NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER

SOURCES, AGES AND EXPLOITATION OF NEW ZEALAND OBSIDIAN

An interim report

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When, less than a decade ago, authoritative books or articles on New Zealand's prehistory stated there was only one source of Moa-hunter and Maori obsidian flakes, little attention was paid to this ubiquitous artifact. But precisely because of its presence in nearly every type of site, whatever its yield of other portable and structural artifacts, it constitutes one of the more valuable pieces of evidence we possess. Thus, when discarded, it is out of ignorance and not out of conclusive evidence pointing to its relative unimportance in interpreting New Zealand prehistory. With the development of techniques for recovering the relevant information, the lowly obsidian flake may yet prove to be "the pottery of New Zealand archaeology".

The potential evidence in assemblages of obsidian flakes is known to be of several kinds:

1 - Hydration rims which vary in thickness according to age and thus provide a non-cultural or independent means of assessing age;

2 - Changes in percentages of obsidians from different sources which provide clues to the maximum possible age for an assemblage and which may indicate its relative position in local or regional chronology;

3 - The same variations in percentages of obsidians from different sources, which through time and interregionally may be interpreted as evidence for patterns of trade, and, as well, the distribution of find spots of obsidian which may help to identify trade routes over less densely occupied areas of the country.

4 - The technological study of the flake assemblages themselves as artifacts in their own right.

Other possibilities may also develop, but these are sufficient to indicate that assemblages of obsidian flakes are already worthy of more attention than they customarily receive. Below, I will comment briefly on the four possibilities outlined above, but the second, which I will discuss last, will be developed at greater length, as it is the one most readily exploited without access to equipment or knowledge of the more sophisticated techniques. As Biek stresses in his recent book on Archaeology and the Microscope, the normal drawbacks to the study of stone and glass materials are that the work is laborious, tedious, and sometimes necessitates the use of statistics (1963: Table 7:212-213) as well as involving "an enormous amount of routine observation" (1963:92). All of the studies about to be discussed exhibit these characteristics to a greater or lesser extent.

Hydration.

The study of hydration rims requires equipment beyond the means of most and even then it is difficult to acquire rapidly under New Zealand

