OBSIDIAN SOURCE LOCALITIES IN THE NORTH ISLAND OF NEW ZEALAND [1973]

G. K. Ward
Department of Anthropology
University of Otago

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Previous research has shown the potential of analyses of artefact obsidian, especially source identification, to contribute to knowledge of New Zealand prehistory. As part of an investigation which sought to characterize obsidians by trace element analysis, deposits of raw material in northern and central regions of the North Island were located and sampled. The localities of these potential sources of artefact obsidian are listed along with brief hand specimen description of the material.

INTRODUCTION

Obsidian is a natural volcanic glass, usually of rhyolitic composition. Its vitreous or non-crystalline character is produced by the rapid cooling of a highly siliceous molten magma, often by quenching in a body of water, as when a lava flow runs into the sea. Thus mineral formation is effectively prevented and a supercooled liquid, a glass, results. The amorphous or extremely fine grained structure of the glass permits the phenomenon of conchoidal fracture, so that wherever in volcanic areas of the world obsidian was located it as sought after as a raw material for artefacts, particularly where metals were scarce or unknown.

The homogeneity of obsidian has allowed investigators to apply geochemical techniques to source obsidian artefacts. Because of its method of formation a geological deposit of volcanic glass is likely to have firstly, a uniform chemical composition – or, at least, to be much more homogeneous than crystalline rocks – and, secondly, to differ from other discrete deposits of obsidian, so that a source may be distinguished by its unique chemical composition. This characterization has been most successfully accomplished in terms of the proportions of groups of trace elements. Consequently, artefactual material, when similarly charactered, can be shown to have been derived from a particular source on the basis of comparison of its trace element constituents with those of the sources. This method of tracing the origin of a raw material has been widely used in recent years by archaeologists to provide information about patterns of prehistoric behaviour (*vide* Cann, Dixon and Renfrew 1969).

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Another attribute or Obsidian has been made use of by the archaeologist is the technique of hydration rim dating. A freshly flaked surface of obsidian takes up water from the air or ground at a discernible rate, in which one of the ~ain variables 1s temperature. For various temperature zones of the world, rates of hydration have been measured or estimated, so that the phenomenon can be used as a chronometric as well as relative dating technique (vide Michels and Bebrich 1972). There are, however, particular problems with chronometric application in New Zealand (Ward n.d.; 10 ff).

Green (1964: 134) has outlined the potential fields of information available from an analysis or obsidian from flake assemblages: Firstly, relative and 'absolute' dating by measurement of the hydration rim might be attempted. Secondly, changes in proportions of obsidians from different sources might provide evidence of the maximum possible age of an assemblage and indicate its position in a local or relative regional chronology.

Thirdly, variations in the proportions of obsidian through time might be indicative of changes in trading relationships again, the documentation of the location of find spots of obsidian might assist in the identification of the routes by which the raw material .as transported. Finally, the study of the technological attributes per se of a flake assemblage is a valuable source of information. Obsidian flake technology has been investigated systematically by Shawcross (1964) and by Jones (n.d.), but while the use of hydration rim measurement for relative dating was applied only briefly in New Zealand (Green 1962; Ambrose and Green 1962; Green 1964), a greater degree of success was experienced with the application of sourcing methods. Green initially developed the characterization of obsidian by refractive index (RI) procedures then, more recently applied a technique of elemental analysis (Green 1962, 1964; Green, Brooks and Reeves 1967).

INFERENCE FROM CHARACTERIZATION DATA

One of the first dividends that Green derived from the study of obsidian flake assemblages of the Auckland region was found in the pattern of distribution of material from the same source. The common derivation of some obsidians from sites clustering around the Auckland lsthmus suggested an adjacent source of raw material; an investigation of geological criteria indicated the likelihood of a deposit being located on Great Barrier or another of the Hauraki Gulf islands. Accordingly, the Great Barrier Island source of obsidian was located in the field (Green 1962:15; Spring-Rice 1963: 27; Green 1964: 136). Similarly, the distribution of other obsidians with characteristic RI values in both Northland and central North Island regions led to the rediscovery of the major sources at Huruiki and Taupo respectively (Green 1964: 136).

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As part of his programme of investigation analyses of obsidian from a number of archaeological sites were made, and Green was able to report (1964: 139) that the Mayor Island source was the most important and was probably the first discovered by the prehistoric inhabitants of the country. This was evident for, despite the proximity of some early sites to other sources, material from Mayor Island was distinctly predominant in proportion to others. At the inland Archaic site of Tokoroa, for example, nearly all the obsidian was brought from Mayor Island even though there are several obsidian outcrops in the vicinity (Cook and Green 1962). Similarly, the major part of the obsidian assemblage from the Tairua site (itself! adjacent to several natural deposits of obsidian) derived from the Mayor Island source. In their report of the Tairua excavations, Smart and Green commented (1962: 250) that the predominance of Mayor Island obsidian was "characteristic of many early sites whether close or distant from the source".

Building upon these and other results, Green demonstrated the possibility of constructing a relative chronology by comparison of the proportions of Mayor Island to non-Mayor Island obsidian from assemblages at a number of sites in the ~Auckland province (1964: 138, Figure 2. q.v.). Insufficient data was available to attempt a seriation of sites based on obsidian types, but the evidence supported the relative order of the sequence in which sites were placed by reference to other criteria (ibid: 140; Green 1963. 1970).

The success of this programme is all the more remarkable when the restrictions defined by the range of available data are considered. Evidence for the conclusions outlined above came from characterization of a number of obsidian sources by the RI method. Although material from four areas - Mayor Island, Mangakino, Taupo and Arid Island - was originally measured (Green 1962) and other sources subsequently included (Green 1964). the RI measurement were able to effectively distinguish only Mayor Island obsidian from the rest due to the considerable overlap with one another of the RI values of material from the non-Mayor Island sources. It was evident that to develop the full potential of the technique, more powerful means of separating the sources were required. In a subsequent study a technique of estimating the proportion of four trace elements was applied to the characterization of obsidian from seven localities (Green, Brooks and

Reeves 1967). It appears, however, that the results of these analyses have not been used to allocate artefact obsidian to its source and, further. the technique used (emission spectroscopy) is no longer regarded as the most suitable for this type of investigation (Reeves, 1970: pers. comm.). Nevertheless, it was evident from a review of Green's earlier contributions that there is considerable scope for the application of evidence from characterization studies to the investigation of New Zealand prehistory.

