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OBSIDIAN DEPOSITS IN THE WOODY HILL AREA, NEAR TAIRUA, COROMANDEL PENINSULA

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Since Ward's (1973) report of detrital obsidian at Swampy Stream south of Tairua it has seemed likely that more substantial obsidian deposits would eventually be found in the area. Until recently, most of the surrounding hill country lay covered in dense scrub, preventing easy access, but since 1976 large areas have been cleared by the New Zealand Forest Service for development as part of Tairua State Forest.

The first significant obsidian occurrence was reported by Nugent and Nugent (1977:5) near Woody Hill (Fig.2) and in 1978 three more deposits were found by Coster and Johnston (1980:4). A brief visit by PRM in December 1981 resulted in the location of three further deposits, making the Woody Hill area potentially one of the more important sources of flake-quality obsidian on the Coromandel Peninsula.

Three archaeological surveys have been carried out near Woody Hill since 1977 (Fig.1). Coster and Johnston (1980:3) recorded no prehistoric Maori occupation, but Nugent and Nugent (1977:10,11) and Diamond (1979:30, Fig.14) reported a total of 110 sites, in addition to 13 previously recorded in Archaeological Association files.

In this note we provide detailed descriptions and chemical analyses of the obsidian deposits, comment on their geological setting, and examine their archaeological significance.

Description of deposits

Obsidian deposits in the Woody Hill area are associated with Minden Rhyolite lava, of late Miocene to Pliocene age (Schofield, 1967:Fig.1). Woody Hill itself consists of dark andesite or basalt, possibly a correlative of the Omahia Andesite or Mercury Basalt.

The detrital obsidian at Swampy Stream (TA1, Fig.2 inset) reported by Ward (1973) was almost certainly derived from deposits near Woody Hill. Other streams draining the area (Woody Stream, Hikuai River) can be considered likely sources of detrital obsidian and an unconfirmed report of obsidian 'boulders' in Oturu Stream (Rowland, 1975:6) indicates that

