drawings are published without accompanying photographs, and many published photographs of wooden figurines miss significant parts of the carved designs, which makes it difficult to ascertain whether the design is hatched or cross-hatched. Finally, practically all surviving wooden figurines were collected after the cultural collapse, triggered by contact with European visitors and Peruvian slave raids, when artistic conventions were lost and the hatchings might have taken on different meanings.

To sum up, "Hatching" and "Cross-Hatching" are the designs used to indicate colours in Rapanui wooden sculpture. "Curved Parallel Lines" may serve the same purpose. "Hatching" and "Cross-Hatching" sometimes substitute for each other in iconography. Nevertheless, "Cross-Hatching" seems to be associated with black (head hair, obsidian spearheads) and "Hatching" with red (lobster tails, rooster wattles and vulvas). Two arguments strengthen this interpretation. First, both "Hatching" and "Cross-Hatching" mark colours but are attested in images of different objects. Second, "Cross-Hatching" is darker, iconically, than "Hatching" in the same way that black is darker than red. "Curved Parallel Lines" seem to be synonymous in meaning to "Hatching", that is to say, they indicate red.

* * *

In the Kohau Rongorongo script, "Hatching" is a sign that shares its properties with signs for colours of the type "Such-and-Such Colouring" in other pictorial logosyllabic writing systems. It should be stressed that this comparison is typologically justified: scripts with similar properties are expected to share their traits. Although the data at our disposal are scarce, "Hatching" and "Cross-Hatching" seem to be two different signs. "Hatching" and "Cross-Hatching" are also attested in Easter Island iconography, where they also indicate colours. The former seems to stand for red and the latter for black. We can conclude that in the Rongorongo script, "Hatching" is a word-sign for RED and "Cross-Hatching" a word-sign for BLACK. This interpretation makes sense iconically because "Cross-Hatching" is darker than "Hatching". It also makes sense culturally because "Hatching" is much more frequent and red is a sacred colour on Easter Island and in Polynesia.

The term for 'red' in Rapanui is *meamea*; the same word is reconstructed for proto-Polynesian. The term for 'black' in Rapanui is *ʻuriʻuri*, which is

also reconstructed for proto-Polynesian. This gives us tentative phonetic readings for two signs under discussion: "Hatching" **MEAMEA**? RED and "Cross-Hatching" **'URI'URI**? BLACK.

The proposed interpretation of "Hatched *Staff" as **MEAMEA**? RED receives support from two independent contexts. Firstly, "Hatching" is substituted for the sign which may depict "Fish Gills", *mea* in Rapanui (Aa1:68 × Hr6:44 × Pr6:8 × Qr6:10; see Fig. 1). Secondly, a list of the signs depicting sea creatures (shells of different kinds, chitons, urchins, etc.) features a combination of the two signs "Hatched *Staff" and "*Sprout" before each of these sea creatures (Hv9:17–51 × Pv10:29–55). Rapanui *mea* also means 'to abound (with fish, bananas, etc.)'. Thus, the sign "*Sprout" can be interpreted as a postpositive grammatical marker, and the list under discussion can be understood as a sequence of the phrases "such-and-such kind of sea creature has become abundant".

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NOTES

1. For Classical Nahuatl, I use the letter "h" to represent glottal stops, macrons " ¯ " to indicate long vowels and breves " ˘ " for short vowels; if a vowel does not bear diacritical marks, its length cannot be determined.
2. In the example under discussion, the sign **TEPE** HILL is used to indicate that the spelling belongs to the category of place-names, **TLALLOK** "Rain God Head" is coloured blue because water is blue, and the last syllable of the word is abbreviated.

3. I am indebted to Paul Horley for the ornithological identification of the depicted bird (pers. comm., 2017).
4. The terms designating types of wooden figurines—*mōai taŋata* 'male images', *mōai kavakava* 'images with ribs', *mōai moko* 'lizard images' and *mōai pa'apa'a* 'barren images'—were coined in the twentieth century and do not represent emic concepts of the pre-contact culture. For a general description of different types of Rapanui sculpture see Orliac and Orliac (2008); for lizard-shaped figurines see also Wieczorek (2016).

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APPENDIX

"Hatching" and "Cross-Hatching" in Rongorongo Texts (Ligatures Included)

"Hatching"

"Hatched *Band": Pv4:8; Sa6:44
"Hatched Bird": Pv7:10
"Hatched Claw?": Sa6:19
"Hatched Crescent": Aa5:69 × Ab7:79 × Bv8:33 × Ra1:19; Br9:9; Bv9:46; Bv10:32; Da3:2; Er9:6; Sb3:20; Sb6:25
"Hatched *Egg": Bv9:5
"Hatched Fish (Head Upward)": Bv1:6; Bv4:30; Bv6:22; Ia2:71; Ia6:57; Ia14:65
"Hatched Man with Open Mouth": Ia6:105
"Hatched Pendant?": Ab2:61,63; Ab3:67; Ab5:2; Br8:22; Hr4:21 × Pr4:1; Hr4:23 × Pr4:2; Hr4:36 × Pr4:16; Ra4:10; Oa6:7?; Rb6:23
"Hatched *Post": Ia9:46
"Hatched *Staff": Aa2:36,44,50,54,60,69; Aa2:79 × Sa2:22; Aa3:12,39; Aa5:37,44; Aa6:82 × Ra3:9; Aa8:10,38; Ab2:38; Ab3:37; Ab4:2; Ab8:50; Br7:22; Bv5:10 × Bv6:23 × Hv1:22,38 × Pv3:31 × Pv4:7 × Qv4:17,33; Bv5:38; Bv12:30; Cr1:19; Da3:2; Db3:12; Er8:32; Ev5:28; Ev8:4; Gr7:13 × Kv4:18; Gr8:27; Gv2:20; Hr5:20 × Pr5:1 × Qr5:10; Hr6:44 × Pr6:8 × Qr6:10; Hr7:40 × Pr7:10 × Qr7:24; Hr7:47 × Qr7:32; Hr7:48 × Pr7:18 × Qr7:33; Hr11:8 × Pr11:23 × Qv2:11; Hr11:27 × Pv1:8 × Qv2:30; Hv9:17 × Pv10:29; Hv9:22 × Pv10:32; Hv9:30 × Pv10:39; Hv9:33 × Pv10:42; Hv9:39 × Pv10:46; Hv9:48 × Pv10:52; Hv9:51 × Pv10:55; Hv11:41?; Ia6:81; Ia7:38; Ia8:87; Ia9:56,57,73,89,96,110; Ia10:27,40,48,76,95,101,116; Ia11:4?, 59,74,75,81,92,94,103,106; Ia12:16,31,40,56,71,80,118; Ia13:8,25,44,136; Ia14:21,27,35,66,75,97; Pr8:4 × Qr8:10; Pr11:3; Qr9:5; Qv4:4; Sb1:11; Sb7:22?; Ta2:13; Ta8:12; Ta10:6
"Hatched *Stick": Sb4:10,50
"Hatched Worm": Ia2:96

"Cross-Hatching"

"Cross-Hatched *Arrow": Ta3:12
"Cross-Hatched Bud?": Ia10:52
"Cross-Hatched Chief": Ia9:77
"Cross-Hatched *Egg": La1:22
"Cross-Hatched Fish": Ab8:71?; Ia1:54; Ia2:41,73; Ia3:29; Ia5:67,103; Ia11:126; La1:6
"Cross-Hatched Flying Fish": Ia6:20
"Cross-Hatched Pendant?": Aa8:26; Ia6:86; Ia7:9
"Cross-Hatched *Staff": Aa6:60; Cr9:16; Cv6:31; La1:39?,41?
"Cross-Hatched Woman": Cv5:17

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DISTINGUISHING "EXPERTISE" IN TE REO MĀORI: TOHUNGA, PŪ AND REHE

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ABSTRACT: This article presents a model that defines and differentiates three varieties of indigenous Māori expertise—tohunga, pū and rehe. The three terms are commonly defined in the modern Aotearoa New Zealand literature—both academic and non-academic—to all mean the same thing, 'expert'. However, given the importance of knowledge transfer in precolonial society, as well as the established political order in which tohunga are known to historically have played an important role, it seems unlikely that Māori tīpuna 'ancestors' would have used the terms interchangeably. Through an analysis of a sample of newspapers, academic works, dictionaries and traditional Māori resources (whakataukī 'proverbs', kīwaha 'idioms', pūrākau 'histories and mythologies'), primarily older works but also a small collection of newer examples from academia and governmental resources for comparison, the three terms are defined. I argue that each had unique purposes in traditional Māori society, they were ranked and there were specific requirements for achieving each rank. My aim is to help clarify, communicate and legitimise categories of Māori expertise and their use in a society that is increasingly recognising and asserting indigenous rights and treaty obligations.

Keywords: language change, te reo Māori, cultural expertise, tohunga, pū, rehe, indigenous newspapers, whakataukī 'proverbs'

There is no doubt that, right now, Māori expertise is in demand. There are increasing calls for *te reo Māori* 'Māori language' teachers, *tikanga Māori* 'Māori customs' experts and more Māori representation in New Zealand schools, workplaces, healthcare facilities, government and media. Consequently, Māori concepts of expertise are increasingly discussed, particularly within the context of healthcare (Waitangi Tribunal 2011). This has resulted in increased usage of the Māori terms *rehe*, *pū* and *tohunga*, which are all varieties of 'expert' in the contemporary Aotearoa New Zealand lexicon. Whilst this is an undeniably positive trend, Māori ought to consider whether the predominantly Pākehā 'European' or otherwise colonised systems in New Zealand society are adequately equipped to understand and use these terms, and by extension Māori expertise, to achieve optimum outcomes for Māori and Pākehā alike. What *tohunga, pū* and *rehe* meant to

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Māori ancestors will be different to what they mean to Māori today, but an essential nature of tikanga Māori is that it is rooted in *whakapapa* 'genealogy' (Smith 2012: 285–88; Waitangi Tribunal 2011: 22). This means that the fundamental principles and characteristics applied to those terms before the arrival of Pākehā (i.e., prior to colonisation) will be the same that Māori apply today. The purpose of this article, then, is to analyse the literature on these terms and their use in both precolonial contexts and today, determine the fundamental principles and characteristics applied to them and ultimately propose a theoretical model with which we can structure our understanding of Māori expertise in Aotearoa New Zealand today.

It is not difficult to find discussions of Māori expertise in the contemporary literature across a variety of disciplines, where the terms *rehe*, *pū* and *tohunga* are often used. However, the ways these are used is often vague and sometimes result in inconsistent or overlapping definitions. The concern here is that, to the inexperienced reader, the terms will appear to all point to the same meaning, that is, an abstract concept of a 'Māori expert'. Another concern is that by generalising the te reo Māori terms, Māori will lose nuances in Māori bodies of knowledge, and with this, depths in specialist fields; the variety of Māori experts—tohunga, pū and rehe—are potentially treated as 'jacks of all trades' rather than as different kinds of specialists. A look through some of the older texts demonstrates that in precolonial Māori society the terms were used to describe specific varieties of experts and expertise.

A quality of *rehe* that appears frequently in older texts is it is used as an element of compound *kupu* 'words' or *kīwaha* 'idioms/expressions' to add a quality of "expertise". Some examples of this include *Patu-pai-arehe* 'ancient supernatural beings' (Lind 1947: 36–38) and *kātua-rehe* 'expert, deft person, rascal' (Ngata 1993: 375; Orbell 1973) in *pūrākau* 'histories, mythologies, stories', *rehe-taiaha* 'taiaha expert' in *mōteatea* 'lament, sung poetry' (Ngata 1956: 206) and *matarehe* 'handiwork' in kīwaha ("Word List", 1928: 171).

Within these examples, there is a theme of recognising the expertise involved in art, weaving or other handiwork. Given its use in conjunctions, the word *rehe* also seems to appear more frequently in *whakataukī* 'proverbs', kīwaha or pūrākau, which might suggest it has a more candid, colloquial or even humorous use than *pū* or *tohunga*. The whakataukī "Nā te rehe" provides a starting point for looking at these patterns. Mead and Grove (2001: 317) translate the whakataukī to mean 'by an expert' and explain that this is intended to be a compliment on some "fine handiwork, most appropriately weaving or tattooing" (Mead and Grove 2001: 317). "Nā te rehe" also appears in the Williams dictionary (2001: 333) under the term 'rehe' and is prefaced by "Au mahi, e te rehe!—He maikuku tona tukunga iho he rehe" (The work of the rehe!—a neat-fingered (*maikuku*) result, a

neat-handed person), which further emphasises the focus *rehe* places on expert handiwork. The concentration on the hands is continued in other available references: a kīwaha from Whanganui included in the *Journal of the Polynesian Society* (1928: 171) Word Lists series, "He maui matarehe", refers to someone who is left-handed, *he maui* in this case referring to 'left' and the aforementioned *matarehe* to handiwork.

The term *kātua-rehe* demonstrates the colloquial nature of *rehe* as a term for expertise. It makes a notable appearance in a pūrākau recorded at the turn of the century from Ngāti Awa. Margaret Orbell (1973) discusses two versions of this pūrākau, which centres on the life of Te Tahi o te Rangi, a famous tohunga of Ngāti Awa, where one version is written by Hāmiora Pio and the other by Tīmi Wāta Rimini. Hāmiora writes from the perspective of a tohunga, whereas Tīmi, who is younger and not a tohunga, writes from more of a "layperson's" perspective. As Orbell (p. 129) explains, these differing perspectives resulted in vastly different styles and appreciations of the story. Hāmiora tells the story very precisely and directly, and any seemingly arbitrary details have a specific utility, e.g., indicating the name of an important location. Tīmi instead presents the story with more fantasy, and including illustrations, which Orbell (p. 130) explains is a demonstration of how a traditional pūrākau might be used to serve an 'untraditional' purpose; whereas Hāmiroa's telling is educational, Tīmi's is bolstering, for humour and *whakawhanaungatanga* 'community/relationship building'. This stylisation is nowhere more apparent than when Tīmi describes Te Tahi as "kātua-rehe", translated by Orbell (p. 136) to mean 'cunning rascal', 'expert' and 'hero'. To describe a tohunga in this way is indicative of the more colloquial kind of expertise *rehe* was used to represent. In other contexts, it refers to a talented hand; in this context it refers to an expert with fame or a charismatic quality.