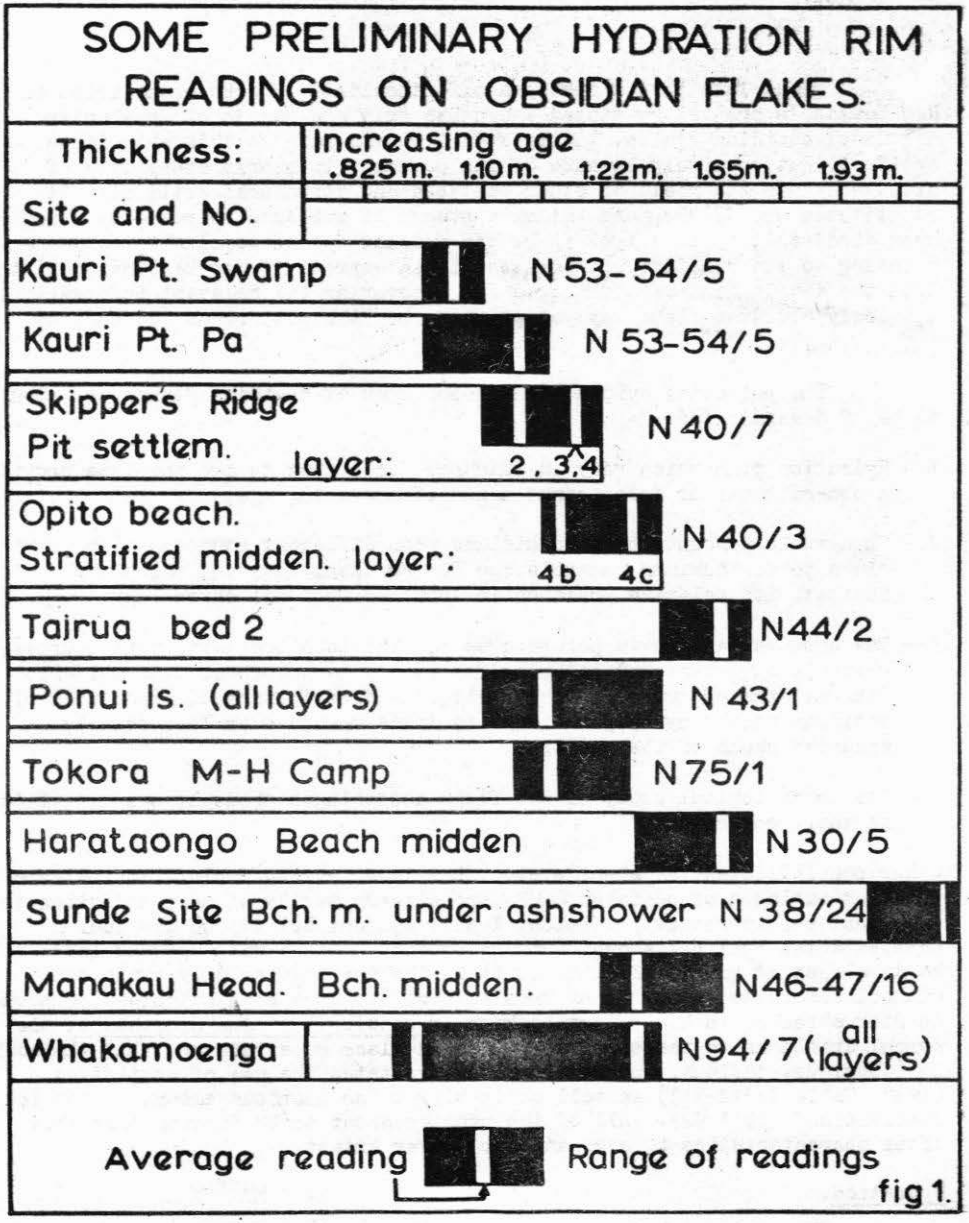

SOME PRELIMINARY HYDRATION RIM READINGS ON OBSIDIAN FLAKES.
Thickness:
Increasing age
.825 m.
1.10 m.
1.22 m.
1.65 m.
1.93 m.
Site and No.
Kauri Pt. Swamp
N 53-54/5
Kauri Pt. Pa
N 53-54/5
Skipper's Ridge Pit settlem.
layer:
2, 3, 4
N 40/7
Opito beach. Stratified midden. layer:
4b
4c
N 40/3
Tairua bed 2
N44/2
Ponui Is. (all layers)
N 43/1
Tokora M-H Camp
N 75/1
Harataongo Beach midden
N 30/5
Sunde Site Bch. m. under ashshower
N 38/24
Manakau Head. Bch. midden.
N46-47/16
Whakamoenga
N94/7 (all layers)
Average reading
Range of readings

fig 1.

conditions. Such equipment, due to the generosity of the University Grants Committee,is now being installed in the Department of Anthropology at the University of Auckland. When the last of it arrives, our processing of the large number of samples already collected will proceed fairly rapidly. The theoretical aspects of the process for New Zealand were described earlier (Green, 1962) and the initial results obtained by working on borrowed equipment briefly outlined by Ambrose and Green (1962). These results, plus some additional material, are presented in Fig. 1. It will be seen that the general sequence of sites, their relative ages, and the range of time encompassed by each, seems reasonably in line with the pattern of the archaeological evidence for the Auckland Province as outlined by Green (1963a), and with the results of Fig. 2. This indicates the potential of the method, but does not assign absolute or relative dates to the site on its own merit alone (a) because the samples are not large enough; (b) because problems associated with reuse of old flakes, which is common, are not solved. Thus several edges often give different readings, and it is not immediately apparent which should be selected; and (c) because all factors known to affect hydration thickness have not been thoroughly tested or corrected for. To overcome a part of this last difficulty, all samples analyzed to date, except those from Whakamoenga cave, have been from the Mayor Island source.

Trade.

Study of trade and trade routes in prehistoric New Zealand has largely been the work of geographers (Cumberland, 1949: 412-413, Fig. 2), although a few archaeologists, notably Coombs and Lockerbie (Golson, 1957: 284-285), have pioneered work in this general field. As the sources of obsidian are many and scattered in the northern part of the North Island, and obsidian is distributed throughout the country in sites of all ages, it should be possible for the archaeologist to contribute more to this field than he has. The work of Mr. R.A.L. Batley in the inland Patea area is some of the most promising so far undertaken in this line, especially in the use of find spots to trace trade routes. But at present little can be done with the overall picture because too little is known about the primary information on which such interpretations must depend.

