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# **A New Possible Source Of Archaeologically Relevant Obsidian From Opoutere, Coromandel Peninsula.**

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## **Introduction**

The geochemical characterisation of obsidian has an extensive history in New Zealand, dating back over five decades (e.g., Green 1967; Ward 1974). Successive studies have identified more than 20 distinct deposits, distributed over three North Island volcanic zones (Northland, Coromandel and Taupo - see Moore 2011; Moore 2012; Sheppard et al. 2011). Analyses of archaeological assemblages indicate that several large-scale sources of high-quality obsidian, such as Tuhua/Mayor Island, Te Ahumata, Kaeo and Taupo, were regularly exploited and widely distributed (e.g., Leach & de Souza 1979; McCoy et al. 2010; McCoy & Carpenter 2014; Moore 2012; Seelenfreund & Bollong 1989; Sheppard et al. 2011)

Although all major sources have almost certainly been identified and characterized (Figure 1), smaller obsidian deposits can potentially form from any rhyolitic volcanic event and several likely sources remain unidentified. For example, in the past year, Robinson (2016; see also; Moore & Coster 2015) has reported a previously unknown source in an assemblage from the Poor Knights Islands, approximately 50 km to the north-east of Whangarei. While smaller obsidian sources might not have been economically important nor widely distributed, it is important that they are characterized and included in reference databases, both as a means of documenting their local exploitation and to minimise the likelihood of misidentifying geochemically similar sources. Here, we report a distinctive deposit of obsidian collected from a property at Opoutere on the Coromandel Peninsula.

On 13 January 2016, Arden Cruickshank and Danielle Trilford of CFG Heritage Ltd undertook an archaeological assessment at 1227 Tairua Road, Onemana (Pt Section 17 BLK VIII Tairua SD). During the assessment, several water-rolled pebbles of obsidian were identified in a track cutting at the base of Pa T12/39. A sample was retained and taken to the Department of Anthropology, University of Auckland for geochemical analysis to ascertain if this is a deposit of an already identified obsidian source or a new one. This brief report outlines the preliminary results of this geochemical analysis.

