NEW ZEALAND JOURNAL OF ARCHAEOLOGY

Pavements, Pounamu and Ti: The Dart Bridge Site in Western Otago, New Zealand

Atholl Anderson

Anthropology Department, University of Otago

and

Neville Ritchie

New Zealand Historic Places Trust, Wellington

ABSTRACT

Earlier investigations had characterised the Dart Bridge site as a sixteenth century, greenstone-working village of some twenty houses, built upon paved mounds which were connected by paved paths. Our investigations found no evidence of paved mounds or the use of mounds as dwellings and no evidence that paving at the site was used as a network of paths. On the contrary, the gravel which comprises most of the apparent mounds seems to be a natural feature resulting from vigorous fluvial activity between two periods of occupation. One area of paving is associated with artefactual remains indicative of a former dwelling, but other paving has no obvious function. *Ti (Cordyline australis)* cooking is extensively represented and that, rather than nephrite working, seems to have been the main attraction for repeated settlement during the early and late Archaic phases.
Keywords: WEST OTAGO, PAVED MOUND SITE, NEPHRITE WORKING, HOUSES, *UMU-TI*, MOA COOKING, FLUVIAL GRAVELS.

INTRODUCTION

The main interest in the Dart Bridge site near the head of Lake Wakatipu (see Ritchie 1980: fig. 1), stems from a brief survey and test excavations by David Simmons in 1967. His small-scale excavations appeared to show that there were artificial gravel mounds connected by slab-paved paths, and this evidence, together with the Haines greenstone collection (below) led him to conclude that the site was a greenstone-working village exploiting the Routeburn source and dated to the early sixteenth century.

Clearly, if more extensive investigations were able to substantiate Simmons' propositions then this would be a most important site in the development of material culture in New Zealand, in terms of settlement patterns no less than in lithic exploitation.

Following an outline of the Haines collection and the investigations undertaken by Simmons, and later by Ritchie, we concentrate upon our excavations of 1981 (for preliminary report see Anderson and Ritchie 1981) and the significance of the results.

PREVIOUS INVESTIGATIONS AND THEIR RESULTS

THE HAINES COLLECTION

In 1919 Mr Charles Haines, a long-time resident of the upper Wakatipu district and a keen fossicker, presented his collection of artefacts from the region to the Otago Museum.

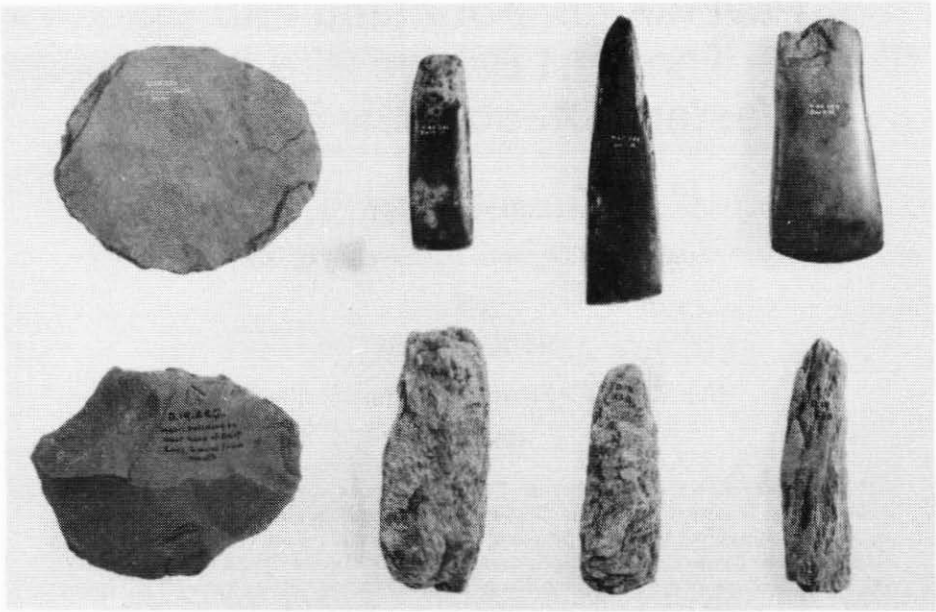

Figure 1: Artefacts from the Dart Bridge area in the Haines collection. Top row from left: D19.224, D44.261, D44.266, D44.267. Bottom row from left: D19.225, D19.237, D19.238, D19.245. Accession numbers refer to Table 1. (Otago Museum)