In my own studies the prediction of sources from materials in sites indicates that such evidence is there to be exploited. For instance, obsidians on many of Auckland's volcanic cone pa matched with those in a midden (N30/19) on Great Barrier, their general distribution suggesting a source on Great Barrier or one of the other islands in the Hauraki Gulf with suitable geological conditions. It remained only to initiate the appropriate inquiries to actually pinpoint some of these sources. Similarly, much of the obsidian from sites around Wanganui matched with that from detrital sources in Taupo suggesting that there were major sources of flake quality obsidian in that area as well. Again, material from Northland contained an obsidian similar to that on Great Barrier, but it appeared likely that another source was involved somewhere in the north. In short, the obsidians in sites indicate an imbricating system of regional and interregional trading networks which are seemingly possible of definition given a sufficient amount of quantitative information.

Artifact assemblages.

Few site reports have appeared in which the flakes, including those of obsidian, have been treated as a part of the assemblage and their frequency given according to some classification. The materials from Shag River Mouth were treated in this way (Skinner and Teviotdale, 1927), as were those at Nenthorn (Trotter, 1961), and I have done so with those from Tairua, Opito, and Kauri Point (Smart and Green, 1962; Green, 1963b, Green 1963c). But these descriptions of flakes in site assemblages have produced few results of comparative value because they failed to give sufficient attention to the majority of the flakes, which can not be treated as formal tool types. Shawcross (1964) has made an advance in this respect, however, and shown not only that different assemblages vary according to size and other features of flakes but also how one may illustrate this in simple graphic terms. It now remains for us to follow his lead and analyze other assemblages until enough data is available to assign possible chronological and/or functional meanings to these similarities and differences.

Sources and their sequence of discovery and use.