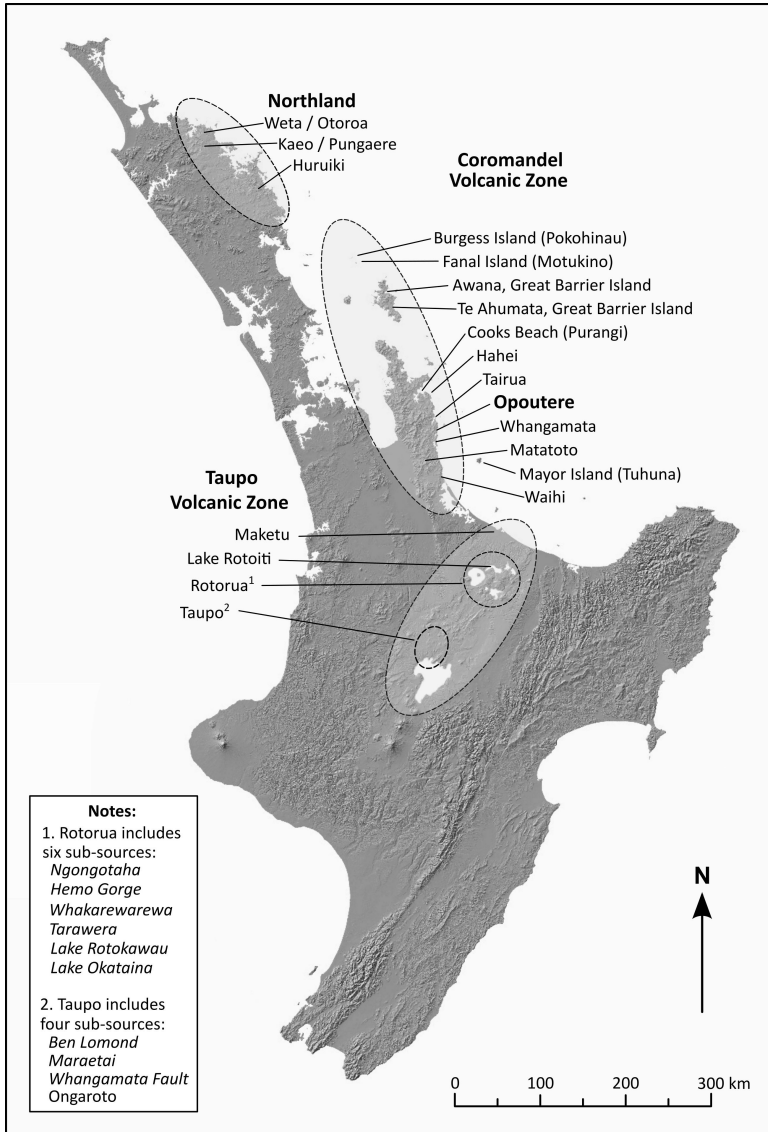
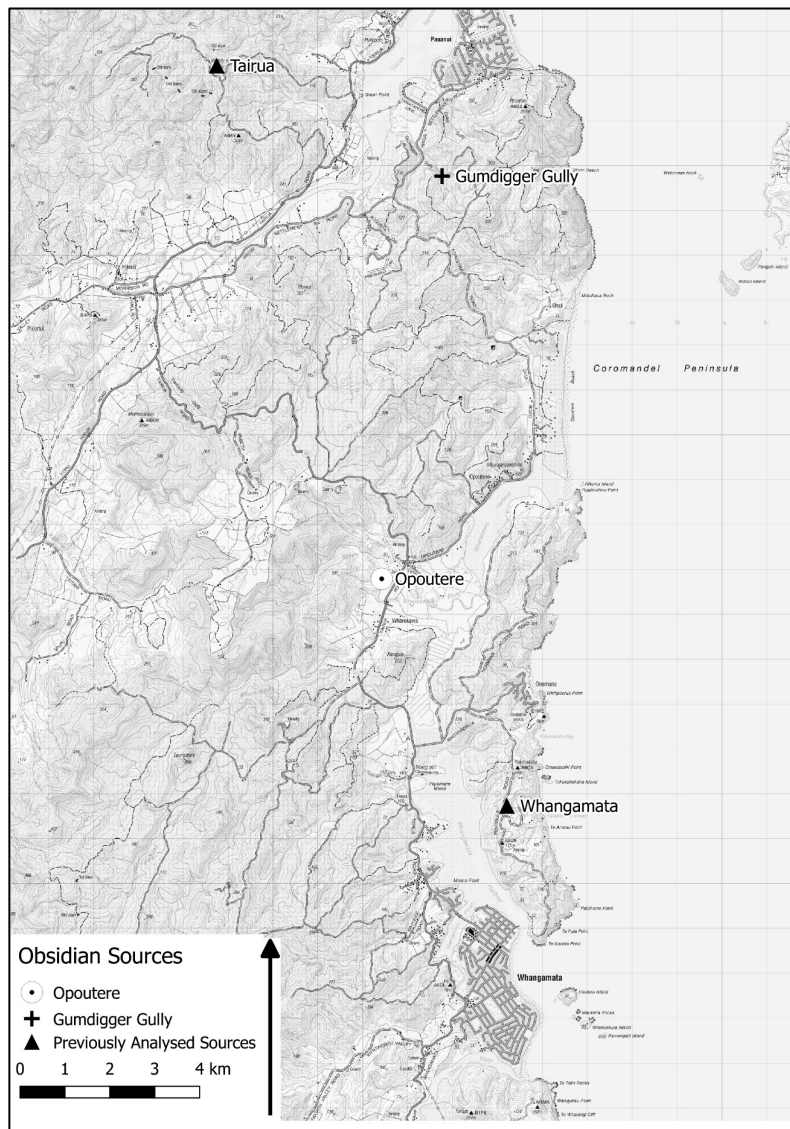


Figure 1. Map showing known New Zealand obsidian sources and the location of Opoutere.