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LOCATION OF POTENTIAL SOURCES OF ARTEFACT OBSIDIAN

Research into a number of aspects of the archaeology of obsidian in New Zealand was initiated in 1969 at the Department of Anthropology, University of Otago. One facet of the study sought to establish a simple, accurate method of allocation of artefact obsidian to its source. A survey of the available methods of trace element analysis indicated that the technique of X-ray fluorescence spectrography (XRF) was the most suitable for the purpose of obsidian source characterization (Ward n.d.: 47 ff). An initial concern of the investigators was the availability for inclusion in the analysis of material from original deposits. It was evident that previous efforts to source New Zealand obsidians had been hampered by the lack of a systematic approach to the rediscovery of potential sources of artefact raw material and the process of collection from *in situ* deposits. It was necessary to relocate natural deposits which were utilizable in the past in order that, firstly, material from as many as possible be included in the analysis and, secondly, so that they could be systematically sampled. Concern with sampling arose from the recognition that it is not sufficient merely to define variation between two sources in terms of a number of trace element proportions: it must be demonstrated that this inter-source difference is significantly greater than the variation Within the sources for the distinctions to be adequate and credible. Thus, a large Dumber of individual analyses are required and these must be based on an adequate sampling of the original deposit.

At least seven localities had been successfully investigated for the presence of Obsidian, suitable and available for artefact manufacture, since Green commenced his research in 1958 (Anon. 1958: 3; Green et al 1967), but it was realised that the number of known sources contributing obsidian to the archaeological record was incomplete (Green 1970: pers. comm.). Consequently, a review was made of historical, archaeological and geological literature pertaining to areas where obsidian might have been deposited (Ward n.d.: 96 ff).

Extensive areas of later silicic volcanic material are found in the North Island of New Zealand. Because obsidian absorbs water over time, eventually forming perlite and so considerably altering its flaking properties (Friedman, Smith and Long 1966), only those areas where relatively recent deposition of Vitreous Volcanics has occurred need be considered. While volcanic activity has been an essential feature of New Zealand geomorphology since the Cambrian, silicic volcanism was more prevalent during the later stages, the Tertiary and Quaternary. Grindley et al. (1959: 10) divided Tertiary volcanism into three distinct stages of which the third, during the Upper Miocene , saw several masses of dacite and rhyolite erupted from vents in eastern Northland and from a section of the

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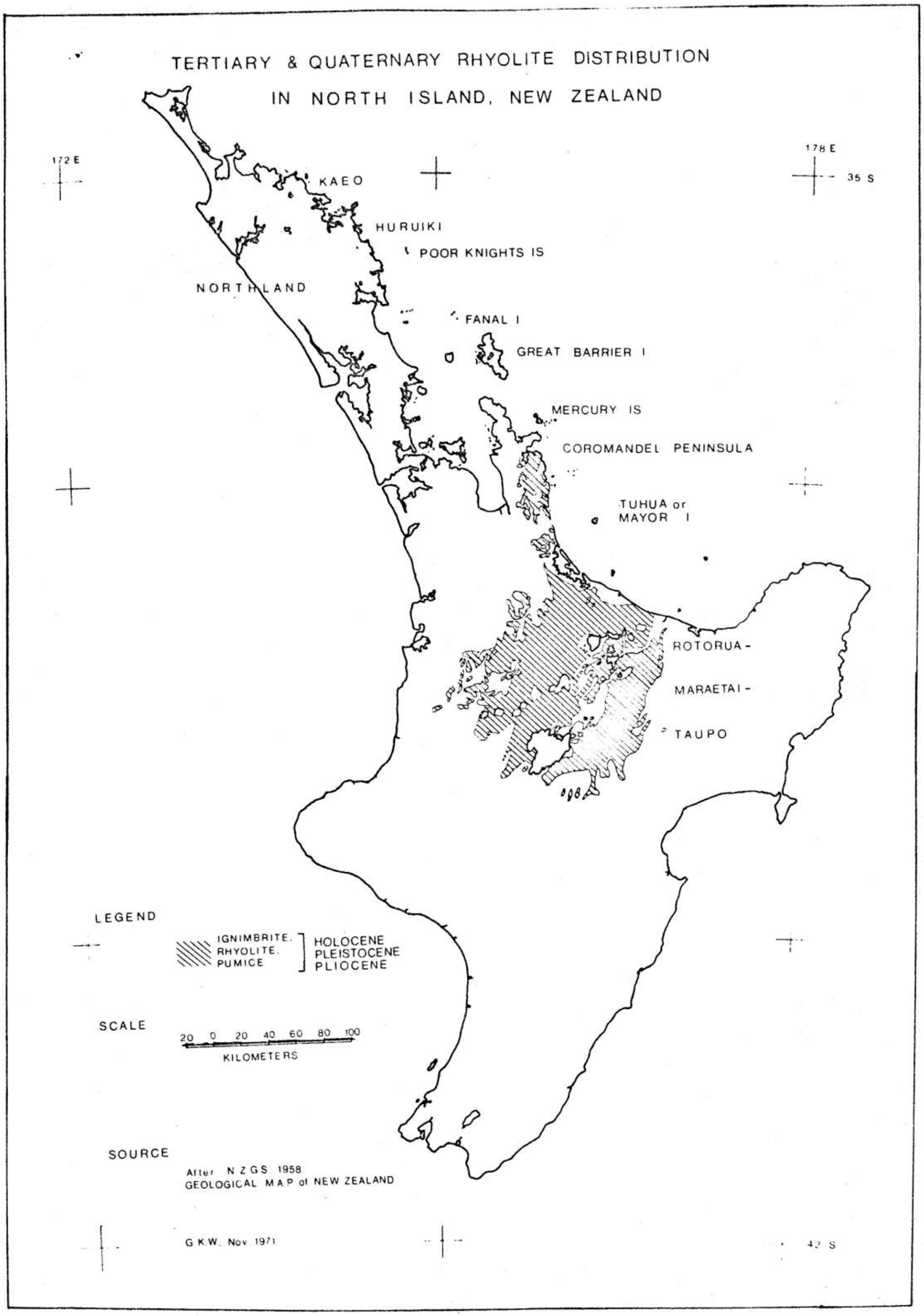
Coromandel arc. During the Quaternary, rhyolitic eruptions produced extensive ignimbrite sheets and tuffs in several areas of the North Island, and in the last two thousand years there have periodic eruptions from vents in the Rotorua-Taupo region. Thus more recent silicic volcanics are confined to the area of the Coromandel arc and to the central volcanic district (Map 1). Their chemical composition is predominantly normal rhyolite but they show much variation in physical form, from extensive ignimbrite sheets to flows and domes of flow-banded, perlitic and spherulitic rhyolite and obsidian, with widespread pumice and ash showers (Harrington 1969: 56).