Pūkenga, on the other hand, appears to have been more of a standardised term for an 'expert/authority' or for a 'skill' or 'expertise' in whatever context provided, but also has a unique history as a title for someone who is a repository of knowledge or a teacher of tohunga in *whare wānanga* 'houses of learning'. An early example of its standard use can be found in an 1885 edition of the newspaper *Te Korimako*, in which a lament to General Korano stated that the general had never considered himself a pūkenga with notable *taonga* 'wealth', *mana* 'prestige/reputation' or *kororia* 'glory', but merely that he cared that the work he did was quality ("otira ko te mahi i te pai ko te mahi i te tika ko ia te take i whakaritea e ia mona") (*Te Korimako* 1885: 2). The author uses *pūkenga* again later in the piece, but this time to describe the skills that General Korano had and had passed on, and that whilst his passing was a true loss, those pūkenga will live (p. 2). Another writer from 1888, also in *Te Korimako*, uses *pūkenga* when describing the

technology of pigeon delivery services, saying that communication is "te pūkenga me te ahua o te hinengaro" (a skill and aspect of the mind) (*Te Korimako* 1888: 10).

Pūkenga was also used as a title for someone who acted as a teacher in the whare wānanga and who instructed and trained the tohunga, the full title being "tohunga pūkenga" (Smith 2008: 268). A famed *karakia* 'prayer/incantation' that Rātā used when felling a tree for his canoe addresses the whare wānanga—its pūkenga and *tauira* 'students' as a group:

> Kotia te pu ka waiho i uta, Ko te kauru ka to ki tai; E ai ra ko te umu tuhi, Kihai tae ki nga pūkenga, Ki nga wananga, ki nga tauira. (Pomare 1876: 3)
>
> Cut away the base of the tree, and here leave it, cut away the crown of the tree, and here leave it, 'Tis said that the ceremonial oven did not concern the *learned ones*, nor those versed in ancient knowledge. (Graham's translation, 1924: 132; emphasis mine)

This confirms the "vocational" quality *pūkenga* can possess, as well as being a general term for skill. This traditional quality can be considered the origin of how *pūkenga* came to be a standard term for a university lecturer (Ryan 2008: 249) following the imposition of foreign schooling systems.

However, as a title, *pūkenga* was not limited to tohunga pūkenga but was also used as a term for someone who acted as a general repository of knowledge for the people (Williams 2001: 307). A letter to the editor from the *Manawatu Times* in 1923, written in English but discussing te reo Māori, finishes with the line "Ask questions, and you become my *pūkenga*", a demonstration of the ability of community members to educate each other with personal wisdoms (*Manawatu Times* 1923: 4).

Of further interest is the existence of the *tipuna* 'ancestor' who was named Pūkenga of Ngāti Pūkenga. I am aware of brief histories explaining how his name was indication that he was considered to be a repository of knowledge for the *hapori* 'community', but I ran into difficulty finding further information on the nature of his life and name. This is definitely a point of interest for future research.

Tohunga was the most formalised of these terms. From the literature on precolonial tohunga, we can identify five qualities that distinguish their title from *pūkenga* and *rehe*: the whare wānanga, reading *tohu* 'signs, indications', relationship with *tapu* 'methodology of restrictions for the purpose of group maintenance', mana and responsibilities for public wellbeing.

The study that tohunga undertook at whare wānanga is arguably their most distinctive point of difference as a kind of expert. The manuscripts of Te Matorohanga, a Ngāti Whakawhena tohunga, recorded by H.T. Whatahoro in 1865, provide some authentic knowledge as to what was taught at the

whare wānanga and how they operated, although according to Simmons and Biggs (1970) and Simmons (1994), some of the published material using these manuscripts has either added new information not provided by Te Matorohanga (Simmons 1994: 117) or used other manuscripts from Whatahoro and linked them to false sources (Simmons and Biggs 1970: 41). However, when applying a critical lens to these sources we can draw out knowledge of what these places were like and the topics that tohunga studied in the whare wānanga. The whare wānanga were physical buildings, the designs of which had whakapapa to the original *whare-kura* 'way of learning' of the *ātua* 'gods' (Matorohanga, cited in Te Whatahoro *et al.* 1915: 39–40). The subjects considered here fell into two categories, *wānanga-a-Rangi* 'heavenly/philosophical knowledge' and *wānanga-a-Papa* 'knowledge of the earth' (pp. 53–54). The wānanga-a-Rangi taught karakia, pūrākau, whakapapa and tapu (Simmons 1994: 148–62), *rāhui* 'environmental restriction' (Mead 2016) and death and embalming (Wikatene 2006). The wānanga-a-Papa taught astronomy, horticulture, geology (including earthquakes and volcanoes), marine biology and fishing, tattooing and meteorology (Simmons 1994: 148–62). Within the wānanga-a-Papa, it is believed that tohunga were taught the skills of reading tohu (Smith 2008).

Smith (2008: 266–70) explains the concept of tohu, in precolonial Aotearoa New Zealand, as signs that were imperative for economic success, health and political survival. Tohu could provide information on environmental conditions, *tohu moana* 'ocean conditions' indicating the quality of fishing and *tohu rangi* 'sky conditions' indicating temporal, meteorological and astronomical information. Tohu could also provide historical and political information, *tohu whenua* 'landmarks' could convey whakapapa or cultural information about the area and *tohu rangatira* 'leadership qualities' could indicate a person or group with political prowess. Lastly, tohu could provide information on health-related issues, *tohu aituā* indicating potential for widespread death, ill health or misfortune and *tohu mate* indicating the same but for individuals.

It is noteworthy that these tohu all deal with tapu. Tapu is a highly complex concept and, according to Shirres (1982: 34–36), exists in two forms, intrinsic and extrinsic. Intrinsic tapu are tapu in and of themselves and can be found in the origins of Māori whakapapa in the ātua. These intrinsic tapu materialise as the winds (Tāwhiri), the human race (Tū), *kūmara* 'sweet potato' (Rongo), sea/fish (Tangaroa), forest/birds (Tāne) and fernroot (Haumia). Extensions of tapu are essentially physical access points to the intrinsic tapu, and as links, it is through them that a clash of intrinsic tapu can occur. Extensions of tapu are inescapable in everyday life, and include the hands (Tū), menstruation (Papatūānuku), harvesting (Rongo), the ocean (Tangaroa), corpses (Hinenuitepō) and the canoe (Tāne), among many others.

Throughout the literature, there are examples of tohunga routinely engaging with extensions of tapu. This was likely because since they were highly educated and skilled in tohu, they were able to engage with tapu at a lesser risk of harming their own or others' intrinsic tapu. Engaging in this work would often leave their hands and bodies in an intensified state of tapu (Waitangi Tribunal 2011: 211; Walker 2004: 66), which meant they risked contaminating things they touched, in essence placing a tapu on them (Waitangi Tribunal 2011: 211; White 1888: 58–61). Rerekura (2011) explains this phenomenon in the context of *whaikōrero* 'oration', where the *kaikōrero* 'orator' cannot also be *kaitunu* 'cook' without the risk of contaminating the food after their whaikōrero. When Walker (2004: 66–67) discusses tohunga, whilst he defines the term as a 'generic term for expert', he does emphasise the risks tohunga took when engaging with tapu and the specialised tikanga that existed to navigate such conditions.

The literature also indicates that tohunga were some of the most tapu individuals in any given *hapū* 'sub-tribe' (Mahuika 1972: 115; Prytz-Johansen 1958; Walker 2004: 67; White 1888: 58–61). White (1888: 58–61) discusses the story of Kiki, a tohunga from Waikato, and his ultimate demise at the hands of Tamure, another Waikato tohunga. Kiki was considered to have been so powerful that when the sun shone, he was not allowed to go out of his house because he was so tapu that if his shadow touched a tree, the tree would wither and die, such was the clash of tapu: this resulted in the proverb "The descendants of Kiki the tree-blighter" (White 1888: 58). Tamure, who was a competing tohunga in the area, wished to face this power of Kiki's and so decided to visit him, bringing along two companions and his daughter. The journey involved many karakia, an important tool with which tohunga and others can manipulate tapu by applying it or removing it and making the environment *noa* 'safe from clashes of tapu'. Upon arrival, Kiki invited the group to a meal, his plan being to *whakatapu* 'make tapu' the food with his own tapu by cooking it in his personal oven and as such incite a clash of tapu within Tamure through the food. However, Tamure had a plan to counter this, applying a karakia whakatapu to the door of Kiki's house and asking his own daughter to partake in the food instead of them, placing the first piece under her feet. This, combined with karakia which Tamure chanted over his daughter, was an act which would *whakanoa* 'make noa' the food imbued with Kiki's own tapu. Having his own tapu made noa, Kiki became very sick and died. What this story demonstrates is the important role tapu played in the work of tohunga. Most of the actions taken by Kiki and Tamure in this story are ones in which they are manipulating tapu, and the remainder of the actions reflect on the political prowess they wielded in their communities, indicative of how someone's tapu influences their mana.

The link between the tapu of the tohunga and their high mana is confirmed in both Shirres (1982: 32–34) and Prytz-Johansen (1958). The successful completion of a tapu ritual was shown routinely in Māori histories to result in a confirmation of new mana (Shirres 1982: 33). Whilst Shirres (1982: 32) describes this phenomenon philosophically, this was also likely because having the skills to navigate tapu would have made one an asset to one's community. Such skills could be used to keep the community safe and provide them opportunities to embolden their own mana, for example through a successful campaign for food, battle in war, *pōwhiri* 'welcoming ritual' or birth. Prytz-Johansen (1958) explains that because tapu provided such opportunities for mana growth, Māori would not shun it but would actively seek it out because whilst the risk was high, so were the rewards. However, the high risks also meant that tohunga often took more of an advisory role within tapu rituals. An example from Wikatene (2006) is that a tohunga might not prepare a *tūpāpaku* 'corpse' themselves but rather instruct the relatives to do so; another example in Prytz-Johansen (1958) is the leadership and ritualistic roles of the tohunga in the cultivation of kūmara but their abstention from the more laborious tasks involved.

The importance of tapu in the roles of tohunga, as well as their mana/political prowess, is also reflected in the work of Mahuika (1972: 114–18) in his thesis on female leaders in Ngāti Porou. He describes the primary function of tohunga as being "interpreters of the gods" given their unique access to sacred knowledge learnt in the whare wānanga. This knowledge allowed tohunga to use not only karakia imbued with tapu but also the skill of prophecy (pp. 115–16). According to Mahuika (p. 115), if the tohunga failed in their duties, they would damage or lose entirely their *mana atua* 'godly tapu', people would cease to follow and respect them (they would lose mana), and if the task were of great importance, for example predicting the outcome of a war effort, they would lose their life. The converse was also true. The skill of "prophecy", as Mahuika describes it, particularly as a skill coming from whare wānanga, was probably more akin to the skills of observing and interpreting tohu, which as aforementioned were taught in whare wānanga.

The final characteristic of tohunga to consider here is their role within public health. Of all the characteristics mentioned, this one has the most prominence in policy, and health and well-being practices related to Māori. It is not unfounded to consider how Māori might view many tohunga today whilst remaining true to the tikanga surrounding their traditional role. One of the earliest experts to discuss this is Peter Buck (Te Rangi Hīroa), who explained that illnesses were frequently regarded as being caused by infringements of tapu (Buck 1945). If a tapu was broken, someone could

be struck with a variety of illnesses, from loss of appetite and fever to *kutu-kutu-ahi* 'delirium' (Buck 1945: 405). Tohunga were then asked to address the infringement and subsequent ailment to restore the person: Buck (1945: 405) equates this diagnosing a patient and treating them. If this was a mental illness, Buck (1945: 405) explains that tohunga took on the role of psychiatrist and prescribed treatments such as therapy and dream analysis.

This concept was emphasised in the Waitangi Tribunal (2011) report *Ko Aotearoa Tēnei*. The report outlines the impact of the Tohunga Suppression Act, which affected the ability of tohunga to access *rongoā* 'traditional medicines' and which worked to devalue Māori medicine. Like Buck (1945), the Tribunal (2011: 211–12) explains that tohunga worked with rongoā in the context of tapu. The Tribunal (2011: 214–30) also outlined issues tohunga faced with the arrival of foreign disease, their delegitimisation by Pākehā and Māori alike and the subsequent lack of a support system for Māori health, which continues today.

Where this leaves us is a modern Aotearoa New Zealand full of Māori experts—tohunga, pū and rehe. However, because of colonisation and the new systems and circumstances thus imposed on Māori, the means outlined here for distinguishing among these different kinds of experts and terms have been lost. All three can be and often are defined the same. This effect is most noticeable in dictionaries. A good example is *The Raupō Dictionary of Modern Māori* (Ryan 2008), where in the Māori-to-English section, *tohunga*, *pūkenga* and *rehe* are all defined as relatively unique forms of "experts" (in short, priests, experts and lecturers), and in fact *tohunga* is defined in 36 unique varieties, whereas in the English-to-Māori section, *tohunga* is the only one of the three terms provided as a translation for "expert". Consequently, it appears that *tohunga* now acts as the default term for "expert", which is perverse given the immense prestige historically embedded in this role. Using *tohunga* as the default term has the potential to unnecessarily exaggerate the mana of some expertise in te ao Māori, place undue pressure and expectations on up-and-coming specialists and truly undervalue the mana of established tohunga. These factors all risk negative outcomes in the quality of work and the health of the expert, as well as that of the community and the cultural competency of New Zealanders generally. Using each term more carefully would likely lower these risks and assist Māori in best recognising and deploying their varied kinds of expertise. Furthermore, the more defined terms would assist non-Māori in engaging Māori specialists who have the appropriate skills for their needs.