*Figure 2. Location of deposit in relation to nearby sources and deposits mentioned in the text.*

## **Environment**

The property is situated in the eastern foothills of the Coromandel Ranges, overlooking the Wharekawa Harbour and its associated wetland (see Figure 2). The ranges consist of a greywacke basement rock, with andesitic and rhyolitic volcanic eruptions dating from the Miocene and Pliocene forming the landscape present on the peninsula (Homer & Moore 1992; Barker 1992). These later rhyolitic eruptions are responsible for much of the high quality lithic resources that made the Coromandel Volcanic Zone (CVZ) a major source of obsidian and basalt for tool manufacture (Turner 2000: 271).

The property consists of rolling hills with several small waterways intersecting it, most notably the Paritu Stream which feeds into the Wharekawa River. Some of the streams that run through the property have associated ephemeral wetlands. Although most the property is in pasture, there are patches of tanekaha (*Phyllocladus trichomanoides*), manuka (*Leptospermum scoparium*) and other scrub on the margins of the hillsides and within unusable land. There are a number of soil types on the property, generally well-draining and all originating from rhyolitic and andesitic rock (Cruickshank & Trilford 2016). The area in which the obsidian deposit was identified consists of similar Coroglen subgroup outcrops that obsidian is identified as occurring in at other notable CVZ sources, notably Hahei, Whangamata and Te Ahumata (Edbrooke 2001).

## **Obsidian Sources In The Vicinity**

There are significant deposits recorded throughout the Coromandel Peninsula, including near Woody Hill, approximately 6 km south west of Tairua, and on the Whangamata Peninsula. Although many of the sources were known to have been exploited by Maori, the extent of their importance is still to be fully understood, as is the extent of the deposits (Moore 1983; Moore 1999; Sheppard et al. 2011).

There are multiple deposits of obsidian within the Whangamata source, occurring on both sides of the peninsula, as far north as Onemana and possibly further up Normans Access Road (Moore 1999). It is probable that there are more deposits associated with this source, and further investigation will help garner a better understanding of the extent of the deposits, and their exploitation by the Maori.

Another similarly described deposit to that found at Opoutere was identified by John Coster and Gabrielle Johnston in 1975 at the head of Gumdigger

Gully, approximately 9 km north of the Opoutere deposit. The material was described as high quality grey obsidian pebbles, with a water worn cortex and up to 30mm in diameter (Coster & Johnston 1975). A sample of these were provided to the Department of Anthropology, University of Auckland, but these samples were unable to be relocated.

## **The Deposit**

The deposit was situated next to an ephemeral creek and wetland, which was dry at the time of the assessment. It was observed as a moderately dense concentration of small to medium sized pebbles (10–40 mm in diameter) of high quality grey obsidian, over an area of approximately 15 m<sup>2</sup>. The road cutting was approximately 400 mm deep, and the pebbles were observed throughout the depth of the cutting. All the pieces exhibit a water rolled cortex.

Ward (1973: 96) and Green (1962: 15) expressed concern about finding sources which have only been exposed through recent farming activities, which is relevant to this deposit. These concerns were kept in mind while inspecting the deposit and deemed to not apply in this case, as the pieces would have undoubtedly been exposed on the surface if it wasn't obscured with grass.

The deposit was only briefly investigated as it was not the purpose of being on the property, so it is possible that larger pieces are present. Even though these pieces are small, the larger pebbles are still able to be flaked to create a usable cutting edge. The landowner described finding a larger, cobble sized piece of obsidian in the vicinity, but their description indicated it may have been a core rather than a naturally occurring piece that was found, so this should be viewed with caution.