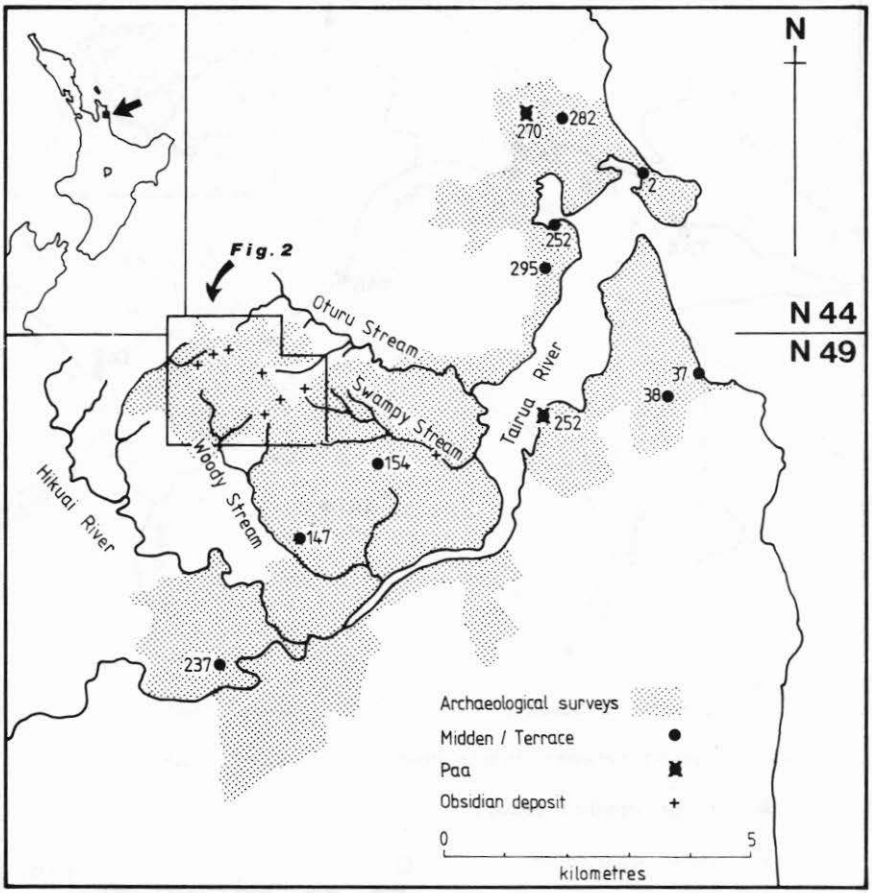

FIGURE 1. Map of Tairua area, showing Woody Hill obsidian sources, archaeological sites mentioned in the text and area covered by archaeological surveys.

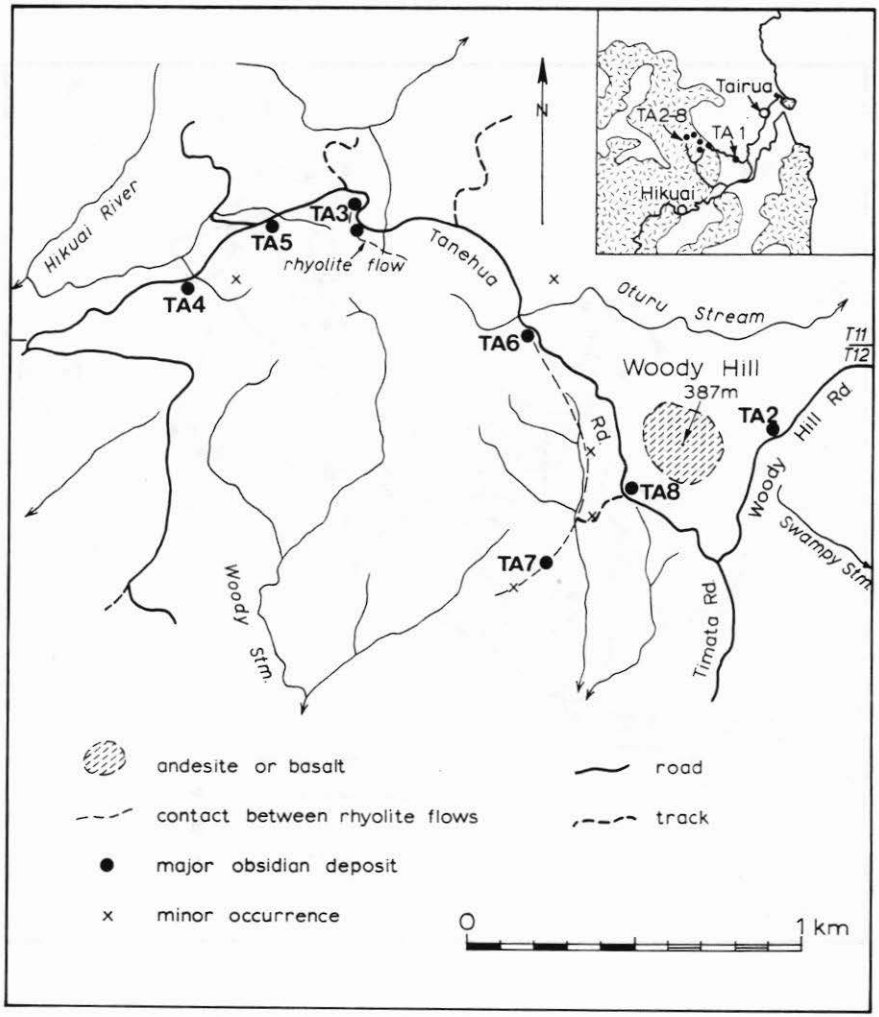

FIGURE 2. Detailed map of Woody Hill area showing location of obsidian deposits. Inset: distribution of Minden Rhyolite in Tairua-Hikuai area (after Schofield, 1967) and approximate position of obsidian occurrences.

a few significant alluvial deposits may exist, particularly in the upper reaches of some catchments. All the known deposits, however, apart from TA1, are located on forestry roads and tracks within a 1.5 km radius of Woody Hill (TA2 to TA8, Fig.2). Detailed descriptions of deposits are given in Table 1 (see also Coster and Johnston, 1980: Appendix 4).