* * *

As explored herein, when we examine what is available of the old interpretations, we can identify distinctive qualities of each that would be useful in helping us understand and refine our understanding of the nature of Māori expertise today. *Rehe* was a colloquial term found most commonly in whakataukī and kīwaha and was used to describe someone who was a professional at a hand-crafting skill and/or who was famous, charismatic or renowned. *Pū* was the most common and generic word for expert and skill, used to elaborate on someone's role or reputation, and sometimes as a title when it came to teachers or knowledgeable community leaders. *Tohunga* was a term reserved for only the most distinguished of experts and applied to someone who had been trained or qualified in a discipline. As in the past, today we might best apply it to one who has achieved such a hold over that discipline that they consistently produce high-quality outcomes (tohu), can navigate the most difficult parts of the job (e.g., tapu), commands the utmost respect in their field (mana) and supports the wellbeing of their community (ideally in a health-centred capacity). I would argue further that *tohunga* should be reserved exclusively for tapu experts, as consistent with past usage. This is not the case presently as the distinctions have become increasingly blurred. However, whilst tohunga might again become a term reserved for tapu experts, tikanga Māori and te reo Māori are not static; instead they adapt to support Māori in ever-changing circumstances. As such, it may be appropriate to extend the scope of the duties of a tohunga to include non-tapu activities that hold a similar weight and which are rooted in the whakapapa of the tohunga role.

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REGIONAL VARIATIONS AND TEMPORAL CHANGES IN THE PREHISTORIC USE OF OBSIDIAN AND CHERT IN THE NORTH ISLAND OF NEW ZEALAND

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ABSTRACT: Analysis of existing quantitative data on chert and obsidian artefact assemblages from 46 archaeological sites in the North Island of New Zealand/Aotearoa shows there was a significant overall decline in the use of chert during the Early (Archaic) cultural period, between about AD 1250 and AD 1500. This was accompanied by a similar reduction in high-quality Mayor Island obsidian in most regions, but a corresponding increase in the procurement of obsidian from other sources. Such changes can be largely attributed to the development of regionally based exchange networks. There is evidence of further change in the use of obsidian and chert more or less coinciding with the construction of defensive pā 'fortified sites' and inferred outbreak of warfare about the end of the Early period ca. AD 1500, although this affected some regions more than others. In Northland and the southern North Island high proportions of chert used at some pā and undefended villages (kainga) were mainly associated with houses. In other regions, use of chert remained at low levels throughout the Late (Classic Māori) period, up until European contact in the late eighteenth century. The data support a gradual and non-synchronous transition from Archaic to Classic Māori culture in the North Island, with greater response to change in some regions than others.

Keywords: obsidian, chert, regional variations, temporal changes, North Island, New Zealand

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The significant cultural change in New Zealand prehistory from an Early or Archaic phase (with distinct East Polynesian affinities) to a Late or Classic Māori phase (Golson 1959) resulted in major differences in adze styles and technology, fish hook design, ornamentation and adaptations to new lithic materials. The changes in material culture relating to these two phases or periods have been well documented (e.g., Davidson 1984; Duff 1956), but it remains uncertain whether the transition from Archaic to Classic culture occurred in a gradual and non-synchronous fashion (Davidson 1984) or was relatively abrupt and triggered by a major event such as the outbreak of warfare (Schmidt 1996) or destruction of coastal settlements by large tsunami (McFadgen 2007). This transition is generally considered to have occurred around AD 1500 (Walter *et al.* 2010; cf. Anderson 2016).

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Obsidian and chert are typically the most common lithic materials found in pre-European North Island archaeological sites. Although both were widely employed for cutting and scraping purposes, chert was also used for drill points, and in some cases for adzes/chisels, particularly during the Early period. Only limited study has so far been undertaken into the use of chert in New Zealand (e.g., Brassey 1985; H. Leach 1979; Phillipps *et al*. 2016). By comparison, there has been considerable research on obsidian artefact assemblages, aimed mainly at identification of their geological sources and the nature and extent of exchange networks, and primarily focused on Mayor Island obsidian (see review by Sheppard 2004). In recent years, much of this work has relied upon analysis of the obsidian by portable XRF (e.g., Ladefoged *et al*. 2019; McAlister 2019; Sheppard *et al.* 2011).

This paper demonstrates that there were some significant regional differences and temporal changes in the use of both obsidian and chert during the prehistoric period, and considers possible causes for them. The study is largely based upon data obtained from published and unpublished reports on excavations conducted at various sites in the North Island since the 1960s (Fig. 1). Although these excavations have provided important stratigraphic information, as well as details on the context and spatial distribution of artefacts, many sites remain poorly dated. Consequently, some information has also been included from surface collections in order to increase the dataset. The northern half of the island contains all of the known geological sources of obsidian in New Zealand (McAlister 2019; Moore 2012a; Sheppard 2004), along with numerous deposits of chert (Moore 1977).

In the southern half of the North Island there have been few fully reported excavations, apart from those undertaken at Palliser Bay in the 1970s (Leach and Leach 1979). These southern sites are remote from any obsidian sources but situated relatively close to occurrences of chert in eastern parts of the region (Moore 1977). No relevant information is available for sites in the central and southwestern North Island.

RELIABILITY OF DATA

Data on the amounts of obsidian and chert recovered from 46 selected North Island sites are presented in Table 1. Sites are arranged according to type, and within these categories, broadly from north to south, by region. A number of other sites, particularly middens, were excluded because they contained insufficient artefacts or obsidian only, or lacked radiocarbon dates. Relative proportions of obsidian (O) and chert (C) are conveniently expressed by the O/C ratio.

There are several potential sources of error in the dataset. Firstly, it is not always certain what the original analyst has identified as chert: in some cases it has been included in the lump term "siliceous material" (e.g., Leahy

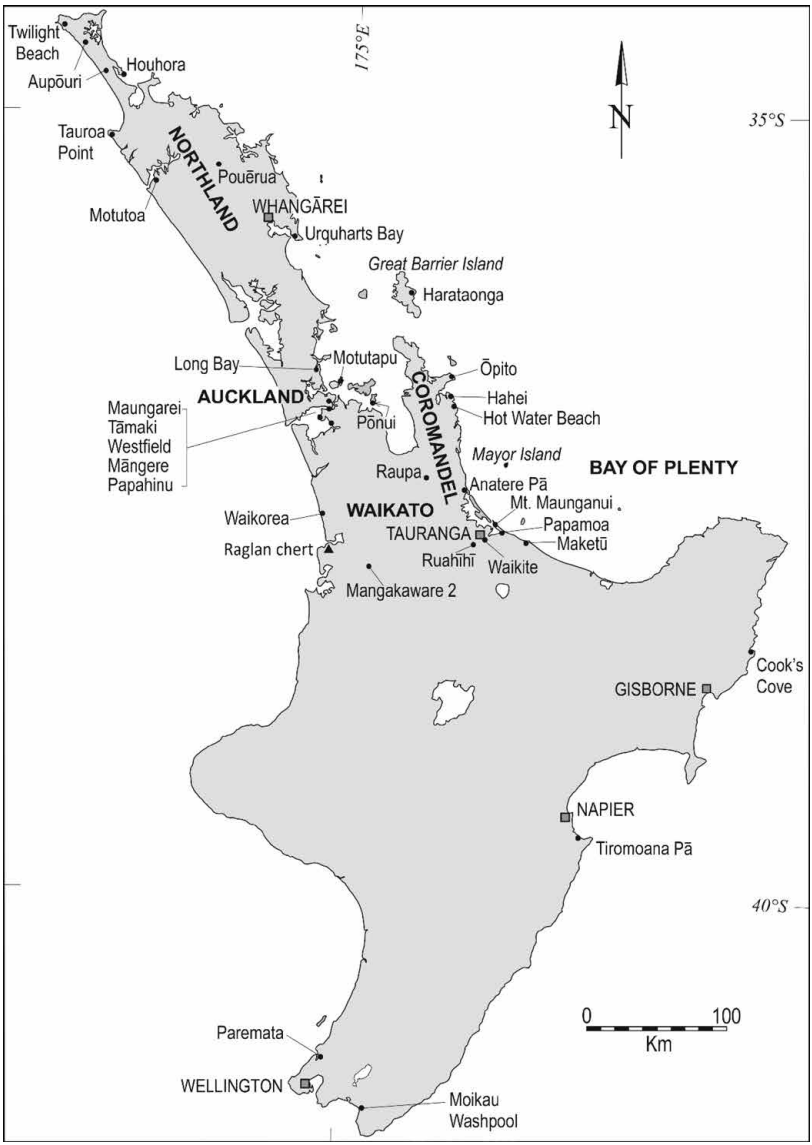

Figure 1. Map of the North Island, New Zealand, showing the location of archaeological sites with analysed obsidian and chert assemblages.

Table 1. Quantitative data on obsidian and chert, and Mayor Island obsidian, for 46 sites in the North Island (see Fig. 1). Sites arranged according to type, and approximately from north to south.

* Site numbers are those of the NZ Archaeological Association site recording scheme, www.archsite.org.nz
† Regions indicated by abbreviations: NLD = Northland, AUK = Auckland, CBP = Coromandel–Bay of Plenty, WAI = Waikato, SNI = Southern North Island.
‡ Median dates (rounded), from CALIB v8.2 (Stuiver *et al.* 2021). See Table SI-1 for date ranges.
§ Weights (g) in italics.

Site	Site no.*	Region†	Age ‡ (AD)	Obsidian § N, wt	%	Mayor %	Chert N, wt	%	O/C	Reference
MIDDEN/WORKSHOP (n = 22)										
Twilight Beach	M02/162	NLD	1375	> 197	52%		183	48%	1.1	Taylor 1984
Aupōuri	N02/821	NLD	1570	124	86%	10%	20	14%	6.2	Coster (pers. comm.)
Aupōuri	N03/519	NLD	1620	214	90%	8%	25	10%	8.6	Coster (pers. comm.)
Aupōuri	N03/323	NLD	1490	992	98%	24%	21	2%	47	Coster (pers. comm.)
Houhora	N03/59	NLD	1340	*13,904*	57%	57%	*10,394*	43%	1.3	Furey 2002
Tauroa Point	N05/302	NLD	1300	192	21%	77%	731	79%	0.3	Allen 2006; Phillipps *et al.* 2016
Urquharts Bay	Q07/571	NLD	1610	72	83%	17%	15	17%	4.8	Phillips 2010; Moore 2012a
Long Bay	R10/1374	AUK	1490	239	94%	45%	15	6%	15.9	Campbell *et al.* 2019
NRD, Māngere	R11/859	AUK	1700	6,523	96%	31%	270	4%	24.6	Cruickshank 2011

Site	Site no.*	Region†	Age ‡ (AD)	Obsidian § N, wt	%	Mayor %	Chert N, wt	%	O/C	Reference
Pōnui Is.	S11/20	AUK	1480	326	56%	49%	251	44%	1.3	Nicholls 1964
Harataonga	T08/5	CBP	1350	114	34%	89%	223	66%	0.5	Law 1972; Allen 2014
Ōpito	T10/161	CBP	1340	86	11%	99%	710	89%	0.1	Boileau 1980
Hahei	T11/376	CBP	1390	3,470	31%		7,809	69%	0.4	Harsant 1985
Hot Water Beach	T11/115	CBP	1520	1,183	74%	38%	426	27%	3.4	Leahy 1974
Mt. Maunganui	U14/363	CBP	1475	322	91%	97%	13	9%	25	Hooker 2009
Papamoa	U14/2912	CBP	1630	31	94%	100%	2	6%	15.5	Gumbley 2010
Maketū	V14/187	CBP	1390	125	77%	98%	38	23%	3.3	Moore 2008
Waikorea	R14/256A	WAI	1420	475	85%	96%	84	15%	5.7	Ritchie *et al.* 2009
Cooks Cove	Z17/311	SNI	1490	60	48%	100%	65	52%	0.9	Walter *et al.* 2011
Washpool	S28/47	SNI	1530	237	55%		194	45%	1.2	H. Leach 1979; K. Prickett 1979
Washpool	S28/49	SNI	1300	3,525	50%	70%	3,504	50%	1	B.F. Leach 1979; K. Prickett 1979
Paremata	R26/122	SNI	1340, 1600	110	62.5%	92%	66	37.5%	1.7	Davidson 1978; Moore and Challis 1980

Site	Site no.*	Region†	Age ‡ (AD)	Obsidian § N, wt	%	Mayor %	Chert N, wt	%	O/C	Reference
KAINGA/HOUSE (n = 11)										
Pouērua	P05/402	NLD	1560	*106*	1%		*10,121*	99%	0.01	Brassey 1985
Pouērua	P05/857	NLD	1490	119	8%	8%	1,409	92%	0.08	Brassey 1985; Marshall 1994
Pouērua	P05/858	NLD	1610	*365*	44%	16%	*466*	56%	0.78	Brassey 1985
Motutoa	Q06/307	NLD	1770	102	42%		142	58%	0.72	Frederickson 1990
Tāmaki	R11/887	AUK	1600	187	98%		3	2%	62.3	Foster and Sewell 1988
Tāmaki	R11/899	AUK	1600	68	96%		3	4%	23	Foster and Sewell 1988
Tāmaki	R11/1201	AUK	1640	206	99%	40%	3	2%	68.7	Foster and Sewell 1993
Westfield	R11/898	AUK	1670	626	88%	32%	68	12%	7.1	Furey 1983, 1986
Papahinu	R11/229	AUK	1700	71	97%	77%	2	3%	35.5	Foster and Sewell 1995
Moikau	S28/9	SNI	1280	133	15%	70%	789	85%	0.17	N. Prickett 1979
Washpool	S58/26	SNI	1530	1	1%		84	99%	0.01	B.F. Leach 1979

Site	Site no.*	Region†	Age ‡ (AD)	Obsidian § N, wt	%	Mayor %	Chert N, wt	%	O/C	Reference
PĀ (n = 11)										
Pouērua pā	P05/195	NLD	1680	631	19%		2,677	81%	0.24	Sutton *et al.* 2003
Pouērua	P05/371	NLD	1740	67	24%		215	76%	0.3	Sutton 1993
Pouērua	P05/408	NLD	1540	435	19%		1,885	81%	0.23	Sutton 1993
Maungarei	R11/12	AUK	1650	189	99%	12%	2	1%	94.5	Davidson 2011
Tāmaki	R11/1506	AUK	1625	130	74%	41%	45	26%	2.9	Foster and Sewell 1993
Harataonga	T08/3	CBP	1500	168	90%	22%	18	10%	9.3	Law 1972
Raupa	T13/13	CBP	1770	3,547	74%	96%	1,219	26%	2.9	N. Prickett 1990, 1992
Anatere	U13/46	CBP	1640	243	100%	70%	0		100	Phillips and Allen 1996
Ruahīhī	U14/38	CBP	1595	> 142	> 98%	100%	2	< 1.5	71	McFadgen and Sheppard 1984
Mangakaware 2	S15/18	WAI	1660	32	97%		1	3%	32	Bellwood 1978
Tiromoana	W21/1	SNI	1490	13	5%		237	95%	0.05	Fox 1978
PIT/TERRACE (n = 2)										
Motutapu I.	R10/38	AUK	1780	132	84%	21%	25	16%	5.3	Davidson 1970b
Waikite	U14/1611	CBP	1,525	110	99%	100%	1	1%	110	Moore 2009

1974); in other reports it is differentiated from sinter, silicified tuff and jasper. Secondly, it is not necessarily clear whether the figures for chert include or exclude drill points, cores and debitage, and few reports provide information on weights of materials, which would be a more useful way of determining proportions. In addition, lack of sieving may mean that small flakes were not collected, thus introducing sample bias. The classification of sites also poses some problems. Some, and perhaps many, defensive *pā* 'fortified sites', for example, were originally undefended villages or hamlets (*kainga*) that were subsequently fortified, or later functioned as undefended settlements. Therefore the artefacts recovered from such sites may relate to both defended and undefended phases of occupation, which together could have spanned > 100 years. It also needs to be borne in mind that many of the excavated areas represent only a small proportion of the total extent of sites, in some cases < 1 percent.