## **Methodology**

Nine samples of the Opoutere deposit were analysed to ascertain their geochemical signature. Geochemical analysis was undertaken at the Department of Anthropology, University of Auckland using a Bruker Tracer III SD portable X-ray Fluorescence analyser (pXRF). The instrument employs an X-ray tube with an Rh target and a 10 mm<sup>2</sup> silicon drift detector (SDD) with a typical resolution of 145 eV at 100,000 cps. The Tracer III SD is supplied with an in-built obsidian calibration based on 40 samples, mostly from North American sources (see Glascock & Ferguson 2012; Speakman

2012). Although inbuilt pXRF calibrations often perform well and have been used for previous obsidian studies in New Zealand (McCoy & Carpenter 2014; Sheppard et al. 2011; Cruickshank 2011), several New Zealand sources possess trace element concentrations that exceed the range of Bruker's in-built calibration (Philipps et al. 2016). For this reason, an empirical calibration using Bruker's S1CalProcess software was used for this study. (see Philipps et al. 2016 for more information).

A total of 20 reference specimens are used for calibration, including 14 international standards (AGV2a, ANU 2000, GA, GSP2, JA-1, JA-2, JG-1a, JG-2, JG-3, JR2, NIST-278, QLO1b, SARM-1, SARM-2) selected for similar concentration ranges as obsidians, and six New Zealand obsidian specimens from the University of Auckland's Anthropology Laboratory reference collection that were analysed using Wavelength Dispersive X-ray Fluorescence (AC-08, AU-17.59, AU-29.16, AU-32.1, AU-7.21, AU-9.5). A total of 13 elements were calculated as parts-per-million (ppm) concentrations (K, Ca, Ti, Mn, Fe, Zn, Pb, Th, Rb, Sr, Y, Zr, Nb). Standards are analysed three times each for 60 seconds and the results averaged. Selected standards (i.e., NIST-278, AU-9.5, AU-17.59, AU-29.16) are run each time the instrument is operated to check for instrument stability, and the full set of standards is run at regular intervals to access whether re-calibration is required.

The flattest and most uniform surfaces of the obsidian flakes were placed on the detector window which is mounted on test stand provided by the manufacturer (as per Sheppard et al. 2011; Philipps et al. 2016). Any loose soil was removed where necessary but no cleaning agents are used. Tests at the Department of Anthropology, University of Auckland have shown that the use of chemical cleaning agents, such as dilute hydrochloric acid, is generally unnecessary for XRF analysis of obsidians. Additionally, cleaning agents may remove surface residues and contaminate future analyses.

## **Results**

Geochemical analysis of the nine Opoutere samples shows that they form a homogenous group (**Error! Reference source not found.**) and have a unique combination of trace element concentrations that differentiates them from other known sources. As shown in the Figure 3 scatterplots, the samples group as distinct clusters, and do not overlap with the Whangamata or Tairua sources, which are geographically the closest analysed sources to Opoutere. The deposit in Gumdigger Gully requires reinvestigation and geochemical analysis.

*Table 1. Results of geochemical analyses of the Opoutere samples. All values in parts-per-million (ppm).*

<b>Sample</b>	<b>K</b>	<b>Ca</b>	<b>Ti</b>	<b>Mn</b>	<b>Fe</b>	<b>Zn</b>	<b>Pb</b>	<b>Th</b>	<b>Rb</b>	<b>Sr</b>	<b>Y</b>	<b>Zr</b>	<b>Nb</b>
OP-1	33102	5859	1047	285	9564	29	21	8	149	58	25	92	5
OP-2	34382	6026	1046	284	10234	32	27	4	162	60	24	97	7
OP-3	30538	5055	1416	331	12497	31	24	4	157	54	21	101	5
OP-4	31371	5969	1036	280	9605	34	23	4	153	56	24	95	5
OP-5	30965	5501	1056	271	10529	28	24	9	155	54	24	98	7
OP-6	34102	6247	916	289	9632	30	24	9	161	61	26	95	5
OP-7	35210	6212	994	298	9686	28	23	10	159	58	25	96	4
OP-8	35273	6273	850	301	9065	28	24	5	158	56	25	95	6
OP-9	33164	6197	972	294	9801	28	24	6	157	59	25	100	5