The obsidian at Woody Hill occurs in two main situations: (1) in weathered rhyolite (in situ), (2) in proximal colluvial/alluvial deposits.

In situ deposits (TA3, TA6, TA7) consist of large blocks (up to 30 cm) or pockets of fractured obsidian in highly weathered spherulitic rhyolite lava. Pockets of fractured obsidian up to 2 m across at TA6 are composed of small, solid fragments about 1-5 cm in diameter.

Colluvial/alluvial deposits at Woody Hill contain obsidian which has been transported by gravity and/or fluvial processes only a short distrance from its original source. Most of these deposits either overlie weathered rhyolite or are found close to rhyolite outcrops. For example, at TA4 and TA5 pieces of obsidian up to 20 cm diameter occur in clay and gravel overlying highly weathered spherulitic rhyolite. At TA2 clay and soil overlying rhyolite breccia contain nodules and small rounded pebbles of obsidian. The situation at TA8 is slightly different in that obsidian occurs in 2 m of clay and colluvial gravel overlying pumice breccia.

Limited field observations suggest that most obsidian deposits in the Woody Hill area occur along the margins of rhyolite lava flows. At TA6 obsidian occurs in what appears to be the upper, brecciated part of a rhyolite flow. Flow banded obsidian at TA7 probably represents the lower chilled margin of another lava flow which lies above the one at TA6. Obsidian deposits TA3, TA4 and TA5 could all be derived from a single rhyolite flow.

Physical characteristics

Pieces of obsidian from colluvial deposits in particular have a pitted and 'combed' outer surface; the 'combed' appearance results from differential weathering of thin flow-banded layers in the obsidian. Freshly broken material is black to grey-black in reflected light (grey in transmitted light), vaguely to strongly flow-banded, and usually contains common small (< 1-2 mm) crystal inclusions. Some pieces also contain grey spherulites ranging from < 1 mm to 5 mm diameter (e.g. TA3), but in general spherulites are absent. In strong sunlight some obsidian has a silky brown or silky green sheen

No.	Grid refs.	Location	Description	Nature
TA-1	N49/315379* T12/615587+	Swampy Stream	Very rare small pebbles of obsidian in stream.	Alluvial
TA-2	N49/292390 T12/594598	Woody Hill Rd., 250 m east of Woody Hill trig.	Common nodules weathering out of clay + soil horizon exposed for c.20 m along road; abundant small pebbles in pebbly layer at base of clay.	Alluvial/ colluvial
TA-3	N49/278396 to 278397 T11/582604 to 582605	Tanehua Rd. No. 24, on prominent bend	Abundant obsidian where surface scraped down to weathered rhyolite at T11/582605, and common pieces up to 20 cm diam. in clay + soil horizon for at least 50 m to south.	In situ/ colluvial
TA-4	N49/275396 T11/580604	Tanehua Rd. No. 24, for up to 30 m west of prominent gully	Scattered small pieces of obsidian in clay/gravel deposit overlying rhyolite.	Colluvial/ alluvial
TA-5	N49/272394 T11/577603	Tanehua Rd. No. 24, opposite new road	Scattered pieces of obsidian up to 20 cm diam. in highly weathered spherulitic rhyolite, clay, and minor alluvial gravel exposed in bank for 30-40 m west of small stream.	Mainly colluvial?
TA-6	N49/283393 T11/587601	Tanehua Rd. No. 24, in prominent road cutting	Large pockets of fractured obsidian up to 2 m diam. in highly weathered spherulitic rhyolite; pockets consist of smaller fragments 1-5 cm diam.	In situ
TA-7	N49/284385 T12/587594	Track cutting at head of small gully c. 500 m southwest of Woody Hill	9 m long exposure of highly fractured flow-banded obsidian, min. 2 m thick. Also scattered pieces on track up to 200 m to east.	In situ
TA-8	N49/287388 T12/590596	Tanehua Rd. No. 24, on bend c. 200 m west of Woody Hill	Scattered pieces of obsidian in clay/gravel deposit overlying weathered pumice breccia.	Colluvial

* NZMS 1 Sheet N49 'Thames' (3rd Ed.)