Since the introduction of pXRF analysis there has been an increasing tendency to report only on the numbers of analysed obsidian artefacts rather than the total obsidian assemblage (e.g., Ladefoged *et al*. 2019; McCoy *et al*. 2014; Sheppard *et al*. 2011). In some studies only 50–60 percent of artefacts were analysed, leaving doubts over the provenance of the remainder, although Mayor Island obsidian can generally be reliably identified on the basis of visual attributes alone (Moore 2012b). Different sample size criteria for pXRF analysis have also been applied, ranging from a minimum of 3.5 mm (McCoy *et al*. 2014) to 20 mm (Ladefoged *et al*. 2019), or a weight of > 1 g (Sheppard *et al*. 2011). For some assemblages, therefore, the true percentage of obsidian could be somewhat higher, so where possible data used in this study have been taken from earlier papers or original excavation reports.

Establishing reliable ages for sites is also a problem, since many radiocarbon dates obtained prior to the 1980s were based on unidentified wood or charcoal which may have had a significant inbuilt age, and cannot necessarily be relied upon (Anderson 1991). Also, the interval of particular interest, from about AD 1450 to 1600, happens to coincide with relatively flat portions of both the terrestrial and marine calibration curves, resulting in calibrated dates with large errors. For these reasons, as well as consistency, all dates have been recalibrated using the latest calibration curves SHCal20 for terrestrial samples and global Marine20 (with regional reservoir offset Delta R of -154 ± 38 ^{14}C years, http://calib.org; Stuiver *et al*. 2021) for shell samples, following Anderson and Petchey (2020); details are provided in the Appendix.

EARLY SITES

The identification of any significant changes in the use of obsidian and chert during the prehistoric period requires a reference point, and therefore we need to first look at the data from some of the more important early sites, occupied during the first 100–200 years after initial settlement. Unfortunately, there are relatively few well-stratified early sites in the North Island that have been adequately investigated or dated and are able to provide reliable data on the proportions of obsidian and chert (Table 2, Fig. 2). The five sites considered here are all coastal middens and/or working areas dating securely to the Early period. The date of initial settlement is taken as ca. AD 1250 (Anderson 1991), and almost certainly lies between ca. AD 1230 and AD 1280 (Wilmshurst *et al*. 2011), while the division between Early and Late periods at about AD 1500 follows Walter *et al*. (2010). Some have also argued for the existence of a transitional "Middle Period" from AD 1450 to 1650 (Anderson 2016; McCoy and Ladefoged 2019).

Houhora, in the Far North, is unquestionably one of the more significant early sites in New Zealand (Fig. 1). It has yielded an outstanding assemblage of Archaic artefacts (Furey 2002), though the large collection of obsidian has been only partially analysed and there is limited information on the chert component. Five main cultural layers (2a–d, 3) are recognised, all except the upper one (2a) apparently dating to the fourteenth century. The basal Layer 3 probably dates to the early 1300s, while Layer 2b was most likely deposited around AD 1350 (see Appendix). Recalibration of the single ^{14}C date from Layer 2a (NZA2391) suggests it was formed after about AD 1640 and probably in the eighteenth century; obsidian hydration readings indicate an age closer to AD 1700.

The available data (Furey 2002, tables 4, 17) suggest that, despite a significant reduction in the proportion of chert in the intermediate layer (2c), there was minimal change in the use of obsidian or chert over the period represented by the more important Layers 2b and 3 (Table 2). The lower obsidian percentage in Layer 2a should be treated with caution. Furey (2002: 20–22) noted that this layer was difficult to distinguish from the underlying Layer 2b, and consequently some artefacts may have been wrongly assigned; also there was a certain degree of reworking from older layers. Thus Layer 2a probably contains material from two or more separate events.

Site S11/20 (formerly N43/1) on Pōnui Island, near Auckland, was originally excavated between 1956 and 1962, and three main cultural levels were recognised (Nicholls 1964). Although there are indications of a decline in use of chert at this site (Fig. 2), the upper part of the sequence was considerably disturbed and contained some intermixed European

Table 2. Data on obsidian and chert from five early sites. See also Fig. 2.

Site	Layer	Age (AD)*	Obsidian N/wt	%	Mayor Is. N	%	Chert N/wt	%	O/C
Houhora	2a	> 1500?	2,983 g	37		50	5,031 g	63	0.6
	2b	1345	4,919 g	47		53	5,599 g	53	0.9
	2c	n.d.	4,701 g	80		61	1,143 g	20	4.1
	3	1330	4,284 g	54		44	3,652 g	46	1.17
Pōnui Island	Level 1	n.d.	179	67	100	56	88	33	2.03
	Level 2	1480	110	52	78	71	100	48	1.1
	Level 3	1480	37	37	26	70	63	63	0.6
Cooks Cove	Layer 3	n.d.	0	0	0	0	12	100	0
	Layer 5a	1555	38	44		100	49	56	0.78
	Layer 5b	1350–1510	22	58		100	16	42	1.38
Washpool S28/49	Level 3	ca. 1540	83	36	68	82	148	64	0.56
	Level 2	1340	1,975	50	1,411	71	1,964	50	1.0
	Level 1	1270	1,467	51	1,016	69	1,392	49	1.05
Paremata	Layer 2C	1660	51	59	46	90	36	41	1.4
	Layer 3	1340	55	65	51	93	30	35	1.8

* Median dates (rounded) from CALIB 8.2 (Stuiver *et al.* 2021).

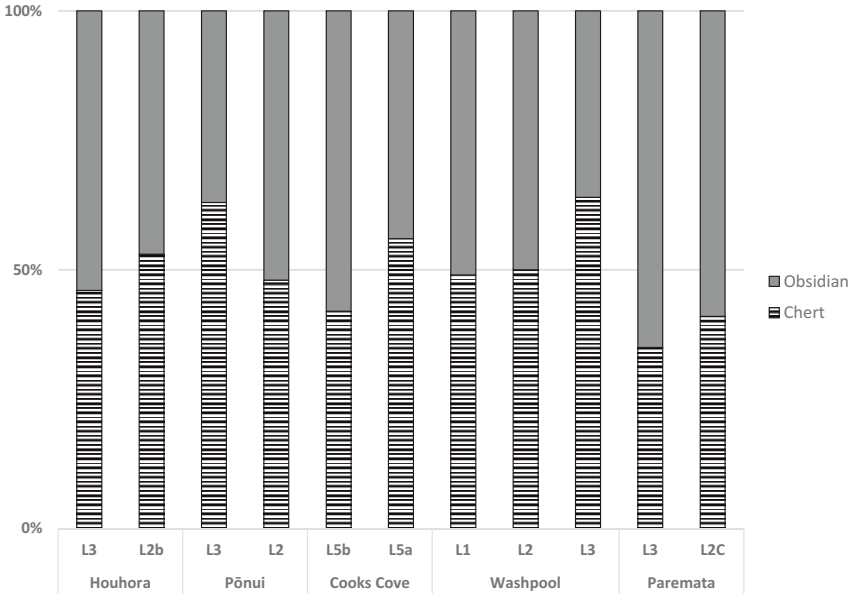

Figure 2. Proportions of obsidian and chert at early coastal sites, at different stratigraphic levels. Data from Furey (2002); Nicholls (1964); Walter *et al.* (2011); K. Prickett (1979); and Moore and Challis (1980). See Table 2 for details.

material, and therefore the data for Level 1 should probably be disregarded. Radiocarbon dates presented by Sheppard *et al*. (2011) and Irwin (2020) indicate the main cultural horizon at this site (apparently equivalent to Layers 2 and 3) was formed in the fifteenth century.

On the East Coast, the Cooks Cove site includes an early cultural layer divisible into two parts (Layers 5a, 5b) which were possibly formed 50–100 years apart (Walter *et al*. 2011). New calibrations of dates indicate the earlier Layer 5b was deposited between AD 1430 and 1580, and Layer 5a between AD 1520 and 1650 at 65% probability (Anderson and Petchey 2020). There is a suggestion of a slight increase in the proportion of chert in Layer 5a, but the numbers of flakes are too few to make a reliable judgement. All of the obsidian was apparently from Mayor Island.

Arguably the best information comes from the Washpool midden site S28/49 (formerly N168/22) at Palliser Bay (B.F. Leach 1979; K. Prickett

1979). Here three main cultural levels were recognised, the lowest (Level 1) originally considered to date to ca. AD 1180, but in view of subsequent reassessments of the time of initial settlement of Aotearoa (Anderson 1991; Wilmshurst *et al*. 2011) probably more likely ca. AD 1250 or later. The proportions of obsidian and chert in this and the intermediate level (Level 2, ca. AD 1340) are remarkably similar, and indicative of considerable stability over the first century of occupation. The uppermost Level 3, which is only indirectly dated to ca. AD 1540, shows some indication of a decline in the use of obsidian, but not of Mayor Island material. This is not evident at the nearby Washpool garden site (S28/47), which contained a similar proportion of obsidian to that of Levels 1 and 2 at the Washpool midden and is reliably dated to AD 1450–1680 (Anderson and Petchey 2020), or ca. AD 1530 (H. Leach 1979; Table 1).

Consistent proportions of obsidian and chert have also been recorded from the Paremata site near Wellington (Davidson 1978; Moore and Challis 1980). Most of the artefacts came from the lower Layers 3 and 2C, and assuming that dating of these layers can be relied upon (L3 = AD 1285–1400, L2C = 1440–1780 at 95% probability, see Appendix), it appears there was virtually no change in the use of obsidian or chert (or Mayor Island obsidian) over a period of perhaps 100 years or more.

As illustrated in Figure 2, the relative proportions of obsidian and chert at the five sites are remarkably similar. Although there are indications of a slight intra-site increase in the use of chert over time (except at Pōnui), the changes are small and could be influenced by size of the excavated areas and variability in the spatial distribution of artefacts. The percentage of Mayor Island obsidian at each site is also reasonably consistent (Table 2). The data from these particular sites do not, therefore, point to any widespread change in the use of obsidian and chert. However, as shown in Figure 3, there was in fact a significant overall increase in the O/C ratio during the Early period, by approximately a hundredfold over a period of 200 years (or 5% per decade). This represents either a major increase in the use of obsidian or a decline in the use of chert.

REGIONAL VARIATIONS AND TEMPORAL CHANGES

To identify any significant geographic and temporal differences in the use of obsidian and chert over the entire North Island, all data from Table 1 are plotted in Figure 4. This reveals that the overall increase in the O/C ratio during the Early period (Fig. 3) gradually reduces or levels off in the Auckland and Coromandel–Bay of Plenty (BOP) regions. The situation in Northland is more complex, while the limited data from southern North Island (SNI) sites show even greater variability. There is a clear indication here, though, that the main changes occurred around AD 1450–1500.

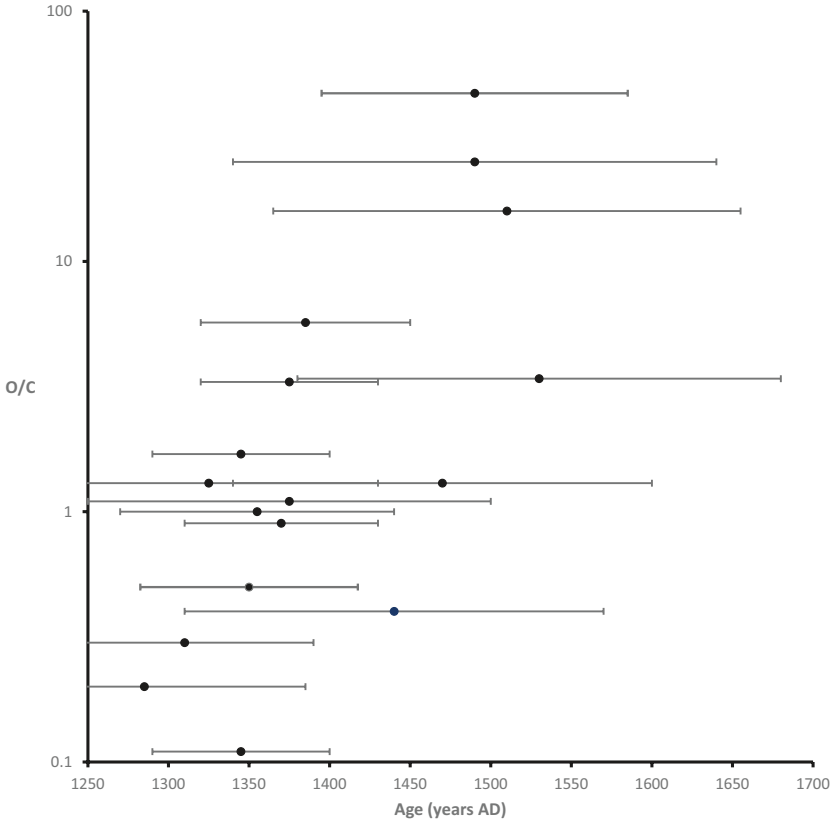

Figure 3. Trend in the O/C ratio for early sites. 95% probability age ranges from Table SI-1.