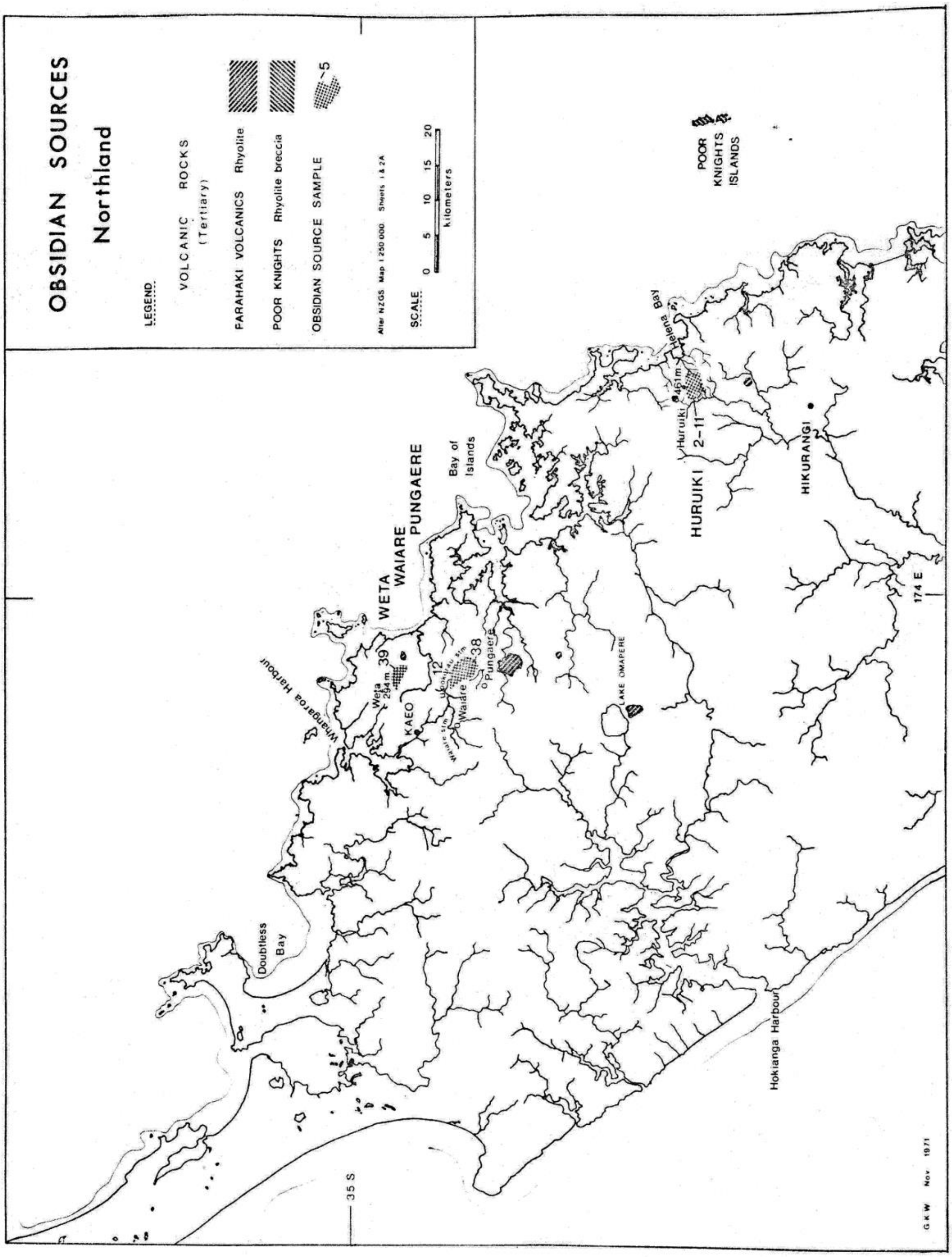
Three main regions of geologically late silicic volcanism may there tore be de fined: Northland. Great Barrier-Coromandel-Mayor Island, and Rotorua-Maraetai-Taupo. It is in these regions that the rhyolitic glass obsidian may be expected to be found. Indeed, Green reported material from all of these regions, and not from without, in his 1962, 1964 and 1967 papers. The localities he defined, combined with those possible deposits gleaned from the survey of the historical and geological literature (which turned out to be of widely varying usefulness), comprised a total of more than fifty potential sources of artefact obsidian (Ward n.d.: 123 ff. Table III.1). Of these, about thirty were relocated and sampled as a result of a period of fieldwork during May and June 1970, or subsequently provided from deposits inaccessible at that time or which were reported later by persons in their vicinities. Thus material from a wide area was able to be included in the characterization analysis. The results of the field survey and collection are presented briefly here; the methodology, results and conclusions of the characterization study are discussed elsewhere (Ward n.d.).