\+ NZMS 260 metric sheet

TABLE 1. Detailed descriptions of obsidian deposits in the Woody Hill area, Tairua.

Almost all of the material collected from Woody Hill deposits is of flake quality.

Chemical analyses

Chemical analyses of obsidian from three of the deposits are presented in Table 2. The chemical variation among deposits appears quite small, although TA4 seems to have slightly different concentrations of Fe, Mg, K and Ba. TA2 and TA6 have very similar values for most elements, which suggests they may be derived from the same rhyolite flow.

Ward's (1974) Ti, Mn and Zr values for obsidian from Swampy Stream (TA1) are similar to those obtained for Woody Hill deposits, but his Rb and Sr concentrations are considerably higher. This may reflect differences in analytical methods rather than any real difference between material from Swampy Stream and Woody Hill. Thorium is similar to that obtained by Leach et al (1978), but their U concentration is lower.

Compared to Cooks Beach-Hahei obsidians (Moore, 1983) Ga, Rb, Y, Th, Zn, Pb and Cu values are similar, U is possibly slightly higher (Leach et al, 1978), and Zr considerably higher. Sr is slightly higher than Cooks Beach, and much higher than Onemana (Moore, 1983). Y is slightly lower than Onemana, and Ca is higher than both Cooks Beach and Onemana. Compared to other Minden Rhyolite obsidians on the Coromandel Peninsula (Rutherford, 1978) the Ba concentration is much lower, Y, Nb, Pb, Ga and Rb are low, Zn average, Zr moderately high, and Sr very high. Obsidian from deposits in the Woody Hill area, therefore, can probably be distinguished from most other occurrences in the Coromandel volcanic zone on the basis of high Zr and Sr, and low Ba concentrations.

Evidence for prehistoric exploitation

Of the 123 prehistoric archaeological sites recorded within 8 km of Woody Hill, only eleven (9%) are reported to have included obsidian flakes (see Table 3). With the exception of N44/2, discussed below, no information is available on the likely sources of any of this material. The two flakes recorded by Nugent and Nugent (1977) are held in the Auckland Institute and Museum (see Table 3) but, so far as is known, none of the flakes noted by Diamond (1979) were collected (Diamond, pers. comm.).

The one archaeological site in the Tairua area which has been intensively investigated is the archaic midden N44/2 (Smart and Green, 1962; Jones, 1973) containing two occupation

layers, of which the earlier (Bed 2) probably dates from the 14th century and the later (Bed 6) from the 16th or 17th (Rowland, 1976:6; Davidson, 1979:186, 187 and 200). Approximately 250 obsidian flakes were excavated from the site, the great majority being from Bed 2 (Anon, n.d.; Jones, 1972: Fig.7). This assemblage was subjected to trace element analysis using XRF techniques at the Institute of Nuclear Sciences, Wellington, as part of an obsidian sourcing programme undertaken by B.G. McFadgen, P.R. Moore and the late G.J. McCallum. The analysis identified 240 flakes (96%) as coming from Mayor Island, some 45 km away, two from Cooks Beach, 20 km north of Tairua, but none from the Woody Hill deposits, although seven could not be assigned to a source (McCallum et al, n.d.:Table 3). This analysis does not therefore exclude the possibility that one or more of the seven unidentified pieces are from Woody Hill, even though Woody Hill source material was included in the programme (McFadgen, pers. comm.).