Chert

The relative proportions of chert at most North Island sites are plotted in Figure 5, according to region. Contrary to indications of minimal or no change at the five early sites (Fig. 2), it shows there was a general decline in the use of this lithic material (relative to obsidian) during the Early period, especially in the Auckland and Coromandel–BOP regions. The situation in the sixteenth–seventeenth century is more complex, with chert forming up to 100 percent of assemblages at some sites in Northland (e.g., Pouērua) but less than 20 percent in the Auckland and Coromandel–BOP regions. After about AD 1600 the use of chert at Late period sites in Auckland and

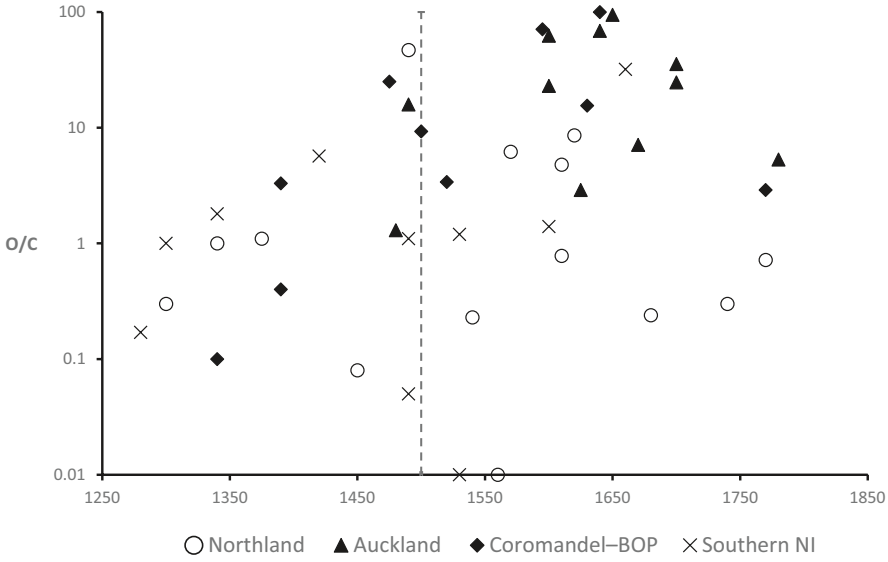

Figure 4. The O/C ratio for all sites, according to region. Based on data from Table 1 (with Waikato included in Southern North Island). Vertical dashed line marks the approximate commencement of pā construction (from Schmidt 1996).

the Coromandel–BOP region remained at low levels, but this was clearly not the case in Northland.

Although few detailed studies of chert assemblages have been undertaken, there is little evidence of any long-distance transport of artefacts or raw material in the North Island, apart from the distinctive Raglan chert on the Waikato coast (Moore and Wilkes 2005; Fig. 1). While it has been claimed that much of the chert (sinter?) found at the Houhora site in the Far North came from Coromandel Peninsula (Best and Merchant 1976), this remains equivocal (Furey 2002: 110). Notably, at the nearby and similar-aged site of Tauroa Point all the chert appears to be from local sources less than 70 km away (Phillipps *et al*. 2016), and at Pouērua most of the chert was probably also obtained locally (Brassey 1985). In the Auckland area at least some of the higher-quality material found at Early sites (e.g., Matatūahu, N. Prickett 1987) may have originated from Coromandel, whereas the chert recovered from later sites seems to be predominantly from local sources, and is described as being of relatively poor quality (e.g., Cruickshank 2011). The overall

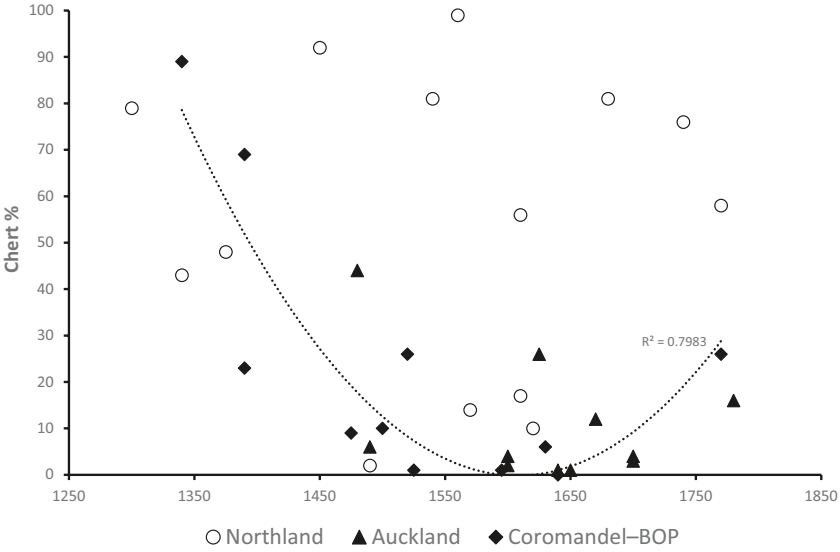

Figure 5. Proportion of chert at northern sites, and trendline for the Coromandel–BOP region.

decline in use of chert in Auckland, therefore, may have been partly due to increasingly restricted access to high-quality material, forcing a shift towards the utilisation of poorer-quality chert obtained mainly if not exclusively from local sources. But this does not explain the similar trend for Coromandel, where chert occurrences are relatively abundant (Moore 1977). Clearly, more research into the types of chert used in particular regions is required, particularly from sites dating to around the fifteenth–sixteenth century.

Mayor Island Obsidian

Obsidian from Mayor Island (MI) in the Bay of Plenty was dispersed throughout New Zealand (Walter *et al*. 2010), and there are few early sites in the North Island which do not contain any material from this source. Previous studies have established that there was a general decline in use of this high-quality obsidian over the prehistoric period (Green 1964; Leach and de Souza 1979; Moore 2012a; Seelenfreund and Bollong 1989), though details of this trend remain sketchy. In the South Island a major contraction in the distribution of MI obsidian had occurred prior to AD 1500 (Walter *et al*. 2010).

The proportion of MI obsidian relative to the total obsidian recovered from individual sites is illustrated in Figure 6 (see also Table 1). Only sites in Northland, Auckland and Coromandel–BOP are plotted since these regions provide the best data. This shows a steady decline in the use of MI obsidian in the Northland and Auckland regions during the prehistoric period, but a consistently high percentage for most Coromandel–BOP sites. The only significant outliers are the Hot Water Beach site on Coromandel Peninsula and the pā at Harataonga (T08/3) on Great Barrier Island, both of which are located close to alternative sources (Hahei/Cooks Beach and Te Ahumata respectively). Houhora in the Far North contains a surprisingly low proportion (40–60 percent) of MI obsidian for an early site (Furey 2002).

As seen for the chert (Fig. 5), regional differences in use of MI obsidian became more pronounced after about AD 1450–1500. Although a number of Late period sites still contain a high proportion, these are all located in the Coromandel–BOP region close to the source. In contrast, sites in the Auckland and Northland regions are characterised by low MI percentages, with many Northland sites containing < 20 percent. This regional differentiation is supported by data from other sites (Moore 2012a).

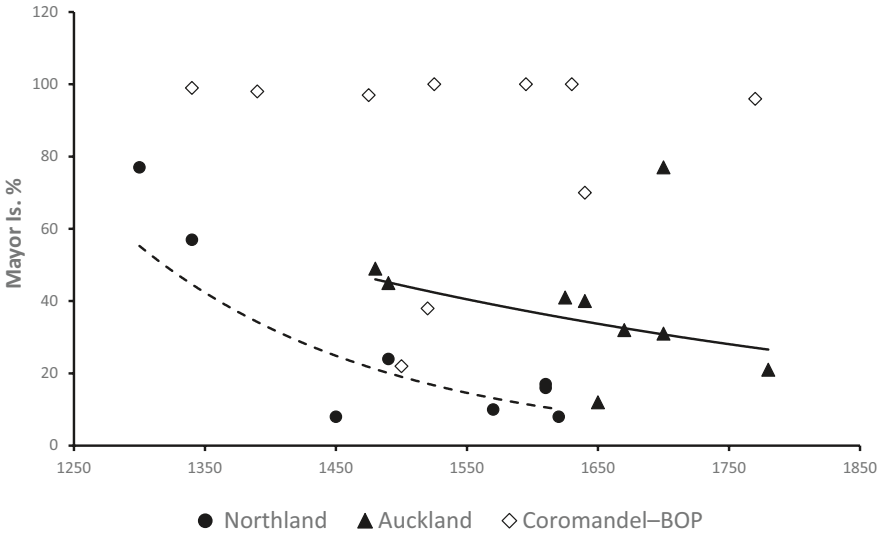

Figure 6. Proportion of Mayor Island obsidian at sites in the three northern regions, showing a decline in Auckland (solid trendline) and Northland (dashed trendline).

Other Obsidian

Despite the decline in use of MI obsidian in Northland and Auckland, O/C ratios for flake assemblages from Auckland sites remained high (Fig. 4), indicating that the reduction in MI obsidian was compensated for by the procurement of material from alternative sources. Until fairly recently the identification of these sources had been largely based upon visual attributes (see Sheppard 2004), but the introduction of pXRF analysis has now provided greater certainty. Nevertheless, there are still only limited data for sites in these regions.

The relative proportions of obsidian from different sources for three sites in Northland and three in Auckland are shown in Figures 7 and 8 respectively. These sites were selected on the basis that their obsidian assemblages had been at least partly analysed by pXRF, four of them solely by this method, while those from Aupōuri and the NRD site at Māngere were analysed by a combination of visual attributes and pXRF. The Aupōuri site chosen (N03/450) is reasonably representative of those in that area (Moore and Coster 2015). In each figure, sites are ordered by decreasing age from left to right.

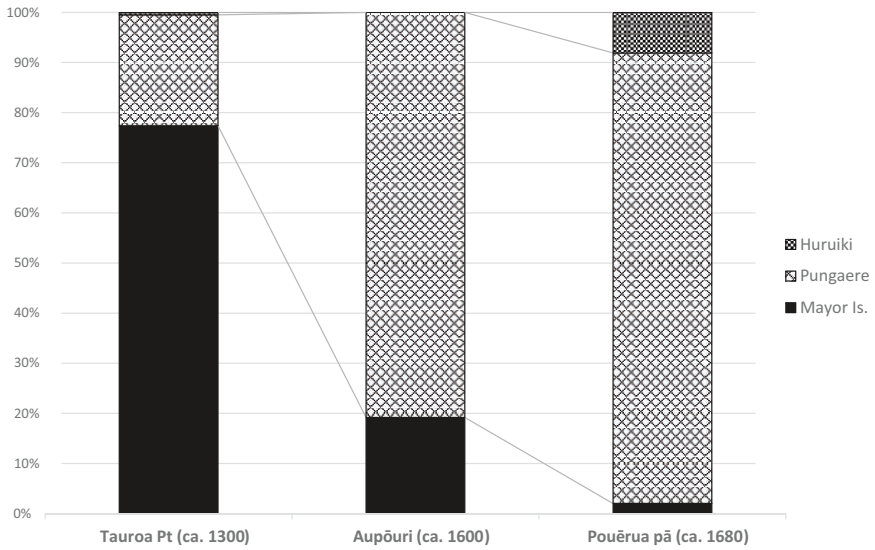

Figure 7. Temporal changes in the provenance of obsidian in Northland. Data from Phillipps *et al*. (2016, Tauroa Point), Moore and Coster (2015, Aupōuri) and McCoy *et al*. (2014, Pouērua pā).

The Northland sites range in age from the early fourteenth century (Tauroa Point, ca. AD 1300) to the seventeenth century (Pouērua pā, ca. AD 1680), and clearly illustrate the decline in use of MI obsidian in this region (Fig. 7). It was primarily replaced by inferior-quality obsidian from the main local source of Pungaere (Kāeo), which at Pouērua pā made up almost 90 percent of the total assemblage (McCoy *et al*. 2014). "Grey" obsidian (grey in transmitted light) from the distant Coromandel sources was only a minor component (< 1 percent), while material from the other local source, Huruiki, was significant only at Pouērua pā. Although these sites adequately illustrate the broad trend in obsidian procurement in Northland, the situation is considerably more complex. A recent study of artefact assemblages from 53 sites on the Aupōuri Peninsula, for example, showed that the proportion of MI obsidian utilised there remained relatively constant during the late fifteenth to seventeenth century, and apparently increased in the eighteenth century (Moore and Coster 2015). In contrast, the proportion of "grey" obsidian was highly variable and came from multiple sources, mainly Coromandel (Cooks Beach, Hahei), Great Barrier Island (Te Ahumata) and Huruiki. In

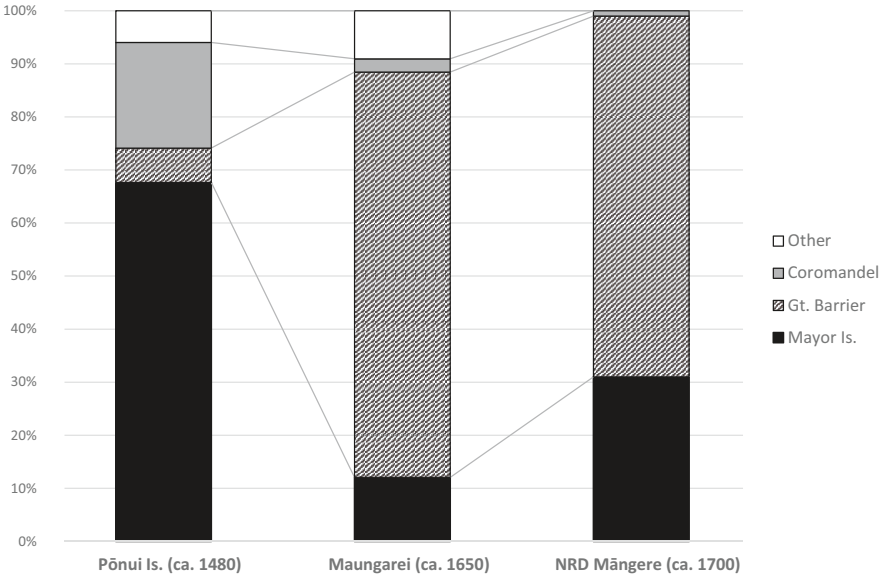

Figure 8. Temporal changes in obsidian provenance in the Auckland region. Data from Sheppard *et al*. (2011, Pōnui Island), McCoy and Carpenter (2014, Maungarei) and Cruickshank (2011, NRD Mangere).

southern Northland, analysis of a small assemblage (n = 72) from Urquharts Bay near Whangārei indicated that 45 percent of the obsidian was obtained from Great Barrier (Moore 2012a).