The localities of potential sources of artefact obsidian from the North Island of New Zealand are listed in the Table. The locality name, by which reference is made to material from a given deposit is accompanied by an identifying number which is also found on the maps (Maps 2- 5). Indication of the type of deposit is followed by a brief statement giving more precise location of the place where the outcrop or flow was sampled, and reference is made, where possible, to the N.Z.M.S. maps. In this respect it should be noted that there was not available in this series a map of Mayor Island. A brief hand-specimen description is given of typical obsidian from each locality. The term 'flake quality' was used by Green (1962: 15) to differentiate obsidians that lent themselves to successful tool manufacture, from those which broke fragmentedly and so were useless for this purpose. 'Semi-flake quality' is used here to indicate that, although various inclusions render it of poorer quality, the obsidian could be used to form implements of limited size and use if, for example, lack of better glass made this necessary. Non-flake quality and semi-flake quality obsidian was included in the characterization analysis because of the possibility that it is associated with flake quality obsidian' in another part of the deposit of similar trace element composition and so could be

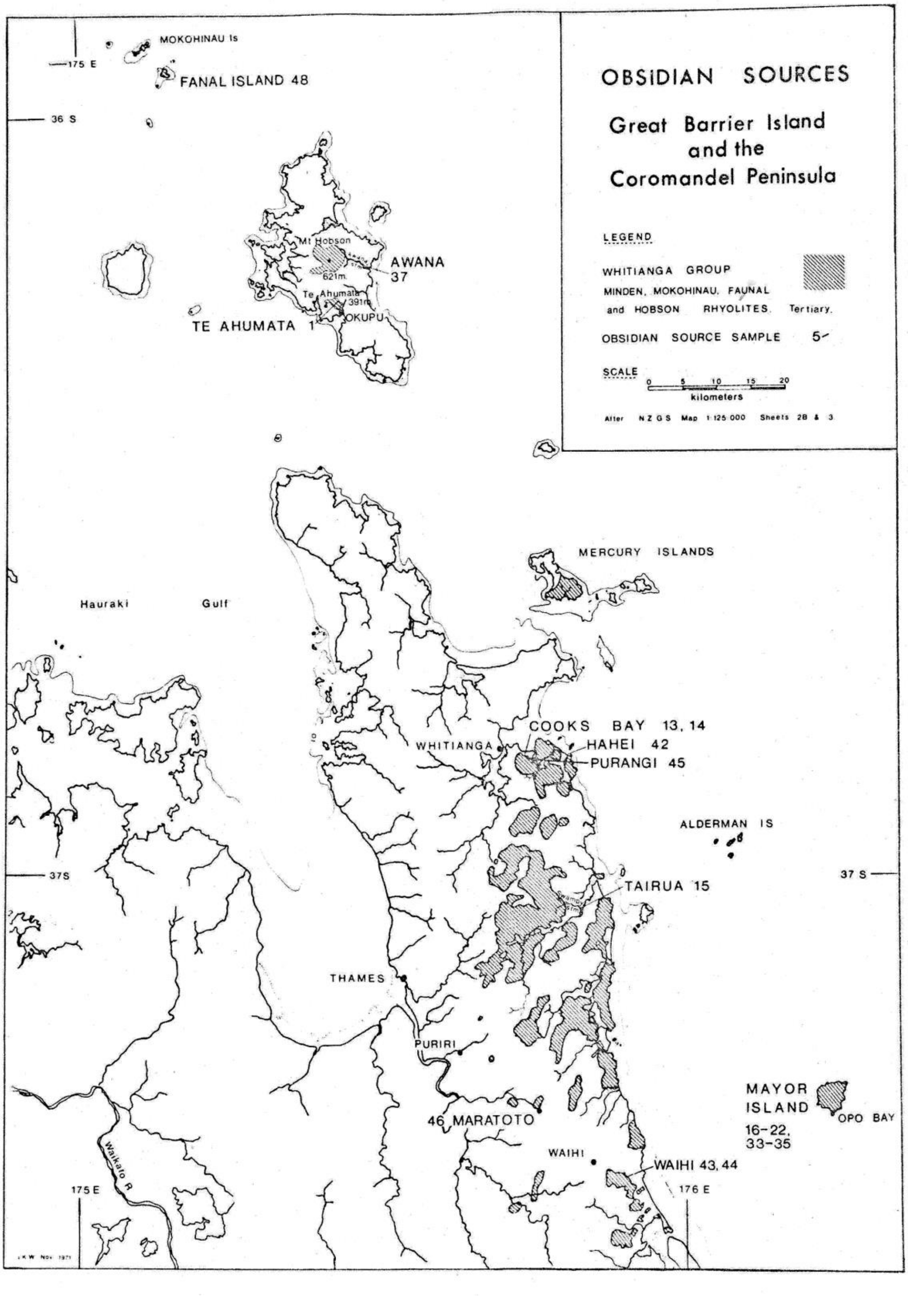
[Pp.89-90] / Map 1


TERTIARY & QUATERNARY RHYOLITE DISTRIBUTION
IN NORTH ISLAND, NEW ZEALAND
172 E
178 E
35 S
KAEO
HURUIKI
POOR KNIGHTS IS
NORTHLAND
FANAL I
GREAT BARRIER I
MERCURY IS
COROMANDEL PENINSULA
TUHUA or
MAYOR I
ROTORUA -
MARAETAI -
TAUPO
LEGEND
IGNIMBRITE,
RHYOLITE,
PUMICE
HOLOCENE
PLEISTOCENE
PLIOCENE
SCALE
20 0 20 40 60 80 100
KILOMETERS
SOURCE
After N Z G S 1958
GEOLOGICAL MAP of NEW ZEALAND
G K W. Nov 1971
42 S