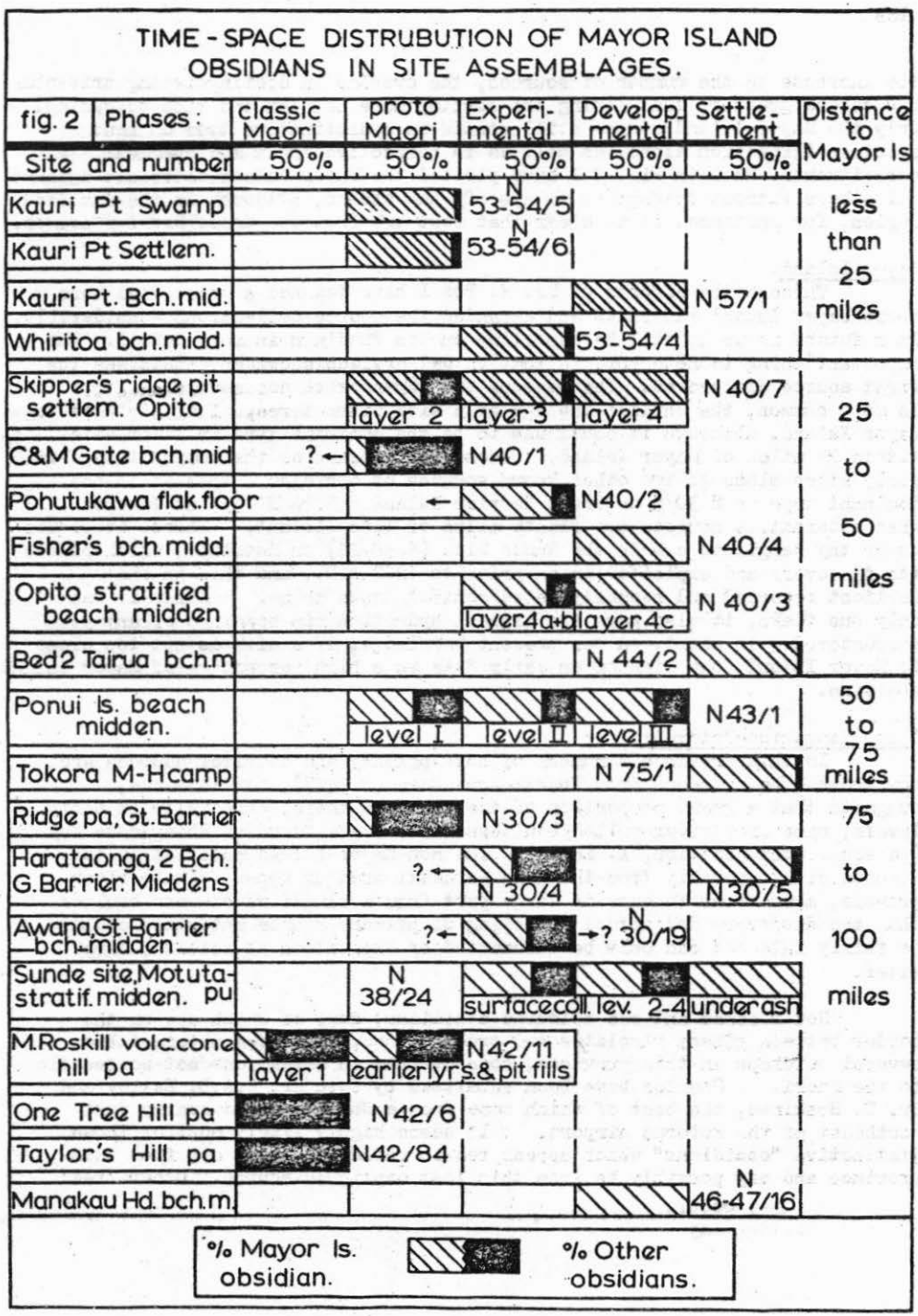
Known sources of flake quality obsidian number at least eight or nine in New Zealand. Obviously they were not all discovered at once, or exploited at the same time. Equally obvious, any changes in local or regional patterns of trade through time, if more than one source of obsidian was involved, would provide a basis for working out a relative chronology. Such a chronology would be akin to a seriation study of pottery or other types and their increase and decrease through time. It remains only to discover the sequence in which sources were discovered and then widely exploited to apply this knowledge to the obsidian flakes from site assemblages in a region and arrive at a relative chronology of sites.

In such a relative chronology no claim is made for absolute dating. But when the general nature of the artifact assemblage (pits, adzes, fishhooks and ornaments, etc.), the economy (shellfish and bone), indepdendent means of age assessment (radiocarbon dates, ash showers, hydration rim readings) and the results of a seriation based on several sources of obsidians or other rock types all agree, it is reasonable to conclude that one is on fairly firm ground. It is in this respect that the results in Fig. 2, to be discussed below, are to be evaluated. As Mason (1963:111) notes, this type of chronology is a likely outcome of any study of rock types in which the incoming and obsolescence of source materials is plotted. Given the paucity of other means of cultural dating, due to the low quantities of portable artifacts recovered from many sites, it seems a shame that so little has been done in this field.

Sources.

In 1962 I listed sources then known by the geologic province in which they occur. Others I did not list because of insufficient documentation. The listing may now be expanded, but it is important to stress that with

TIME - SPACE DISTRUBUTION OF MAYOR ISLAND OBSIDIANS IN SITE ASSEMBLAGES.



the increase in the number of sources, the overlap in distinguishing criteria has become greater, thus making the sorting more complex and time consuming. Only the Mayor Island source still stands as a distinctive type on hand specimen inspection alone, as well as in refractive index and chemical constituents. Thus in Fig. 2 I have plotted the Mayor Island materials against all others without attempting to specify the others, although in the Auckland region, for instance, it is clear that most are from the Great Barrier source.