Twenty-four pieces, mostly of nephrite, were said to come from the one "camp". The Museum register has a note by H. D. Skinner (1919) to the effect that

> all these objects were found by Mr Haines on thesite of a Maori building situated on the west bank of the Dart River six miles from its mouth opposite an island or islands. Within the building was a hearth [here there is a sketch of three stones set at right angles] of three stones. Along one wall was a paved space measuring 6' × 3'. The objects were presented by Mr Haines, 1st September. Mr Haines states that there were moa bones in the associated midden.

It has subsequently been assumed that the site is the one now recorded as S122/1 and the subject of this paper, but although that seems most likely and would correspond with the locational details given to Skinner, we cannot be certain that there are not, or were not, other sites near by from which Haines derived his collection. Table 1 lists the pieces attributed to the Maori building site, some others in the Haines collection which *may* be from the same place, and those pieces in the Otago Museum which, although not from the Haines collection, could also be from the same place (see also Figs 1 and 2). The most interesting aspects of the Haines collection are the number of ulu and nephrite blanks. The function or functions of the former type, and its unusual frequency in inland Otago sites remain a mystery. The blanks have a size and shape suggestive of adze manufacture (Table 1 and Fig. 1), and appear to have been obtained by "smash and bash" techniques without the assistance of sawing.

THE OTAGO MUSEUM SURVEY AND EXCAVATIONS, 1967

In January 1967 the site was mapped, reportedly by plane table, under the direction of David Simmons, Otago Museum, but no copy of the plan can now be located. Attached