The situation in Auckland was similar to Northland, except that the main alternative source of obsidian was Te Ahumata, on Great Barrier Island, about 90 km offshore to the northeast (Figs 1 and 8). The use of material from this source seems to have increased significantly over time, from only 6 percent in the late fifteenth century (Pōnui) to 50–70 percent in the seventeenth to eighteenth century. On the other hand the importation of obsidian from Coromandel sources appears to have declined markedly, and little or no obsidian was obtained from Northland. This trend has recently been confirmed by pXRF analysis of an obsidian assemblage (n = 239) from a fifteenth-century site at Long Bay, north of Auckland City (Campbell *et al*. 2019).

It is evident from Figures 7 and 8 that the shift towards a greater reliance on alternative sources had already begun by the early fourteenth century in northern Northland (in good agreement with the evidence from Houhora) and by the fifteenth century in Auckland. In both cases this apparently predates construction of the first defensive pā (Schmidt 1996).

SITE TYPES

While archaeological sites are usually classified according to their dominant feature (e.g., midden), in reality many were multifunctional and used for any combination of living, cooking, food storage, food processing and manufacture of tools. Thus the sites referred to here as "midden/workshops" could, in some cases, also be regarded as kainga (e.g., Houhora). Similarly, few pā were constantly defended, and at times they functioned as open settlements or kainga (e.g., Maungarei/Mt Wellington, Davidson 2011). There is, therefore, considerable overlap between site types, and in situations where there is some doubt as to how they should be classified I have simply used my own judgement.

It is evident from Table 1 that there is considerable variation in the O/C ratio among some site types (from 0.01 to 100), which is clearly illustrated in Figure 9. The early sites are almost exclusively midden/workshops, and overall these show a relatively consistent increase in the O/C ratio, at least until the sixteenth century (Fig. 3). Although this trend appears to have levelled off after about AD 1500 (cf. Fig. 3), as mentioned earlier many later middens (not included in this study) tend to contain very few artefacts, often of obsidian only, resulting in high O/C ratios. Nevertheless, the continuity of this trend, as shown in Figure 9, would seem to suggest that whatever purpose the obsidian and chert were used for during the Early period remained much the same in the Late period.

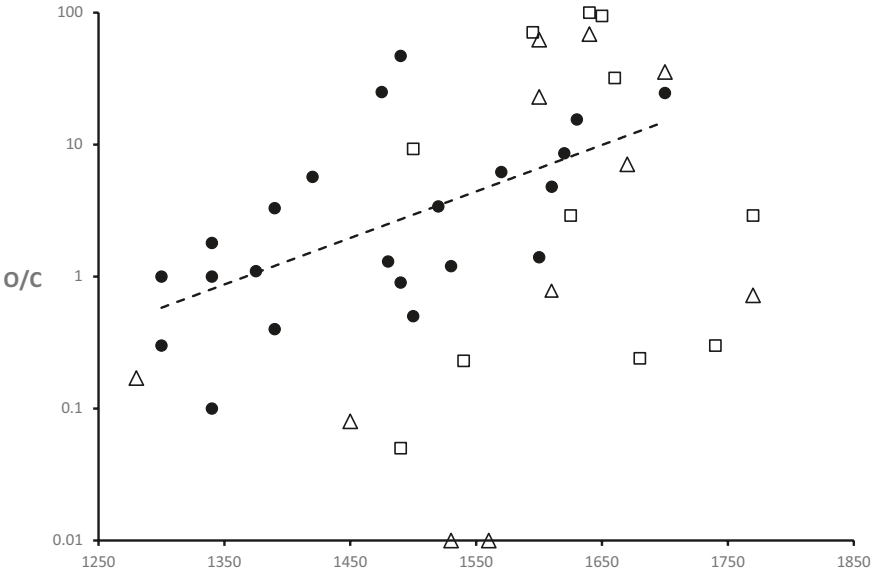

Figure 9. The O/C ratio for different site types, and trendline for midden/workshops.

Many of the excavated sites dating to the Late period are kainga and pā which, in contrast to the middens, show a much wider variation in the O/C ratio (Fig. 9). A number of kainga and pā have low O/C ratios, and most of these are situated in Northland (e.g., Pouērua) and the southern North Island (Fig. 4, Table 1). By comparison, many of the kainga and pā in the Auckland and Coromandel–BOP regions are characterised by high O/C ratios. Such marked differences in the relative proportions of obsidian and chert among these site types may be at least partly attributable to regional cultural differences.

Midden/Workshops

Early midden/workshops were exclusively coastal, and are generally interpreted as seasonal or semi-permanent camps or hamlets primarily focused on fishing and/or exploitation of larger fauna, particularly moa. Initially, as illustrated in Figure 2, a significant quantity of chert was being used at some sites (typically around 50 percent), but by the sixteenth century it had fallen, particularly in Auckland and Coromandel–BOP, to < 30 percent (Fig. 5). There is no indication, however, of an abrupt change in the use of obsidian or chert at these early coastal sites that might be attributable to some catastrophic natural event, such as the impact of large tsunami (McFadgen 2007).

Kainga and Houses

Figure 9 shows that the proportion of chert being used at some kainga was particularly high (O/C < 0.1), and excavation reports for these sites in many cases indicate it is related to a close association with houses. The Moikau house S28/9 at Palliser Bay, which is dated to AD 1185–1390 (see Appendix), is the earliest dwelling site that has been excavated in New Zealand (N. Prickett 1979). A large number of chert and obsidian flakes were found on the floor of this house, with a particular concentration on the left side (looking in) and rear of the building suggesting, by reference to ethnographic accounts, that the flakes were primarily used by junior members of the household, and most likely women. Surprisingly, a very high proportion of the chert (92 percent) consisted of waste material, indicating that flakes were actually being produced inside the house. Nigel Prickett (1979) speculated that the used flakes were employed in making clothing or other objects from flax and perhaps skins. At the nearby sixteenth-century Mākōtukutuku house S28/56, most chert flakes (all very small) were found in the porch area (H. Leach 1979).

This association between houses and high chert/low obsidian usage is also particularly well illustrated at Pouērua, where five separate kainga were excavated (Sutton 1994). Unfortunately, only one of these (P05/402) is securely dated, to the fifteenth–seventeenth century (ca. AD 1560?), but dates for two other sites (P05/857, 858) suggest they were occupied around AD 1450–1550. What is most notable is the consistent proportions of obsidian and chert (and thus O/C ratio) at these sites, with the exception of P05/858 (Table 1). This is suggestive of a close relationship between the inhabitants of the kainga, for perhaps 50–100 years or more.

The best data are from the kainga P05/857, where the remains of five houses were discovered and the amounts of obsidian and chert associated with each house were recorded separately (Marshall 1994). The interpreted sequence of house construction, as indicated in Table 3, would suggest a gradual increase in the use of obsidian at this site (Fig. 10). Houses H1 and H3 were considered to be contemporary, and this is supported by the similar O/C ratios. This apparent increase in obsidian at P05/857 is not evident at nearby P05/402, where the later of the two houses identified contained only chert (Brassey 1985).

Evidence of numerous houses was also uncovered during extensive and meticulous excavations on the impressive volcanic cone of Pouērua (P05/195) in 1984–1985 (Sutton *et al*. 2003). On this large pā, early house sites, pre-dating the construction of defences, contained few if any stone flakes, and the bulk of the obsidian and chert was associated with later houses within the uppermost cultural layers (Layers 1 and 2), mainly post-dating the defensive phase which is inferred to have begun around AD 1600. Dates for Layers 1 and 2 suggest most of these later houses were constructed after

Table 3. Proportions of obsidian and chert associated with houses at Pouērua. Data from Sutton (1993, 1994); Sutton *et al*. (2003); and Table SI-1. See Fig. 10.

Site/feature	Age (AD)	Obsidian (N, %)		Chert (N, %)		O/C
Pouērua Pā P05/195 (1450–1810) ca. 1680						
Area I (house?)	ca. 1730	58	17%	274	83%	0.21
Area II total	1450–1640	180	20%	741	80%	0.24
Quad B (2 houses)	ca. 1700?	115	21%	441	79%	0.26
Quad D house	ca. 1700?	16	9%	171	91%	0.09
Area III south terrace	ca. 1750	26	12%	187	88%	0.14
Area IV (house)	1750–1800	293	24%	934	76%	0.31
Area V	ca. 1600?	4	20%	16	80%	0.25
Area VII (house)	ca. 1750?	3	5%	54	95%	0.06
Peripheral pā P05/371 (1510–1890)						
Area 2 house	ca. 1740	67	24%	215	76%	0.31
Peripheral pā P05/408 (1440–1640)						
Area 1 house	ca. 1540	62	8%	669	92%	0.09
Kainga P05/857 (1330–1620) ca. 1490						
House H2 (Area III)	Latest?	18	19%	76	81%	0.24
House H1 (Area I)	Same as H3	37	7%	474	93%	0.08
House H3 (Area IV)	Same as H1	54	9%	537	91%	0.1
House H4 (Area V)	Second	2	2%	101	98%	0.02
House H5 (Area VI)	Earliest	1	1%	80	99%	0.01

about AD 1700. Though not all of the stone flakes recovered from the various excavation areas were associated with houses, the O/C ratio is remarkably similar throughout (Table 3, Fig. 10). The highest ratio is for the largest and possibly latest house, in Area IV. For the most part the ratios are also slightly higher than for the nearby kainga, suggesting greater use of obsidian on the pā. House sites excavated on two smaller peripheral pā P05/371 and P05/408 (Sutton 1993) have similar O/C ratios (Table 3).

Interestingly, the association of chert with houses at Pouērua and in the southern North Island is not evident in the Auckland area among sites of similar age. Foster and Sewell (1988: 49), for example, found no spatial relationship between house structures and the occurrence of obsidian and other stone flakes at site R11/899, Tāmaki. This was also true at the nearby pā R11/1506 (Foster and Sewell 1993), at Hamlins Hill (Davidson 1970a) and on Motutapu Island (Leahy 1970), although one house on Motutapu contained abundant obsidian on the floor (Ladefoged and Wallace 2010). At Papahinu, none of the 14 separate houses identified were associated with

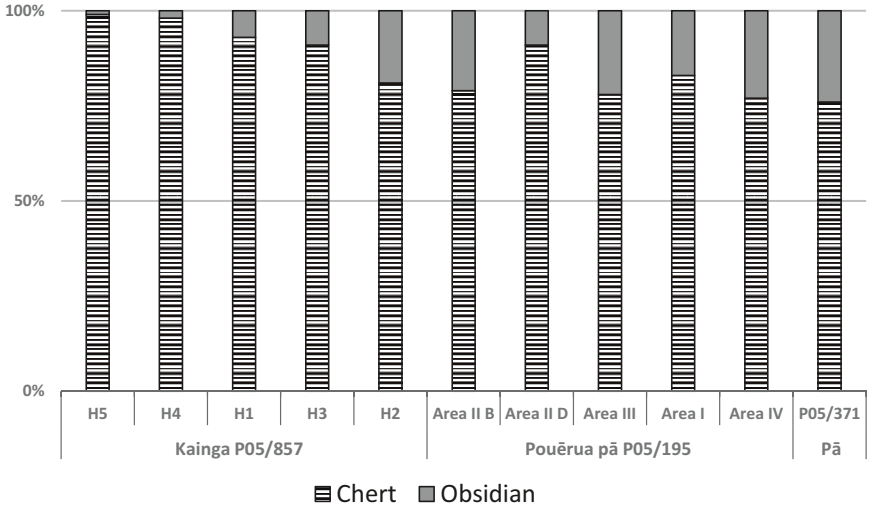

Figure 10. Proportions of chert and obsidian associated with house sites at kainga and pā at Pouērua, arranged from older (left) to younger for each site. This sequence potentially spans a period of up to 250 years (ca. AD 1500–1750). Data from Table 3.

concentrations of chert flakes (Foster and Sewell 1995). It is reasonable to assume, therefore, that whatever the chert was being used for at Pouērua was undertaken by other lithic materials, or at other places within sites, in the Auckland area.

Defensive Pā

Radiocarbon dates indicate that the construction of pā, and by implication the initiation of warfare (or at least the threat of conflict), commenced around AD 1500 (Schmidt 1996), at or close to what is conventionally accepted as the end of the Early (Archaic) period. Notably, a typical range of Early period artefacts and faunal material was recently recovered from a small pā (Te Ahua) on the west coast of Auckland which appears to date to the mid-to-late fifteenth century (Turner *et al*. 2010). Recalibration of the two dates (Wk27056, 27057) indicates this pā was probably occupied around AD 1490 (AD 1420–1560 at 68% probability). Therefore, pā construction may have begun somewhat earlier in some areas, perhaps around AD 1450.