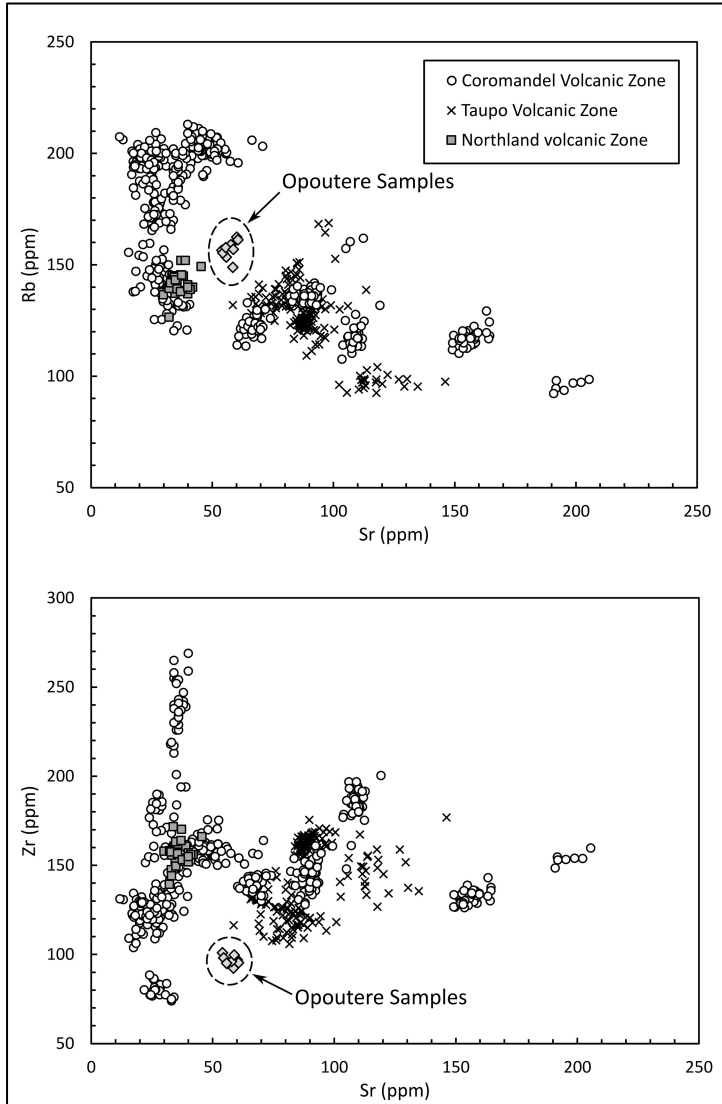
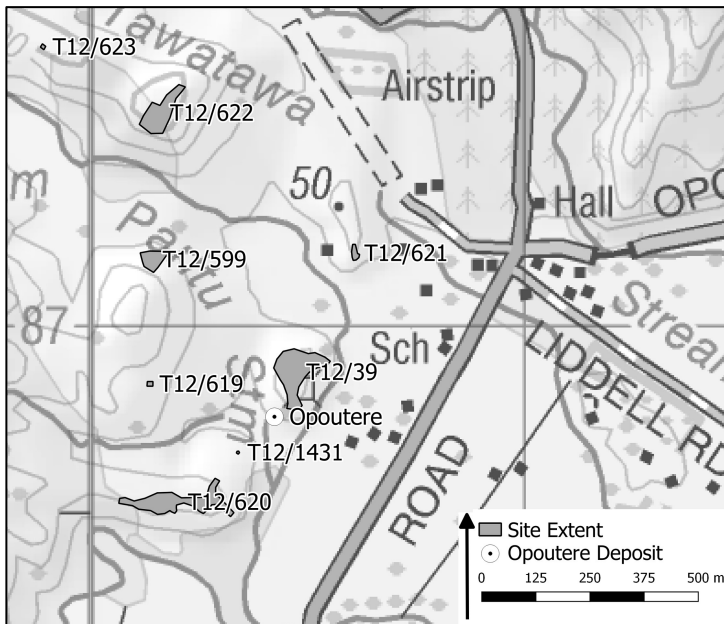