Mayor Island:

Through the efforts of Mr. H. Pos I have learned a great deal more about Mayor Island materials and expanded the source collections considerably. In a future issue he will be reporting on his findings in more detail. The important thing to note here is that on all available evidence this was the first source discovered. The reasons for saying this are several. First it is more common, the earlier the age of a site without respect of distance to Mayor Island, although it continues to be the dominant type in later sites within 25 miles of Mayor Island. Second, it appears as the dominant type in early sites close to two other known sources of obsidian. Thus it is the dominant type in N 30/5 on Great Barrier Island and in N 75/1 at Tokoroa when alternative sources are twenty miles or less distant. Third, it occurs under the Rangitoto ash in the Sunde Site (N 38/24) on Motutapu, which places its discovery and exploitation as prior to 1200 A.D., and this is the earliest recorded and securely dated context known to me. While it was only one flake, it also gave the highest hydration rim readings of any yet encountered. In short, on our present knowledge, if a site is not too close to Mayor Island, one sign of an early date is a high percentage of Mayor Island obsidian.

Taupo-Mangakino-Rotorua:

In this province a number of both primary and detrital sources are now known. The evidence from Whakamoegna Cave (N 94/7), for instance, suggests that a great proportion of the obsidian there, especially in early levels, came from river-rolled boulders such as are found at Whangamata Bay (personal communication, A. Leahy). The non-Mayor Island material in the Tokoroa site, probably from the Lake Maraetai area or upper Waikato river gravels, also seems to come in large part from a single water-worn boulder. Thus the discovery and actual quarrying of primary source materials could be fairly late and can only be documented by excavation at actual quarry sites.

Red flecked and red coloured obsidians, some of which are on the border between glassy rhyolites and true glasses, have been obtained from several outcrops in this province, some of them in situations not accessible to the Maori. Samples have been submitted by both Mr. R.A.L. Batley and Mr. T. Hoskings, the best of which come from a Whakarewarewa quarry just southeast of the Rotorua airport. It seems highly likely most of those distinctive "obsidians" which appear red in reflected light are from this province and may possibly be from this last mentioned source. Other 'red'

obsidians are known, however, the red colour frequently appearing only when viewed in transmitted light. There is even a beautiful clear glass red obsidian from the core of one of Auckland's volcanic cones, but it is unlikely that this source was exploited by the Maori.

Whitianga Rhyolite Group:

In this group the list of possible sources of obsidian has been greatly expanded. On Great Barrier Island, large lumps of flake quality obsidian were recovered from the top of Ahumataa (Spring-Rice, 1962). They correspond to the types in the Gt. Barrier middens and on Auckland volcanic cone sites. In addition, source materials of obsidian from Fanal Island and others in the Mokohinau group have been assembled for study. Another well exploited detrital source of flake quality obsidian occurs near Whitianga and presumably derives from unidentified outcrops farther inland. This obsidian is very like that from Great Barrier, as might be expected on geological grounds, and is probably a source of many of the local non-Mayor Island obsidian flakes in early sites on the Coromandel coast.

Northland Group:

A more recently identified source of obsidian near Kaeo was first brought to my attention in 1961. Since then several samples have been collected from the area by a number of people. To date, the material has not been well enough studied to relate it precisely to the other obsidians, but in some properties it is very close to those from Mayor Island. Another obsidian from the Huruiki area has also been noted by an M.A. geology student mapping in the area. Both of these sources will doubtless become more important and better known as excavation provides a knowledge of site assemblages in the area.

Relative chronology:

The possibility of constructing a relative chronology from sites in the Auckland Province based on the relative percentage of Mayor Island obsidians in their assemblages can now be demonstrated. Unfortunately, there are relatively few stratigraphic sequences with adequate flake samples which serve to document the changes in frequency solely on this basis, but those that exist tie in nicely with expectations for site assemblages where these conditions do not apply. Figure 2 is not a seriation of sites based on obsidian types, but an arrangement of sites according to their postulated position in a succession of cultural phases as outlined previously (Green, 1963a). The purpose here is to illustrate that a seriation of sites based on obsidians is possible and in accord with our expectations on the basis of other criteria. As such it is supporting evidence for the relative sequential order in which these sites have been placed to yield a more elaborate overall cultural sequence.