[Pp.90-91] / Map 2

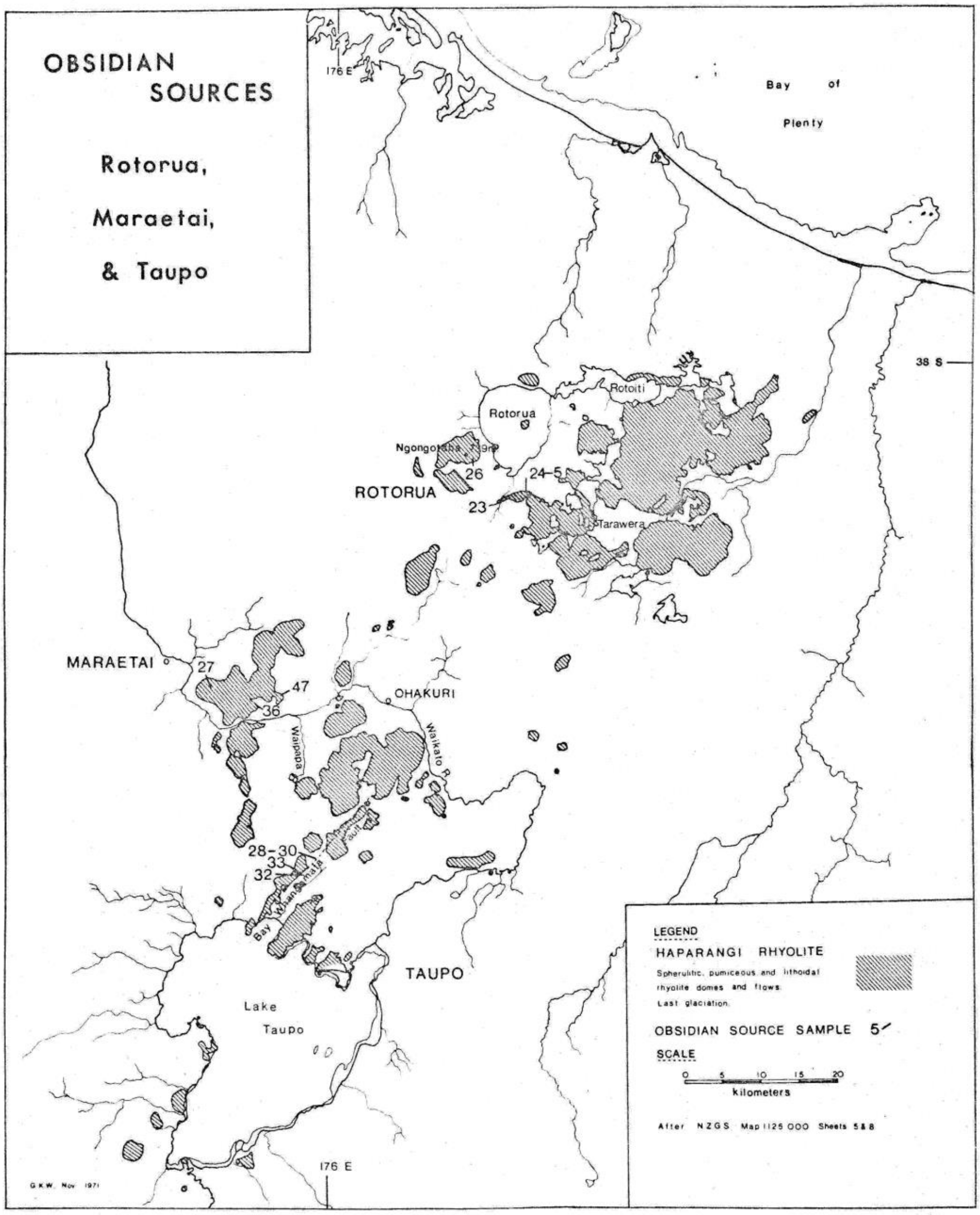

OBSIDIAN SOURCES
Northland
LEGEND
VOLCANIC ROCKS
(Tertiary)
PARAHAKI VOLCANICS Rhyolite
POOR KNIGHTS Rhyolite breccia
OBSIDIAN SOURCE SAMPLE
5
After NZGS Map 1:250 000 Sheets 1 & 2A
SCALE
0 5 10 15 20
kilometers
POOR KNIGHTS ISLANDS
Helena Bay
Huruiki
461m
2–11
HURUIKI
HIKURANGI
Bay of Islands
WETA
WAIARE
PUNGAERE
Whangaroa Harbour
Weta
294m
39
12
38
KAEO
Waiare
Pungaere
LAKE OMAPERE
174 E
Doubtless Bay
Hokianga Harbour
35 S
GKW Nov 1971