Figure 3. Scatterplots showing the relationship of the Opoutere samples in relation to known New Zealand obsidian sources: Upper Sr vs Rb; Lower Sr vs Zr. Sources with extreme trace element concentrations (i.e., Mayor Island, Kaeo, Weta and Burgess Island) are omitted from the plots. Data from other sources from McAlister (in prep.).

## Discussion and Conclusion

Based on the results of the geochemical analysis of the samples, the Opoutere obsidian is a distinct and separate source, not a deposit of one of the previously recorded sources. It has shown to be of a good quality; capable of making useful flakes and although it was uncovered within a cutting of a farm track, it is likely that the pebbles would have been exposed on the surface if not for the grass cover. The location of Pa T12/39 directly above the deposit and three other sites surrounding the deposit (T12/619, T12/620 and T12/1431 [all within 350 m]) it is unlikely that the deposit would have gone unnoticed during the pre-European occupation and use of the landscape (Figure 4).



*Figure 4. Sites that surround the Opoutere deposit. Note that these stars represent the NZAA SRS GPS point, not the extent of the sites.*

This brief report only presents the data for the source, which has not yet been compared to archaeological assemblages. At this stage, it should be noted that it is only theoretically an archaeologically relevant source and will require

positive identification of worked obsidian from this source being uncovered from within a secure archaeological context.

Although there are currently more than 20 distinct obsidian sources recorded throughout the New Zealand source areas (Figure 2) future research will undoubtedly uncover more. The major sources of high quality obsidian, such as Tuhua / Mayor Island, Te Ahumata, Kaeo and Taupo, have been well documented and reported (Leach & de Souza 1979; Moore 1982; Jones 2002; Sheppard 2004; Moore 2011; Cruickshank 2011; Moore 2012 for example); but as we gain a better understanding of the minor sources, and as more assemblages are geochemically analysed a much finer grained pattern of obsidian procurement and distribution can be created.

## References

- Barker, R.G. (1992) *Geology of the Coromandel Peninsula*, Auckland, N.Z. Pagez Productions.
- Coster, J. & Johnston, G. (1975) *Tairua State Forest (Wentworth and Ohui Blocks) Archaeological Site Survey, October 1975*,
- Cruickshank, A. (2011) *A Qualitative and Quantitative Analysis of the Obsidian Sources on Aotea (Great Barrier Island), and their Archaeological Significance*. MA. University of Auckland.
- Cruickshank, A. & Trilford, D. (2016) *1227 Tairua Road, Onemana: archaeological assessment*. Unpublished CFG Heritage Ltd report to RMS Surveyors Ltd and Murray Bridson.
- Edbrooke, S.W. (2001) *Geology of The Auckland Area*, Lower Hutt: Institute of Geological and Nuclear Sciences.
- Glascook, M.D. & Ferguson, J.R. (2012) *Report on the Analysis of Obsidian Source Samples by Multiple Analytical Methods*, University of Missouri Research Reactor, Columbia.
- Green, R. (1967) Characterisation of New Zealand Obsidians by Emission Spectroscopy. *New Zealand Journal of Science*, 10, pp. 675–682.
- Green, R. (1962) Obsidian and its application to archaeology. *New Zealand Archaeological Association Newsletter*, 5(1), pp. 8–16.
- Homer, L. & Moore, P.R. (1992) *Vanishing volcanoes: a guide to the landforms and rock formations of Coromandel Peninsula*, Wellington: Landscape Publications.
- Jones, M. (2002) *A Brief Prehistory of Time*. Phd thesis, University of Auckland.
- Leach, B.F. & de Souza, P. (1979) Changing Proportions of Mayor Island Obsidian in New Zealand Prehistory. *New Zealand Journal of Archaeology*, 1, pp. 29–51.