Discussion

Ward (1973:96) and Seelenfreund (1983:57) note that direct evidence for quarrying of New Zealand obsidians is rare. Thus there is no reason to expect quarry sites as such to be found at Woody Hill, especially since it is likely that obsidian from the deposits was readily available to the Maori only as detrital material in stream beds. Nonetheless, the scarcity of worked obsidian on nearby sites and the apparent absence of local obsidian in the Tairua archaic site are surprising, considering the proximity of the Woody Hill deposits.

Although by no means exhaustive, site surveys in the region were reasonably thorough. All but one of the Nugents' sites had been deeply disturbed by bulldozed tracks (Nugent and Nugent, 1977:9-11) while the majority of Diamond's sites had been disturbed by farm development (Diamond, 1979:36, 39-52). It is reasonably certain therefore, that had obsidian been present in quantity on any number of the sites recorded, it would have been observed. Furthermore, the one site in the district which has been excavated fails to provide any evidence for the use of local obsidian, but demonstrates rather that a more distant source - Mayor Island - was favoured.

It seems valid to suggest therefore that if extensive utilisation of the Woody Hill obsidian had taken place, some indication of it would have been found associated with the main deposits or in nearby archaeological sites. Such indications are so far lacking, and while it is questionable

(%)	TA-2	TA-4	TA-6	Mean	S.D.
SiO_2	75.96	75.34	75.75	75.68	0.3
TiO_2	0.20	0.12	0.20	0.17	0.05
Al_2O_3	12.79	12.91	12.83	12.84	0.06
Fe_2O_3	1.65	1.91	1.71	1.76	0.14
MnO	0.05	0.05	0.04	0.05	0.01
MgO	0.27	0.15	0.25	0.22	0.06
CaO	1.44	1.36	1.46	1.42	0.05
Na_2O	3.75	3.81	3.95	3.84	0.1
K_2O	3.23	3.42	3.23	3.29	0.1
P_2O_5	0.02	0.03	0.03	0.03	0.01
H_2O^+	0.35	0.94	0.36	-	-
Total	99.71	100.04	99.81	-	-
(ppm)					
Ba	685	664	688	679	13
Rb	119	130	120	123	6
Sr	103	101	102	102	1
Y	28	33	27	29.3	3.2
Zr	186	191	188	188	2.5
Nb	7	8	7	7.3	0.6
Pb	16	22	17	18.3	3.2
Zn	41	45	41	42.3	2.3
Ga	15	15	14	14.7	0.6
Cu	5	6	5	5.3	0.6
Ni	<2	<2	<2	<2	-
Cr	22	12	10	14.7	6.4
V	4	<2	3	3	1
U	3.5	4.4	4.5	4.1	0.6
Th	11.3	13.5	12.8	12.5	1.1

TABLE 2. Chemical analyses of obsidian from Woody Hill deposits (by K. Palmer, Victoria University of Wellington).

Site No.	No. of Flakes Recorded	References
N44/2	250(1)	Smart and Green 1962:245, 251; Jones 1973; Green pers. comm.
N49/37	Not recorded	Easdale & Jacomb n.d.
N49/147	1(2)	Nugent & Nugent 1977:10
N49/154	1(3)	Nugent & Nugent 1977:11
N44/252)) N44/270)) N44/282)) N44/295)) N49/38)) N49/237)) N49/252)	Probably fewer than 50 (not collected)	Diamond 1979:30, Fig.14; n.d.

Notes:

(1) Sourced as follows: 240 Mayor Island, 2 Cooks Beach, 7 not identified, 1 not analysed (McCallum et al. n.d.).

(2) Auckland Institute and Museum Catalogue No. AR 6259 (pt.Z235)

(3) AR 6258 (pt.Z235).

TABLE 3. Obsidian flakes recorded from archaeological sites near Tairua (see Fig, 1 for site types and locations).

to argue from an absence of evidence, especially when it cannot be claimed that site surveys have revealed all possible sites, it is reasonable to propose that, on current knowledge, the Tairua obsidian deposits were not a major source of obsidian in prehistory. The problem arising from this account is to explain why such an apparently suitable supply of flake-quality obsidian was not exploited when more distant sources were. At present, we can only guess at the answers.

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