The wide variation in the O/C ratio among pā sites (Table 1, Fig. 9) would seem to suggest that while there was limited effect on the supply of obsidian in the Coromandel–BOP area as a result of increasing conflict (Figs 4, 6), there was a more significant impact in parts of Northland and the southern North Island. However, this is difficult to confirm because although obsidian assemblages from many pā have been analysed, few can be confidently attributed to pre-defensive or defensive phases. It is therefore worth taking a closer look at the data from Pouērua, especially since obsidian from the main pā P05/195 has been recently analysed by McCoy *et al*. (2014). Their analysis suggests there were significant changes in not only where the obsidian was procured from but how. Specifically, they argue that there was a change from unrestricted access to local obsidian sources during the earlier undefended period to "extreme restriction" in direct access coinciding with construction of the first fortifications on Pouērua Pā around AD 1600.

The data presented by McCoy *et al*. (2014) indicate the main changes in obsidian assemblages occurred during the defended period in Areas I and III of the pā (Fig. 10). They do not state which stratigraphic level their obsidian artefacts were from, but 85 percent of those in Area III (n = 50) were found in the uppermost Layers 1 and 2 (Sutton *et al*. 2003, table 5.5 and p. 39). Layer 2 was interpreted as pre-dating the second defences in that area and dates to < 250 BP. Most of the obsidian in Area I also apparently came from Layers 1 and 2, which date to ca. AD 1730 and are considered to post-date the defences. Thus although some of the obsidian from Area III may relate to the defended period, both in this area and Area I most was associated with features dating to after about AD 1750. Therefore the "extreme restriction" in access to local obsidian did not coincide with the

first fortifications, as might be expected (McCoy *et al*. 2014), but with late defences and post-defensive occupation perhaps > 100 years later. As shown in Figure 10 there is no indication of a dramatic change in the proportions of obsidian and chert being used at Pouērua relating to late occupation of the main pā (Areas I, II and IV). No information is available on the nature or likely sources of the chert.

Dating Pouērua. The data from Pouērua are of particular importance because the consistently high use of chert in this area (Fig. 10) is suggestive of considerable stability over a period of > 200 years, despite the construction of defensive pā and inferred restrictions in obsidian supply (McCoy *et al*. 2014). Notably, similar-aged sites in Northland, on the Aupōuri Peninsula and at Urquharts Bay, do not contain an unusually high proportion of chert (Table 1). Although more reliable dating of the kainga and peripheral pā at Pouērua is required to establish when this high use of chert began, for the time being we are limited to the few dates obtained by the original investigators. The three main sites of interest are the peripheral pā P05/408 and kainga P05/402 and P05/857. Previously reported dates, which were all based on identified charcoal, suggest these sites were occupied between about AD 1450 and 1600.

In order to gain greater certainty about the age of these sites the available ^{14}C dates were recalibrated (Table 4). This indicates that the "Cattleyards" pā P05/408 and kainga P05/402 are of similar age and probably date to between AD 1440 and 1640 (95% probability), or ca. AD 1540. The single date obtained for the kainga P05/857 is attributed to clearance of the original vegetation (Marshall 1994), and provides only a maximum age (AD 1390 at 85% probability) for occupation of the site. Moreover, the dated sample consisted mainly of charcoal from larger tree species (rewarewa, kohekohe) and could have an inbuilt age of at least 50 years. Allowing for these factors I have estimated a likely age for the kainga of about AD 1490 (AD 1420–1630 at 95% probability).

The reassessment of these dates means that initial occupation of the Pouērua area, exceptionally high use of chert and gradual increase in obsidian (Fig. 10) probably began sometime between AD 1450 and 1550, well before construction of defences on the main pā at around AD 1600. Also, it is possible that some of the kainga and peripheral pā were contemporary, and therefore that the settlement as a whole was not necessarily undefended and may already have been under some degree of threat prior to AD 1500 (cf. McCoy *et al*. 2014). However, the consistently low O/C ratios across all sites at Pouērua would suggest that the unusually high use of chert was not related to conflict but to some cultural factor that has not yet been identified.

Table 4. Recalculated ^{14}C dates for Pouērua. Dates calibrated using SHCal20 and rounded to nearest 5–10 years.

Site	Lab no. *	Material †	CRA (BP)	Calibrated age (95% probability)
P05/402 (kainga)	NZ7309	Charcoal	400 ± 55	AD 1450–1640
P05/408 ("Cattleyards"pā)	NZ7330	Charcoal	407 ± 60	AD 1440–1640
P05/857 (kainga)	NZ7308	Charcoal	495 ± 55	AD 1390–1510 (85%), AD 1575–1620 (11%)

* All dates by Institute of Nuclear Science (now GNS Science).
† Details of charcoal composition are given in Sutton (1994, Appendix 1) and Sutton (1993, "Cattleyards" pā).

DISCUSSION

There are clear indications, from changes in the use of obsidian and chert, that regional differentiation had already begun in the North Island in the fourteenth century. This is well illustrated, for example, by the high proportion of local Pungaere/Kāeo obsidian at Houhora and other early sites in the Far North (Moore 2012a; Phillipps *et al*. 2016), despite an apparently strong connection (in the case of Houhora) with the Coromandel area (Furey 2002). Either it was proving difficult to procure superior-quality obsidian from Mayor Island in the fourteenth century, or it was simply considered more expedient to make use of poorer-quality local material. However, the lack of any significant differences between or changes in the proportions of chert and Mayor Island obsidian at individual Early sites, both in northern and southern parts of the North Island, is at odds with the overall decline in use of these materials. It is indicative of considerable stability at these particular settlements over periods of perhaps 50–100 years and of the maintenance of long-distance communication networks regardless of increasing regionalisation.

The rapid decline in use of chert appears to have ended, or at least slowed, following the introduction of fortified pā around AD 1500 (Schmidt 1996), but it is by no means certain that the outbreak of warfare was entirely responsible. Warfare presumably resulted in increased territoriality, the breakdown or disruption of existing long-distance distribution networks, and greater dependence on local lithic resources, at least initially. It would

seem to be the most likely explanation for the reduced use of Mayor Island obsidian in Northland and the Auckland area from the fifteenth century. But the procurement of lithic materials was not necessarily consistent within regions. In the Far North, sites on the Aupōuri Peninsula dating to the sixteenth century contain a much higher percentage of obsidian than the kainga and pā of similar age at Pouērua (Moore and Coster 2015). Yet many of the Aupōuri sites also have a low MI obsidian content, in common with Late period sites in other parts of Northland (e.g, Urquharts Bay, Motutoa).

To some extent, the proportions of lithic materials also appear to be dependent upon site function. It is notable, for example, that the main differences post-AD 1500 were in relation to pā and kainga, and that the proportions of chert and obsidian being used at midden/workshops remained more similar to those in the Early period. Since these were exclusively coastal then we can probably assume that much of the obsidian and chert was being utilised in the manufacture of items related to fishing and associated activities (e.g., fish hooks, nets). On the other hand, many of the kainga appear to be closely associated with gardening. In regards to pā, it seems there was a preference for using obsidian rather than chert in the Auckland and Coromandel regions, while the reverse was the case in Northland, at least at Pouērua. This would seem to point to the existence of regional cultural differences.

The idea that conflict may have caused restrictions in access to obsidian sources, as promoted by McCoy *et al*. (2014) (see also McCoy and Ladefoged 2019), certainly warrants further examination. Evidence from Pouērua in particular would suggest there was little or no disruption to the supply of obsidian around the time that warfare is inferred to have broken out, and that if existing exchange networks were affected then it was only a relatively short time before they were re-established or entirely new supply chains formed. Clearly the situation during the Late period was complex, and further research will be required to understand it.

* * *

This paper has demonstrated the value of using relative proportions of the two most common lithic materials found at archaeological sites in the North Island, obsidian and chert, in identifying both regional variations and temporal changes in New Zealand prehistory. The O/C ratio also provides an additional means of determining similarities or differences between sites and site types in any particular area. Available data show there was a significant overall decline in the use of chert, and a corresponding increase in obsidian, in all regions during the Early (Archaic) period, up until about

AD 1450–1500, although the use of high-quality Mayor Island obsidian also declined. Data from individual coastal sites, however, suggests that long-distance communication networks were largely maintained.

During the Late (Classic Māori) period there is evidence of increasing regionalism, with higher use of chert at sites in Northland and the southern North Island and of Mayor Island obsidian in the Coromandel–Bay of Plenty region. Changes in the use of obsidian and chert more or less coincided with commencement of the construction of defensive pā (and by inference the outbreak of warfare) ca. AD 1500. Conflict likely caused a breakdown in existing communication networks, at least temporarily, resulting in greater reliance on local lithic resources in some regions.

The evidence presented here lends support to the notion of a gradual and non-synchronous transition from the Early/Archaic period to Late/Classic Māori period of New Zealand prehistory.

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APPENDIX

Radiocarbon dates for archaeological sites mentioned in text. Dates calibrated using SHCal20 for terrestrial samples and global Marine20 with Delta R of –154 +/– ^{14}C years for marine shell (see Anderson and Petchey 2020). Calibrations using OxCal version 4.4 and CALIB version 8.2. Note that most dates have been rounded to the nearest 5–10 years, following recommendation by Stuiver *et al.* (2021). Not all available dates are listed.

* Lab prefixes: NZ = Rafter Radiocarbon Laboratory, GNS Science; Wk = Waikato University Radiocarbon Dating Laboratory
† Median age from CALIB v8.2
‡ Estimated age

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
MIDDEN/WORKSHOP							
Twilight Beach	M02/162	NZ6579	shell	1005 +/– 33	1250–1500	1375	Coster 1989; McFadgen 2007
Aupōuri	N02/821	NZ7066	shell	766 +/– 36	1430–1720	1570	Coster 1989; McFadgen 2007
Aupōuri	N03/519	NZ7069	shell	713 +/– 48	1460–1810	1620	Coster 1989; McFadgen 2007
Aupōuri	N03/323	NZ6581	charcoal	430 +/– 32	1440–1625	1490	Coster 1989; McFadgen 2007
Houhora Layer 3	N03/59	NZA2438	charcoal	727 +/– 86	1190–1420	1310	Furey 2002
Houhora Layer 3	N03/59	Wk5485	charcoal	640 +/– 40	1295–1415	1350	Furey 2002
Houhora Layer 2b	N03/59	NZA2436	charcoal	632 +/– 86	1270–1460	1360	Furey 2002
Houhora Layer 2b	N03/59	NZA2437	charcoal	774 +/– 87	1150–1410	1280	Furey 2002
Houhora Layer 2b	N03/59	Wk5034	shell	960 +/– 40	1280–1550	1410	Furey 2002
Houhora Layer 2b	N03/59	Wk5035	shell	1060 +/– 45	1185–1470	1330	Furey 2002
Tauroa Point	N05/302	Wk13534	charcoal	746 +/–39	1230–1390	1300	Allen 2006

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
Urquharts Bay	Q07/571	Wk26035	shell	719 +/– 35	1470–1790	1610	Phillips & Druskovich 2009
Long Bay Phase 4	R10/1374	Wk45302	shell	869 +/– 19	1350–1635	1480	Campbell *et al.* 2019
Long Bay Phase 7	R10/1374	Wk45304	shell	845 +/– 19	1390–1660	1505	Campbell *et al.* 2019
NRD Māngere Area A	R11/859	Wk27371	shell	709 +/– 36	1470–1800	1630	Campbell & Hudson 2011
NRD Māngere Area B	R11/859	Wk27372	shell	523 +/– 35	1680–1950	1810	Campbell & Hudson 2011
Pōnui Island	S11/20	NZ7764	charcoal	535 +/– 48	1320–1480	1430	Sheppard *et al.* 2011; Irwin 2020
Pōnui Island	S11/20	NZ7765	shell	957 +/– 39	1280–1550	1410	Sheppard *et al.* 2011; Irwin 2020
Pōnui Island	S11/20	Wk3578	shell	840 +/– 40	1380–1670	1510	Sheppard *et al.* 2011; Irwin 2020
Pōnui island	S11/20	Wk3579	shell	850 +/– 40	1370–1660	1500	Sheppard *et al.* 2011; Irwin 2020
Pōnui Island	S11/20	Wk3580	shell	860 +/– 40	1350–1650	1490	Sheppard *et al.* 2011; Irwin 2020
Pōnui Island	S11/20	Wk3581	shell	820 +/– 40	1400–1680	1530	Sheppard *et al.* 2011; Irwin 2020
Ōpito	T10/161	NZ354	charcoal	689 +/– 40	1290–1400	1340	Anderson 1991
Hahei	T11/376	NZ4951	charcoal	556 +/– 61	1300–1500	1415	Harsant 1985; Anderson & Petchey 2020

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
Hahei	T11/376	NZ4952	charcoal	548 +/– 59	1315–1500	1420	Harsant 1985; Anderson & Petchey 2020
Hahei	T11/376	NZ4953	charcoal	700 +/– 59	1270–1400	1340	Harsant 1985; Anderson & Petchey 2020
Hot Water Beach Layer 4	T11/115	NZ1297	shell	832 +/– 44	1380–1680	1520	Leahy 1974; McFadgen 2007
Mt. Maunganui	U14/363	Wk26693	shell	852 +/– 36	1370–1660	1500	Hooker 2009
Mt. Maunganui	U14/363	Wk26694	shell	906 +/– 36	1315–1610	1450	Hooker 2009
Papamoa	U14/2912	Wk22622	shell	675 +/– 30	1490–1830	1655	Gumbley 2010
Papamoa	U14/2912	Wk23092	shell	713 +/– 33	1470–1795	1620	Gumbley 2010
Papamoa	U14/2912	Wk23093	shell	678 +/– 34	1490–1830	1650	Gumbley 2010
Papamoa	U14/2912	Wk23094	shell	740 +/– 34	1450–1760	1590	Gumbley 2010
Maketū	V14/187	Wk23623	bone	609 +/– 30	1320–1430	1390	Moore 2008
Waikorea	R14/256A	Wk1899	charcoal	560 +/– 40	1320–1450	1420	Ritchie *et al.* 2009
Cooks Cove Layer 5a	Z17/311	Wk24846	charcoal	361 +/– 35	1460–1640	1560	Walter *et al.* 2011; Anderson & Petchey 2020
Cooks Cove Layer 5a	Z17/311	Wk24847	charcoal	389 +/– 36	1460–1630	1550	Walter *et al.* 2011; Anderson & Petchey 2020