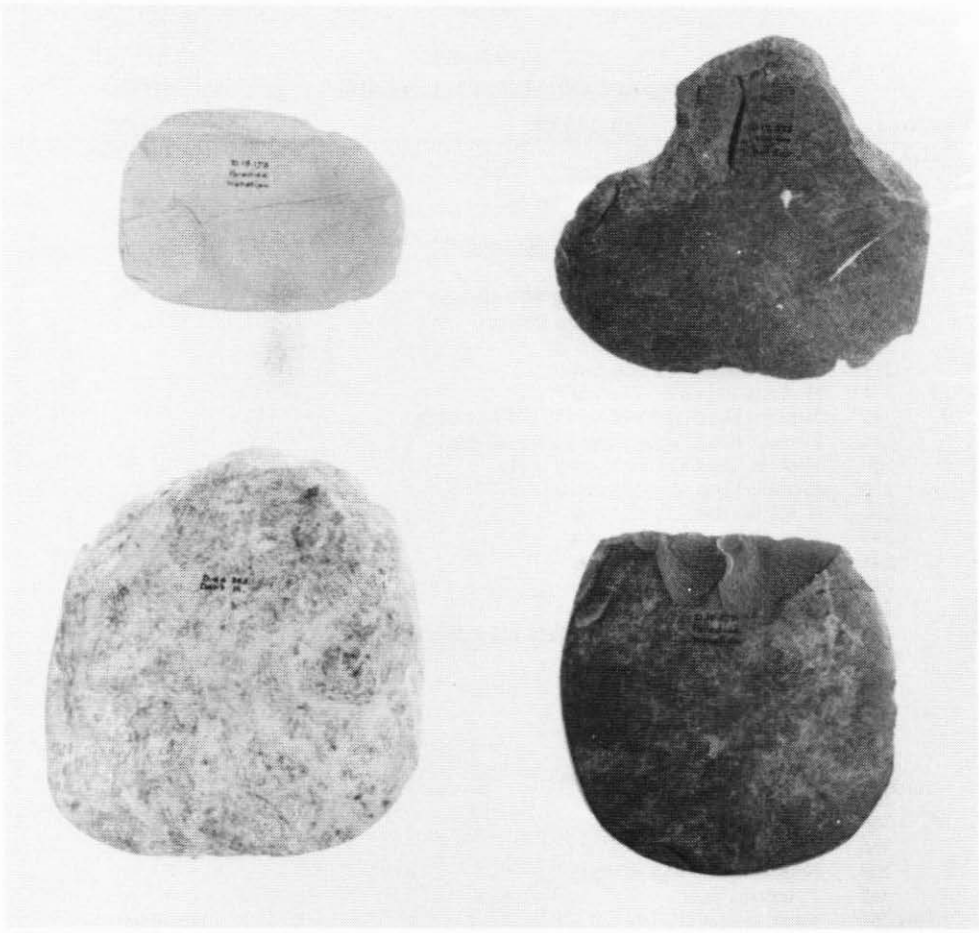

Figure 2: Artefacts from the Dart Bridge area in the Haines collection. Top row from left: D19.178, D19.225. Bottom row from left: D44.282, D19.179. Accession numbers refer to Table 1 (D.19.225 is the ulu). (Otago Museum)

to the site record form, however, are Simmons' field notes and a sketch map (Simmons 1967a). The map shows four raised-rim pits, three mounds (one marked out with stones), one depression, two rectangular areas marked with stones at the corners, and fifteen rectangular mound and despression features. The notes, on the other hand, refer to an additional five pits (four without rims), an additional two depressions and a possible low bank and ditch; conversely, only thirteen mound or mound and depression features are listed. The latter were said to be characteristically in the form of a rectangular mound with a stone at each corner, and, attached to one side, a smaller rectangular depression with a stone at each corner. Simmons (1967a) referred to these as "paved houses".

Two test excavations were carried out (Figs 7 and 9). The first (excavation "A") was across a mound which seems to have been about 2.5 m long by 2 m at one end and 1.5 m at the other. The mound was formed by a brown gravelly soil resting upon an orange "natural" (presumably loess or silt). There were large stones at two corners, a few other stones at one end and a cluster of stones on top of the mound.

TABLE 1

HAINES COLLECTION AND MATERIAL POSSIBLY FROM SAME SITES

NUMBER	ARTEFACT	PROVENANCE
D19.178	Green argillite ulu (Fig. 2)	W.side Dart River
179	Black slate ulu (Fig. 2)	" " "
224	Basalt spall, damaged edges (Fig. 1)	See text
225	Argillite or siltstone flake (Fig. 1)	" "
226	Subcircular schist pebble, damaged edges	" "
227	? Basalt flake	" "
228	Nephrite blank (? preform butt) 84 × 50 mm	" "
229	Nephrite flake with cortex 67 × 50 mm	" "
230	Nephrite blank 91 × 60 mm	" "
232	Nephrite blank 103 × 46 mm	" "
234	Nephrite blank 172 × 71 mm	" "
235	Nephrite blank (patch of polish) 186 × 118 mm	" "
236	Nephrite blank (some polish) 160 × 42 mm	" "
237	Nephrite blank 115 × 47 mm (Fig. 1)	" "
238	Nephrite blank 105 × 35 mm (Fig. 1)	" "
239	Nephrite blank 133 × 39 mm	" "
240	Nephrite blank 138 × 32 mm	" "
241	Nephrite blank 115 × 40 mm	" "
242	Nephrite blank 111 × 36 mm	" "
244	Nephrite blank 70 × 22 mm	" "
245	Nephrite blank (patches of polish) 112 × 30 mm (Fig. 1)	" "
*225	Slate ulu (Fig. 2)	W.side Dart R. 5 miles up
359	Nephrite adze 104 × 45 mm	Dart V. from same site as D.19.224–245
360	Nephrite adze 69 × 27 mm	See text
361	Serpentine/Nephrite pebble	" "
363	? Nephrite flake 125 × 72 mm	" "
364	Nephrite blank 102 × 32 mm	" "
365	? Nephrite pebble	" "
366	Nephrite cortex flake	" "
367	Nephrite blank 88 × 42 mm	" "
368	? Nephrite flake	" "
D44.261	Nephrite adze (Fig. 1)	Dart River
266	Nephrite adze (Fig. 1)	Dart River, from one camp
267	Nephrite adze (Fig. 1)	" " " " "
268	Nephrite adze 90 × 43 mm	" " " " "
282	Nephrite scraper or ulu (Fig. 2)	" "
Material possibly from same site		
D24.1093	? Serpentine block	Between Wakatipu and Paradise
2501	Nephrite flake with polish	Dart Valley
2502	Nephrite blank with cortex 132 × 48 mm	" "
D33.1405	? Serpentine block	" "
1415	? Serpentine block	" "
D55.426	Nephrite blank 98 × 32 mm	? " "
D78.178	Nephrite flakes (5)	" "
184	Nephrite blank 140 × 55 mm	" "