It also demonstrates that such a procedure can not be expected to yield useful results when all sites are within 25 miles or so of Mayor Island and no other obsidians are being traded into the region in any quantity. Finally, in some cases the present samples are too small for purposes of seriation; total samples of 100 or more are normally considered

adequate, and those of 50 or less are open to question (Suggs 1961: 19). Further refinements in seriation would therefore be possible if larger samples existed for a few more key sites, and if the different sources all lumped together under the other category were also specified. The reliability of the samples used may be gauged from the following table:

Site	Mayor Island	Other	Remarks	Site	Mayor Island	Other	Remarks
N 53-54/5	496	4	Sample only	N 43/1	78	32	level 2
N 53-54/6	43	3		N 43/1	25	11	level 3
N 57/1	6	0		N 75/1	480	31	
N 53-54/4	432	30		N 30/3	32	139	
N 40/7	22	13	layer 2	N 30/4	6	7	
N 40/7	10	1	layer 3	N 30/5	92	9	
N 40/7	4	0	layer 4	N 30/19	7	5	
N 40/1	21	113		N 38/24	19	12	surface
N 40/2	63	16		N 38/24	10	7	levels 2-4
N 40/4	81	3		N 38/24	0	1	under ash
N 40/3	3	1	layer 4a, b	N 42/11	5	16	layer 1
N 40/3	9	0	layer 4c	N 42/11	22	47	earlier layers
N 44/2	54	1	bed 2	N 42/6	0	18	surface
N 43/1	101	79	level 1	N 42/84	0	7	surface
				N46-47/16	59	1	

The results have been interesting from other points of view as well. For instance, I had tentatively assigned most of the known Opito beach middens to the earlier periods (Green 1963b) but was not concerned because it was the early middens which attracted attention while the others went unrecorded. But as Davidson (1964:204) pointed out, it seemed unlikely that later middens yielding portable artifacts had not been found and in her opinion some of the Opito middens belonged with the layer 2 material from Skipper's Ridge. An assessment of the obsidian from the Curry and Moore Gate beach midden (N 40/1) leads me to suspect that this is the case with that site, and for this reason it has been placed at a later point in the sequence. The obsidian results also make it unlikely that the Haratoanga beach midden, N 30/4, is of the same age as material in and around the fill of the pit at N 30/3 on the ridge above. Again, as Davidson (1964:210) has noted, the faunal differences between this beach midden (N 30/4) and that of (N 30/5) are not as great as they first seemed, although the two still differ in important respects, and I have thus placed this site earlier in the sequence than was suggested for it previously. Obviously, as our available data increases, additional refinements of our chronologies on the basis of relative proportions of different obsidians in site assemblages will become possible.

Summary.

The study of obsidian flakes in site assemblages has now proceeded to a stage where to ignore them is to lose a valuable portion of the available evidence recovered from most archaeological sites in New Zealand. Moreover, it may be the only evidence recovered which makes possible a

chronological placement of a site in relation to others in the area. Most of the techniques outlined here, except hydration, can equally well be applied to a wide range of stone flakes found in New Zealand sites. In the next stage of New Zealand archaeology it may be predicted that these now neglected materials will take their rightful place alongside better known items. This means, however, that they must be collected carefully while excavating, studied, and the results published as part of a normal site report. For instance, it has taken me, with the help of many, nearly four years to assemble the necessary information on which the present report is based. Most site reports still mention little other than that flakes in this or that material were found, while many museum collections are notoriously deficient in this respect and fail to save even representative samples. To illustrate, let me end by noting that I wished to include Oruarangi in Figure 2, but despite the hundreds of other specimens from the site in the Auckland Museum, only a single flake of obsidian from there could be found.

Acknowledgments.

This study has been assisted by a grant from the University Grant's Committee and is only an interim report on that project. Almost every collection mentioned involves the work of one or more association members, while noting sources and providing samples from them has involved more people than space will permit me to name. As noted in the report the work is tedious and time consuming, and without the help of so many it would not have been possible for me to advance even to this point. I would also like to note here the technical assistance furnished by Mr. W. Ambrose and Mr. K. Peters, and the help of Dr. R.N. Brothers and the Geology Department of the University of Auckland. With so much assistance from so many, I can only express my genuine thanks and hope that the results that are now beginning to emerge justify the expenditure in time and effort.

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Cyclostyled copies of the above reports are available to those with a genuine interest, from the Anthroplogy Department, University of Auckland, Box 2175, AUCKLAND.

"A Guide For Salvage Archaeology " by Fred Wendorf. Reviewed in Vol.6, no. 4 of the Newsletter by Dr Scott, is available from the N.Z.National Library Service on request.