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
Cooks Cove Layer 5b	Z17/311	Wk23489	shell	844 +/– 33	1380–1670	1510	Walter *et al.* 2011; Anderson & Petchey 2020
Cooks Cove Layer 5b	Z17/311	Wk23490	bone	624 +/– 30	1310–1430	1350	Walter *et al.* 2011; Anderson & Petchey 2020
Washpool garden	S28/47	NZ1512	charcoal	390 +/– 87	1410–1800	1555	H. Leach 1979; Anderson & Petchey 2020
Washpool garden	S28/47	NZ1513	charcoal	344 +/– 86	1430–1940	1580	H. Leach 1979; Anderson & Petchey 2020
Washpool garden	S28/47	NZ1514	charcoal	514 +/– 87	1300–1630	1450	H. Leach 1979; Anderson & Petchey 2020
Washpool midden Level 1	S28/49	NZ1505	charcoal	767 +/– 45	1220–1390	1280	Anderson 1991
Level 1	S28/49	NZ1511	charcoal	797 +/– 45	1190–1380	1260	Anderson 1991
Level 2	S28/49	NZ1507	charcoal	665 +/– 44	1290–1405	1345	Leach 1979; Anderson 1991
Level 2	S28/49	NZ1508	charcoal	683 +/– 88	1225–1440	1340	Leach 1979; Anderson 1991
Level 2	S28/49	NZ1510	charcoal	670 +/– 44	1290–1400	1345	Leach 1979; Anderson 1991
Paremata Layer 3	R26/122	NZ8542	bone	680 +/– 45	1285–1400	1340	Davidson 1978; McFadgen 2007
Paremata Layer 2C	R26/122	NZ8543	shell	740 +/– 50	1440–1780	1600	Davidson 1978; McFadgen 2007

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
KAINGA/HOUSE							
Pouērua	P05/402	NZ7309	charcoal	400 +/– 55	1450–1640	1540	Sutton 1994
Pouērua	P05/402	NZ7250	charcoal	330 +/– 60	1460–1800	1580	Sutton 1994
Pouērua	P05/402	NZ7651	charcoal	391 +/– 59	1450–1650	1550	Sutton 1994
Pouērua	P05/857	NZ7308	charcoal	495 +/– 55	1330–1620	1450	Sutton 1994
Pouērua	P05/858	NZ7303	charcoal	360 +/– 55	1455–1660	1560	Sutton 1994
Pouērua	P05/858	NZ7304	charcoal	280 +/– 55	1485–1810	1660	Sutton 1994
Motutoa	Q06/307-8	NZ528	shell	609 +/– 87	1535–1950	1730	Frederickson 1990
Motutoa	Q06/307-8	NZ789	shell	511 +/– 71	1650–1950	1810	Frederickson 1990
Tāmaki	R11/887	NZ7064	shell	726 +/– 30	1460–1770	1600	Foster & Sewell 1988; Bulmer 1994
Tāmaki	R11/899	NZ7048	shell	741 +/– 25	1450–1750	1590	Foster & Sewell 1988; Bulmer 1994
Tāmaki	R11/899	NZ7065	shell	716 +/– 30	1470–1790	1610	Foster & Sewell 1988; Bulmer 1994
Tāmaki	R11/1201	Wk1946	shell	690 +/– 35	1480–1820	1640	Foster & Sewell 1993
Westfield	R11/898	NZ6163	shell	660 +/– 55	1490–1880	1670	Bulmer 1994
Westfield	R11/898	NZ6164	shell	746 +/– 55	1440–1780	1590	Bulmer 1994

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
Westfield	R11/898	NZ6165	shell	637 +/– 52	1510–1900	1700	Bulmer 1994
Westfield	R11/898	Wk1720	shell	630 +/– 45	1520–1900	1710	Bulmer 1994
Westfield	R11/898	Wk1721	shell	540 +/– 45	1655–1950	1800	Bulmer 1994
Westfield	R11/898	Wk2030	charcoal	340 +/– 45	1460–1660	1565	Bulmer 1994
Papahinu Layer 4	R11/229	Wk3316	shell	750 +/– 50	1435–1770	1590	Foster & Sewell 1995
Papahinu Layers 2 + 3	R11/229	Wk3315	shell	490 +/– 50	1690–1950	1835	Foster & Sewell 1995
Papahinu Layers 2 + 3	R11/229	Wk3317	shell	520 +/– 50	1670–1950	1810	Foster & Sewell 1995
Moikau	S28/9	NZ1644	wood	775 +/– 59	1185–1390	1280	N. Prickett 1979; Anderson 1991
Moikau	S28/9	NZ1645	wood	777 +/– 59	1185–1390	1280	N. Prickett 1979; Anderson 1991
Washpool cross-site	S28/56	NZ1642	wood	340 +/– 84	1440–1810	1585	Leach 1979
Washpool cross-site	S28/56	NZ1643	wood	492 +/– 85	1390–1640 (90%)	1470	Leach 1979
PĀ							
Pouērua pā Area VII	P05/195	NZ6869	charcoal	<250		1750 ‡	Sutton *et al.* 2003
Pouērua pā Area II	P05/195	NZ7310	charcoal	300 +/– 55	1460–1810	1630	Sutton *et al.* 2003
Pouērua pā Area I	P05/195	NZ7312	charcoal	260 +/– 55	1505–1810	1730	Sutton *et al.* 2003
Pouērua pā Area II	P05/195	NZ7322	charcoal	390 +/– 55	1450–1640	1550	Sutton *et al.* 2003

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
Pouērua pā Area III	P05/195	NZ7341	charcoal	<250		1750 ‡	Sutton *et al.* 2003
Pouērua (Stone-walled pā)	P05/371	NZ7311	charcoal	250 +/– 50	1510–1890	1740	Sutton 1993; Schmidt 1996
Pouērua (Cattleyards pā)	P05/408	NZ7330	charcoal	407 +/– 60	1440–1640	1540	Sutton 1993; Schmidt 1996
Maungarei	R11/12	NZ7749	shell	655 +/– 50	1500–1880	1680	Davidson 2011
Maungarei	R11/12	NZ7750	shell	685 +/– 50	1470–1840	1650	Davidson 2011
Maungarei	R11/12	NZ7751	shell	674 +/– 50	1480–1850	1660	Davidson 2011
Maungarei	R11/12	NZ7752	shell	732 +/– 50	1450–1680	1600	Davidson 2011
Tāmaki River pā	R11/1506	Wk1940	shell	730 +/– 35	1460–1775	1600	Foster & Sewell 1993
Tāmaki River pā	R11/1506	Wk1941	shell	720 +/– 35	1465–1790	1610	Foster & Sewell 1993
Tāmaki River pā	R11/1506	Wk1942	shell	670 +/– 45	1490–1850	1660	Foster & Sewell 1993
Tamaki River pa	R11/1506	Wk1943	shell	750 +/– 45	1440–1760	1590	Foster & Sewell 1993
Tāmaki River pā	R11/1506	Wk1944	shell	680 +/– 50	1480–1845	1650	Foster & Sewell 1993
Tāmaki River pā	R11/1506	Wk1945	shell	690 +/– 50	1470–1830	1640	Foster & Sewell 1993
Harataonga	T08/3	R4543/3	charcoal	443 +/– 58	1440–1640	1500	Schmidt 1996
Raupa Level I	T13/13	Wk2039	shell	510 +/– 50	1680–1950	1820	N. Prickett 1992
Raupa Level I	T13/13	WK2040	shell	620 +/– 50	1530–1910	1720	N. Prickett 1992

Site	Site no.	Lab no. *	Material	CRA (BP)	Calibrated age (95% probability)	Median age †	Reference
Anatere	U13/46	Wk3751	shell	660 +/– 51	1490–1870	1670	Phillips & Allen 1996
Anatere	U13/46	Wk3755	shell	720 +/– 50	1460–1800	1610	Phillips & Allen 1996
Anatere	U13/46	Wk4659	shell	670 +/– 50	1485–1860	1660	Phillips & Allen 1996
Anatere	U13/46	WK4661	shell	700 +/– 50	1465–1710	1630	Phillips & Allen 1996
Ruahīhī	U14/38	NZ4602	shell	711 +/– 40	1470–1800	1620	McFadgen & Sheppard 1984
Ruahīhī	U14/38	NZ4603	shell	714 +/– 32	1470–1790	1615	Schmidt 1996
Ruahīhī	U14/38	NZ4604	shell	796 +/– 33	1420–1690	1550	Schmidt 1996
Mangakaware 2	S15/18	NZ1125	charcoal	286 +/– 83	1460–1815 (86%)	1660	Bellwood 1978; Schmidt 1996
Tiromoana	W21/1	NZ1915	charcoal	413 +/– 57	1440–1640	1530	Fox 1978; Schmidt 1996
Tiromoana	W21/1	NZ1916	charcoal	488 +/– 57	1400–1625	1455	Fox 1978; Schmidt 1996
PIT/TERRACE							
Motutapu Is.	R10/38	NZ1168	charcoal	188 +/– 86	1625–1950 (93%)	1780	Davidson 1970b; Bulmer 1994
Waikite	U14/1611	Wk24665	shell	821 +/– 31	1400–1670	1530	Moore 2009
Waikite	U14/1611	Wk24666	shell	838 +/– 32	1390–1670	1510	Moore 2009
Waikite	U14/1611	Wk24667	shell	854 +/– 32	1370–1660	1500	Moore 2009
Waikite	U14/1611	Wk24668	shell	780 +/– 32	1430–1700	1560	Moore 2009

REVIEW

O'MALLEY, Vincent: *The New Zealand Wars/Ngā Pakanga o Aotearoa*. Wellington: Bridget Williams Books, 2019. 272 pp., illus., maps, notes. NZ$39.95 (softcover).

ROWAN LIGHT
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Historians, it seems, are on the cusp of a New Zealand Wars boom. The nineteenth-century conflicts—remembered for generations by Māori communities—have recently coalesced into a new national day of commemoration, Rā Maumahara, and a central topic of the proposed compulsory Aotearoa New Zealand histories school curriculum. A logical flow-on effect of these developments is a rise in documentaries and publications to inform newfound public interest and begin the work of translating difficult histories into public remembrance.

Vincent O'Malley's *The New Zealand Wars/Ngā Pakanga o Aotearoa* neatly fits into this trend. It is a text intended for general readership, especially suitable for secondary school teachers and their students, and non-specialist academics wanting to familiarise themselves with a topic of growing public debate.

Ngā Pakanga builds on key themes of the author's magisterial *The Great War for New Zealand: Waikato 1800–2000*, also published by Bridget Williams Books, in 2016. O'Malley draws on many of the themes of this larger work to present a general history well suited to shape public engagement with these wars and conflicts.

In *Ngā Pakanga*, the synonymy of "general" and "national" in New Zealand historiography remains firmly in place. O'Malley's approach is "national" in both the sense of a broad geographic spread and in the author's insistence that the wars were crucial to the creation of a national society. The heart of the conflict, through O'Malley's lens, is the practical and violent working out of the relationship between *kāwanatanga* 'Crown governance' and *rangatiratanga* 'indigenous sovereignty'. The book has a repeated focus on national symbols (it is significant that the cover image is of a red ensign) recognisable to Pākehā 'New Zealand European' audiences. As well as reflecting his career as a Waitangi Tribunal researcher, O'Malley's approach allows him to cast a wide net as to what is—and what is not—part of the frontier of colonial violence.

This national lens is also strategic. O'Malley clearly believes the way to establish these wars in the national imagination is to treat them according to the conventions of Anzac Day and the commemoration of World War I battles, signifying "national foundations", and a new history curriculum that privileges "the evolution of a national identity with cultural plurality" (in the words of education minister Chris Hipkins.) In a particularly powerful comparison, O'Malley shows that the loss of life among Tūranga (Gisborne) Māori over the course of the land disputes (1860–1869) was, per capita, ten to thirty times than that of New Zealand soldiers during the world wars.

The structure of the book, therefore, is a tightly coiled chronology. The introduction consists of a detailed overview of the migration patterns that shaped the settler state which arose from the ruins of the war—particularly the influx of some 18,000 imperial troops and their families, over 3,600 of whom would become settlers in government land schemes. This introduction—drawing on recent social histories of the war—allows O'Malley to place the conflict in global context, which will make it useful for international scholars. O'Malley also points to key historical interpretations of the wars since James Cowan's 1922–1923 official histories, although in a curious omission, he fails to cite Danny Keenan's *Wars Without End*, which provides a valuable Māori perspective.

The book follows a fairly standard overview of the wars—from the Northern War (1845–1846) to the prophetic resistance of Te Kooti Arikirangi (1868–1872). Each chapter opens with a useful summary. Generally, O'Malley successfully straddles the line between the simple and the simplistic. Some of the most traumatic moments of the wars, such as the Crown raid on the unfortified supply village of Rangiaowhia which ended in the massacre of non-combatants, are dealt with briskly but delicately. "Aftermath" captures O'Malley's oeuvre on the remembrance of the wars, with Māori memory contrasted with Pākehā silence. O'Malley asserts, rather tritely, that "it was easier [for Pākehā] just to forget" (p. 254), but it fits the author's purpose. Creating shared public understandings of the wars will allow greater complexity to be addressed in local places.

Ngā Pakanga is not a book that substantially expands our knowledge of the wars. Rather, its contribution lies in packaging these stories in publicly accessible ways. To this end, the book is richly illustrated and well formatted: Bridget Williams Books continues to be a leading publisher of impactful and beautiful scholarship. Image researcher Melanie Lovell-Smith deserves some credit for the lavish figures of objects, documents, and pictures assembled alongside O'Malley's narrative.

The publication is rounded off with appendices—timelines, maps, and substantive endnotes, although no index—that will be helpful to readers seeking to build a foundational knowledge of the wars. Importantly, much of this material goes beyond typical imagery reproduced in popular texts to provide the reader with a vision of the wars firmly embedded in a New Zealand landscape. Overall, *Ngā Pakanga* confirms O'Malley as one of New Zealand's leading public historians.