NOTES

(1) *225. This piece has the wrong number but the provenance is accepted.
(2) The following pieces could not be re-located:
D19.231, 233, 243 ("unfinished scrapers and adzes")
D19.362,369-372 ("unfinished adzes")
D44.268 (probably finished nephrite adze)

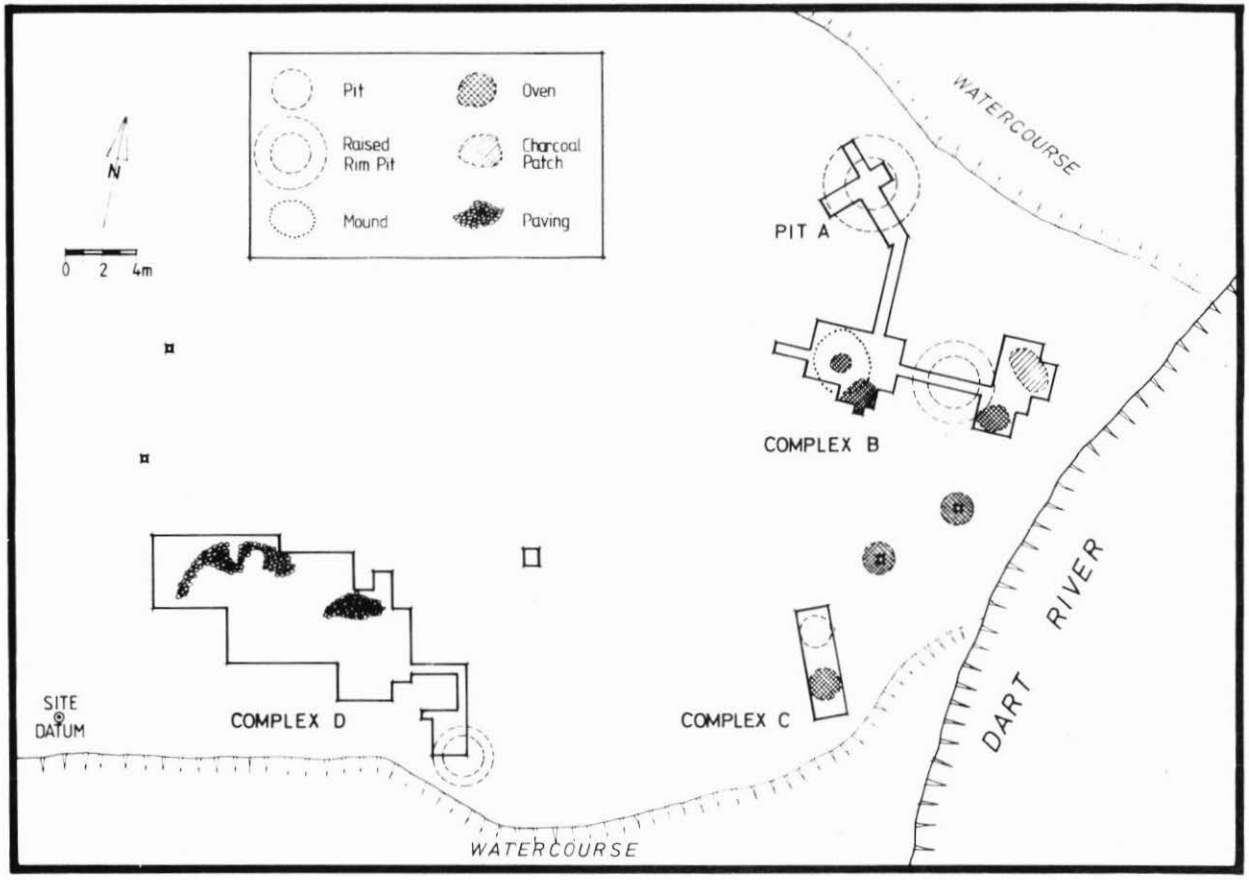

Figure 3: The Dart Bridge site showing the excavated areas. The site datum is the same as for the 1967 investigations.