[Pp.91-92] / Map 3



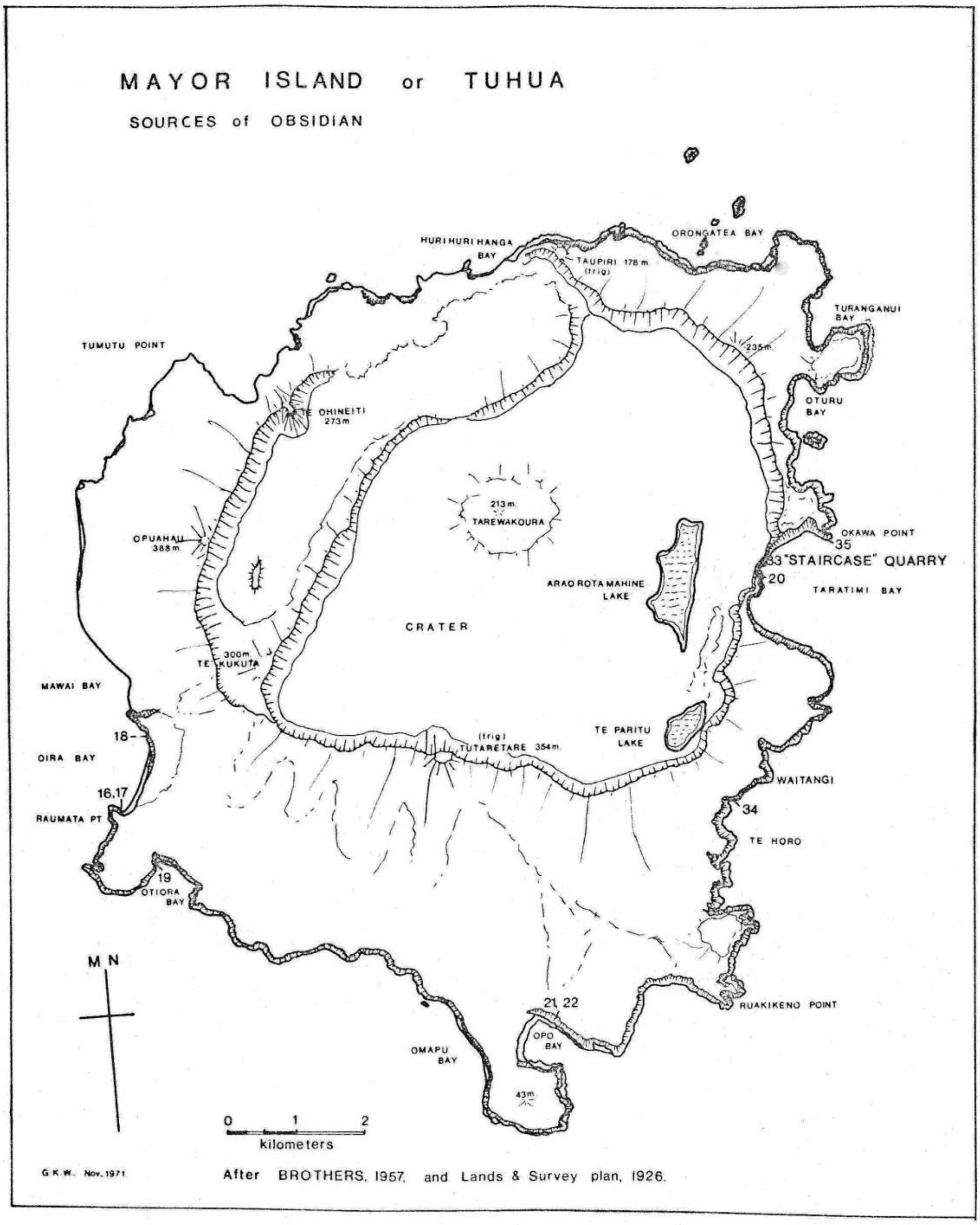
OBSIDIAN SOURCES
Great Barrier Island and the Coromandel Peninsula
LEGEND
WHITIANGA GROUP
MINDEN, MOKOHINAU, FAUNAL and HOBSON RHYOLITES. Tertiary.
OBSIDIAN SOURCE SAMPLE 5
SCALE
0 5 10 15 20
kilometers
After N Z G S Map 1:125 000 Sheets 2B & 3
MOKOHINAU Is
175 E
FANAL ISLAND 48
36 S
Mt Hobson
621m
AWANA 37
Te Ahumata
391m
TE AHUMATA 1
OKUPU
MERCURY ISLANDS
Hauraki Gulf
COOKS BAY 13, 14
HAHEI 42
PURANGI 45
WHITIANGA
ALDERMAN IS
37S
37 S
TAIRUA 15
THAMES
PURIRI
MAYOR ISLAND
16-22, 33-35
OPO BAY
46 MARATOTO
WAIHI
WAIHI 43, 44
Waikato R
175 E
176 E
K.W. Nov. 1971

[Pp.92-93] / Map 4



OBSIDIAN SOURCES
Rotorua,
Maraetai,
& Taupo
176 E
Bay of Plenty
38 S
Rotoiti
Rotorua
Ngongotaha
26
24-5
ROTORUA
23
Tarawera
MARAETAI
27
47
36
OHAKURI
Waipapa
Waikato R.
28-30
33
32
Lake
Taupo
TAUPO
176 E
LEGEND
HAPARANGI RHYOLITE
Spherulitic, pumiceous and lithoidal rhyolite domes and flows. Last glaciation.
OBSIDIAN SOURCE SAMPLE 5
SCALE
0 5 10 15 20
kilometers
After N.Z.G.S. Map 1:125 000 Sheets 5 & 8
G.K.W. Nov 1971

[Pp.93-94] / Map 5



MAYOR ISLAND or TUHUA
SOURCES of OBSIDIAN
ORONGATEA BAY
HURIHURI HANGA BAY
TAUPIRI 178 m. (trig)
TURANGANUI BAY
TUMUTU POINT
235m
OTURU BAY
TE OHINEITI 273m
213m
TAREWAKOURA
OKAWA POINT
35
OPUAHAU 388m
33 "STAIRCASE" QUARRY
20
TARATIMI BAY
ARAO ROTA MAHINE LAKE
CRATER
300m
TE KUKUTA
MAWAI BAY
TE PARITU LAKE
18
(trig)
TUTARETARE 354m
OIRA BAY
WAITANGI
16,17
34
RAUMATA PT
TE HORO
19
OTIORA BAY
M N
21, 22
RUAKIKENO POINT
OPO BAY
OMAPU BAY
43m
0 1 2
kilometers
G.K.W. Nov. 1971
After BROTHERS, 1957, and Lands & Survey plan, 1926.

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used to indicate the source of artefactual material. Finally, persons who forwarded specimen obsidians are acknowledged at the end of each listing.