- McCoy, M.D. et al. (2010) Reconstructing lithic supply zones and procurement areas: An example from the Bay of Islands, Northland, New Zealand. *Journal of Pacific Archaeology*, 1(2), pp. 174–183.
- McCoy, M.D. & Carpenter, J. (2014) Strategies for obtaining obsidian in pre-European contact era New Zealand. *PLoS One*, 9(1).
- Moore, P.R. (1983) Geology and Geochemistry of Obsidian Deposits in the Cooks Beach-Hahei Area, Coromandel Peninsula: A Contribution to Archaeological Sourcing Studies. *New Zealand Journal of Science*, 26, pp. 523–533.
- Moore, P.R. (1982) Obsidian Deposits at Huruiki, Northland. *New Zealand Archaeological Association Newsletter*, 25(4), pp. 240–246.
- Moore, P.R. (2012) Procurement and Cultural Distribution of Obsidian in Northern New Zealand. *Journal of Pacific Archaeology* 3(2).
- Moore, P.R. (2011) The Taupo obsidian source, central North Island, New Zealand. *Journal of the Royal Society of New Zealand*, 41(2), pp. 205–215.
- Moore, P.R. (1999) Whangamata Obsidian, Coromandel Peninsula. *Archaeology in New Zealand*, 42(4), pp. 289–294.
- Moore, P.R. & Coster, J. (2015) Evidence of a Well-developed Obsidian Distribution Network in the Far North of New Zealand: New Data from the Aupouri Peninsula. *Journal of Pacific Archaeology*, 6(1), pp. 1–17.
- Philipps, R.S., McAlister, A.J. & Allen, M.S. (2016) Occupation duration and mobility in New Zealand prehistory: Insights from geochemical and technological analyses of an early Māori stone artefact assemblage. *Journal of Anthropological Archaeology*, 42, pp. 105–121.
- Robinson, J. (2016) *Tawhiti Rahi : ‘nga poiito o te kupenga o Toi te Huatahi’ [a float of the fishing net of Toi te Huatahi] : A multi-disciplinary study of Māori settlement of Tawhiti Rahi, an offshore island in northern New Zealand*. PhD. Department of Anthropology and Archaeology, University of Otago.
- Seelenfreund, A. & Bollong, C. (1989) The Sourcing of New Zealand Archaeological Obsidian Artefacts using Energy Dispersive XRF Spectroscopy. In D. Sutton, ed. *Saying so does not make it so: Papers in honour of B. Foss Leach*. Dunedin: New Zealand Archaeological Association.
- Sheppard, P.J. et al. (2011) Characterization of New Zealand obsidian using PXRF. *Journal of Archaeological Science*, 38(1), pp. 45–56.
- Sheppard, P.J. (2004) Moving Stones: Comments on the Archaeology of Spatial Interaction in New Zealand. In L. Furey & S. J. Holdaway, eds. *Change Through Time*. Auckland: New Zealand Archaeological Association, pp. 147–168.

- Speakman, R.J. (2012) *Evaluation of Bruker's Tracer family factory obsidian calibration for handheld portable XRF studies of obsidian*, Unpublished report for Bruker AXS, Kennewick WA, United States of America.
- Turner, M.T. (2000) *The Function, Design and Distribution of New Zealand Adzes*. PhD. University of Auckland.
- Ward, G. (1974) A Paradigm for Sourcing New Zealand Archaeological Obsidians. *Journal of the Royal Society of New Zealand*, 4(1), pp. 47–62.
- Ward, G. (1973) Obsidian Source Localities in the North Island of New Zealand. *New Zealand Archaeological Association Newsletter*, 16(3), pp. 85–103.