DISCUSSION

More than seventeen hundred specimens were systematically collected and made available for inclusion in the characterization study (vide Catalogue, Anon. n.d.: GS 105-999, GT 000-850). In the Table are listed the thirty more or less discrete localities of potential sources of artefact obsidian from which samples were collected. The localities represent eight major areas in the North Island and include nearly fifty subsources. The method of sampling *in situ* deposits was adjusted to suit the various types of deposition encountered (Ward n.d.: 169 ff). One form of a primary natural deposit was found as an obsidian selvage on a rhyolite flow as, for instance, at Mayor Island localities. Secondly, deposits which outcrop massively, but which are not obviously parts of a discrete flow, were found on the Central Volcanic Plateau particularly around Rotorua and Maraetai. Volcanic bomb deposits which are *in situ* in as much as it is unlikely that they would have been moved more than a few metres since their original deposition, were found on Te Ahumata, on Huruiki and on the hillsides above Cooks Bay, Weta and Pungaere. A fourth type of deposit is detrital. Water-worn material in pebble or boulder form was found located in stream beds, beaches and on flats susceptible to flooding, as at the Waiare, Hahei and Tairua localities. For the purposes of the present study the last type is included in the category of *in situ* depositions although such material must originally have derived from one of the previous types of primary deposit. It was often more difficult to decide, however, if the detrital material was available for prehistoric exploitation (*vide infra*). Comparison of the list of possible obsidian deposit localities originally derived from the literature (Ward n. d.: 123 ff. Table III.1) with than given here, will show that not all of the possible localities given in the former are represented in the list of localities of potential artefact obsidian from which the specimens were collected (Table). It proved impossible to relocate some of the putative deposits in the field; others were inaccessible at that time; still other localities have been brought to the notice of the collector since June 1970, and other potential sources of artefact obsidian are rumoured to exist in several areas. Material from some of these localities was made available by other persons; some disputed sources are noted below and elsewhere (Ward n.d.: 96 ff), but the location of many others remains problematical and the subject, it is to be hoped, of further investigation.

On the basis of the results of the characterization analysis all of the geographically located sources and subsources have been reduced to only eighteen petrographically distinct source groups

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(Ward n.d.: 169 ff). Where one of these groups contains more than one locality the petrographic similarity of members reflects geographic relationships; for example, all of the Mayor Island sources listed in the table are subsumed under the Mayor Island petrographic grouping. Were a greater number of variables used in a similar analysis, it may prove possible to distinguish amongst the subgroups. It is doubtful, however, if the definition of separate localities in such a case could be claimed to have any cultural significance; it appears most likely that prehistorically, Mayor Island, as it was during the protohistoric phase (Gold-Smith 1885), was controlled by a single social group. Therefore the identification of obsidian from one locality on the island plausibly has the same significance in at least this respect as that from another Mayor Island source.

Assessment of the validity and significance of the eighteen groups must await the production of more data concerning flake assemblages than is available at present. It is possible, however, to anticipate the foci of some appraisals. For instance, it is probable that some of the localities represented in the basic reference list were not accessible or for other reasons not exploited for raw material by the prehistoric inhabitants of the vicinity. Although an attempt was made in the field situation to evaluate the likelihood of an obsidian deposit being available tor utilization, ambiguous cases remain. One example that falls into this category is the Waiare (12) locality. Detrital material in the bed of the Upokorau stream derives from a slip in the upper reaches. Intensive farming in the area is a recent phenomenon that has been accompanied by considerable erosion: it is possible that effective exposure of the deposit dates from relatively late times. To the knowledge or the present writer, no artefact analysis has yet identified Waiare as a prehistorically exploited source of obsidian. Further, it has not been possible to check on the provenances of obsidian from several localities. Hahei (42) is an example of a probable secondary deposit. In this respect also it may be noted that few of the deposits exhibited certain evidence of quarrying. Conspicuous exceptions are found at Mayor Island and Taupo. The commanding site of KI/5 (Pos 1965: 108) is littered with evidence of extraction and flaking activities, and one section of the seam has been mined for more than a metre. At least two of the Whangamata Fault localities (30 and 31) attest to extensive working of implements besides obvious quarrying and could well benefit further investigation by the archaeologist.

Again, more intensive enquiry might well indicate that it is not possible to make a useful discrimination between material from two closely related groups, or that it was mistaken to include the Rotorua area localities from which no flake quality obsidian has been reported. More importantly, it is evident, from the initial

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flake assemblage analyses by the XRF technique in which an artefact obsidian was unable to be allocated to a group within the range of sources for which characterization data is available, that not all of the deposits that were exploited prehistorically have yet been rediscovered by the archaeologist. Known omissions include material from the supposed sources at Arid Island and Ohakuri (Green 1963: 15; Green *et al*. 1967: 678; note, however, that both these are of doubtful status as natural deposits: Ward n.d.: 111-112, 121-122). Inevitably, more potential sources will be located. Areas which might bear fruitful investigation are those of the Puhipuhi plateau and other districts near Whangarei; the Coromandel Peninsula and adjacent island groups are sure to reveal further minor deposits; and the regions to the west and north of Lake Taupo need to be more thoroughly searched. While it is conceivable that no evidence now remains of a source which was of some importance, so that the origin of a class of flake obsidian will remain unknown and unidentifiable, it is possible to be confident that the majority of significant sources of obsidian in New Zealand will soon be identified; further analysis of flake assemblages in the future will indicate the proximity of this goal.

CONCLUSION

In summary, this paper has attempted to re-introduce the reader to the value of the information potential in assemblages of artefact obsidian. Some of the inferences drawn from evidence resulting from an earlier programme of investigations by Green and his co-workers were outlined and it was suggested that even greater use might be made of data available from the application of methods based on elemental analysis. As part of a research programme at the University of Otago sources of Obsidian in the North Island of New Zealand were relocated and systematically sampled. 'list of localities of possible sources of artefact obsidian, accompanied by a brief description of the material from each, was made in tabular form. Discussion of other aspects of the study will be made elsewhere.

ACKNOWLEDGEMENTS

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TABLE: LOCALITIES OF POTENTIAL SOURCES OF ARTEFACT OBSIDIAN IN THE NORTH ISLAND OF NEW ZEALAND

Northland (Map 2)	
Huruiki 2 - 11	Nine apparently distinct deposits of bomb material over an area of approximately 4 km^2 west of Huruiki Trig. N 16/825315. Black, vitreous lustre. Flake quality.
Waiare 12	Detrital material located in bed of Upokorau stream near Kaeo. N 11/346662. Black with matt surface due to pitting; thin section pale green in transmitted light. Flake quality.
Pungaere 38	Bomb deposited obsidian thinly scattered over wide area north or Pungaere settlement. N 11/365615. Black, matt, pitted; pale yellow-green in thin section. Flake quality.
Weta 39	Bomb deposit thinly spread over wide area south of Weta Trig. N 11/771348. Black with white inclusions; red with white inclusions; vitreous lustre. Semi-flake quality. (D. Miller, Weta)
Great Barrier Island (Map 3)	
Te Ahumata 1	Bomb deposited material spread over flat south of Te Ahumata. N 30 & 31/924335. Grey-black, vitreous lustre. Flake quality.
Awana 37	Detrital material from Awana stream east of Mt Hobson. N 30 & 31/955408. Grey-black; some with white vesicles; vitreous lustre. Flake quality. (Spring-Rice 1962)
Fanal Island (Map 3)	
Fanal Island 48	Block from beach. Grey-black, vitreous lustre. Flake quality. (Fleming 1950; Geological Survey sample P 10284)
Coromandel Peninsula (Map 3)	
Cooks Bay 13, 14	Bomb material from two spatially discrete deposits on ridge behind bay. N 44/241613, N 44/244611. Black with some white vesicular material, vitreous lustre. Flake quality.

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Wairua 15	Detrital material, mainly small pebbles from Swampy Stream approximately 20 km south of Tairua. N 49/316378. Black, vitreous lustre. Flake quality.
Hahei 42	Detrital material from beach, probably river boulder; may be naturally or cultural deposited. Black, vitreous lustre. Flake quality. (J. Price, Tairua)
Waihi 43, 44	Detrital material from near Waihi. Red-brown, bands of grey and black respectively; vitreous lustre. Flake quality. (P. Murdock, Hikutaia)
Purangi 45	Piece from large boulder near Purangi. Red-brown, vitreous lustre. Flake quality. (Mineralogical Museum, Thames)
Maratoto 46	Small pebbles from stream near Maratoto. Black, highly vitreous lustre. Flake quality. (P. Murdock, Hikutaia)
Rotorua (Map 4)	
Hemo Gorge 23	Deposits outcropping in the vicinity of the junction of Rotorua-Taupo

	and Rotorua-Atiamuri Highways. N 76/711998. Black with white vesicular material. Not flake quality.
Whakarewarewa 24, 25	In this modern quarry, only fragmental material remains of obsidian which is said to have previously outcropped in the vicinity. N 76/745010. Red, matt, and black with some white vesicular material, vitreous lustre, respectively. Semi-flake quality.
Ngongotaha 26	Deposits outcropping in the vicinity of a modern quarry on the eastern side of the mountain. N 76/686073. Black with white vesicular material, vitreous lustre. Not flake quality.
Maraetai (Map 4)	
Maraetai 27	Outcrops cut by Plateau Road, one of many on the forested Plateau east of Mangakino. N 84/308748. Black with white vesicular material, vitreous lustre. Semi-flake quality.
Whakamaru 36	Material from outcrops situated on the southern slopes of Whakamaru. N 84/369715. Red-brown, vitreous lustre. Flake quality. (J. Crewys, Atiamuri)

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	Material from a number of outcrops on a ridge W of the Ongaroto Road. N 84/385725. Black with some white vesicular material, vitreous lustre. Semi-flake quality.
Taupo (Map 4)	
Whangamata Fault	
28	Obsidian flow exposed by road cutting near Ben Lomond Station. N 93/436498. Black material, vitreous lustre. Flake quality.
29	Immediately adjacent to 28. Predominantly grey material banded with different intensities of grey/grey-black, showing flow structure, vitreous lustre. Flake quality.
30	Immediately adjacent to 28 and 29. Predominantly black material with some white vesicular inclusions, vitreous lustre. Flake quality.
31	From scattered large rocks at foot of fault 2.5 km from road. N 93/428473. Black and grey-black material showing flow banding, vitreous lustre. Flake quality. Evidence of quarrying.
32	Outcrop of flow 2.25 km from road. N 93/429477. Black and grey-black material showing flow banding, vitreous lustre. Flake quality. Quarry.
Tahua (Mayor Island) (Maps 3 & 5)	
Raumata 16, 17	Southern end of Oira Bay. Parts of flow nearest sea and cliff respectively. Opaque, in some sections flow banded, showing a vitreous lustre, pale olive-green in transmitted light. Flake quality.
Oira Bay 18	Northern end of Oira Bay. Sample widely dispersed over flow. Colours range from black to tan in reflected light, green in transmitted light, vitreous lustre. Flake quality.
Oira Bay 19	From flow at northwestern end of the bay. Opaque with vitreous lustre, green in transmitted light. Flake quality.

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Taratimi Bay 20	From 'Staircase' section of ridge about 200 m above sea level. Opaque, vitreous lustre, green in transmitted light. Flake quality.

Opo Bay 21, 22	Flow at northern end of bay from upper and lower seams respectively. Opaque with vitreous lustre, green in transmitted light. Flake quality.
MI/5 33	From quarry near 'Staircase' section of the ridge of crater 200 m a.s.l., Taratimi Bay. Opaque, vitreous lustre, green in transmitted light. Flake quality. (T. Inman, Opo Bay)
Honey 34	From flow in bay on section of coast between Waitangi and Te Horo. Light tan or 'honey' coloured, vitreous lustre. Flake quality. (T. Inman, Opo Bay)
Okawa 35	From flow on southernmost tip of Okawa Point. Opaque, vitreous lustre, green in transmitted light. flake quality. (T. Inman, Opo Bay)

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