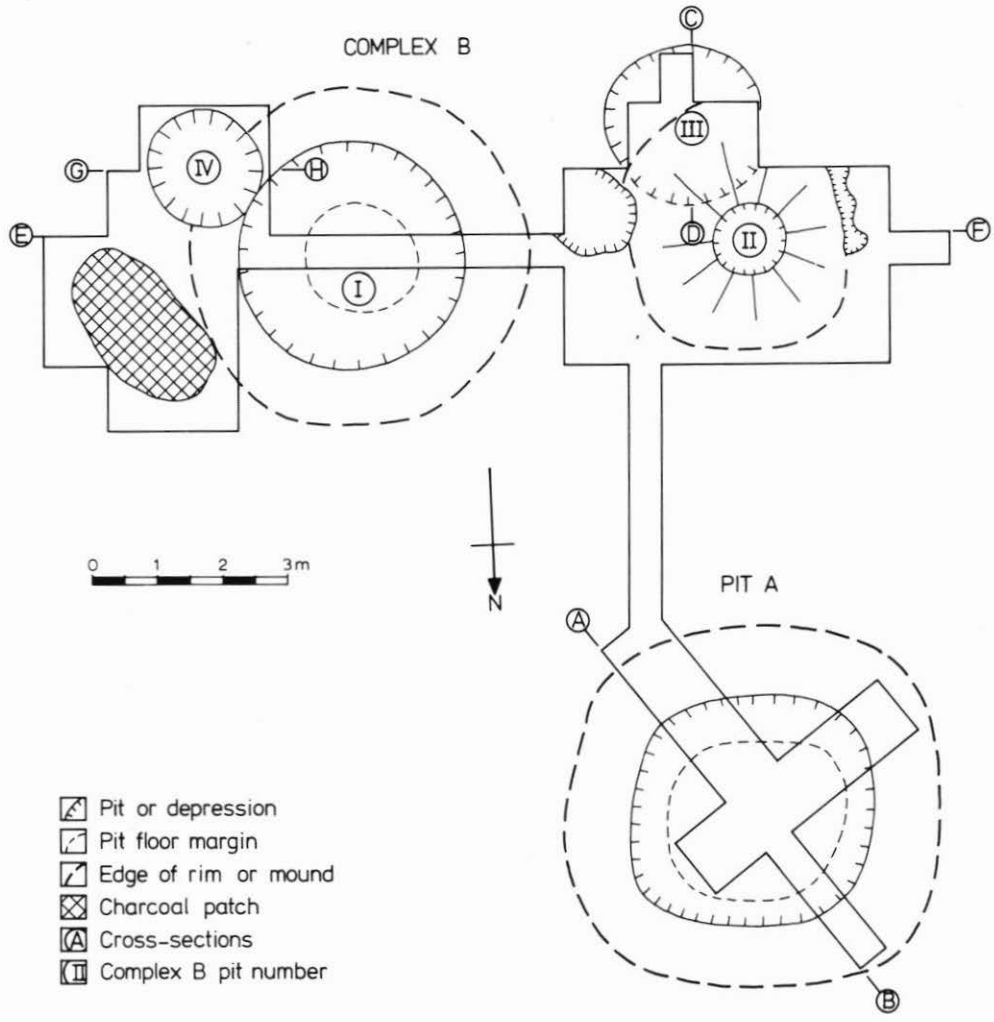

Figure 4: Pit A and Complex B. Note the location of cross-sections in Fig. 5.

The second excavation ("B") opened an area of 3.6 m × 2.7 m between two mounds and it disclosed an area of stone paving resting upon a brown cultural soil which overlay a grey natural horizon. Above the paving was loess and a modern topsoil. The excavation notes and a plate (Simmons 1967a, 1967b: plate facing p.17) indicate that the "gravel paved mound" was exposed but not excavated down to the natural horizon. Simmons thus assumed that the paving was *contiguous with* the mound. In fact, it continues *under* it (below).

From both excavations Simmons recovered charcoal, opal [? silcrete], jasperoid [porcellanite], greenstone and basalt flakes, as well as some fragments of dog [probably moa] and small bird bone. The Otago Museum collection from this investigation is listed in Table 2.

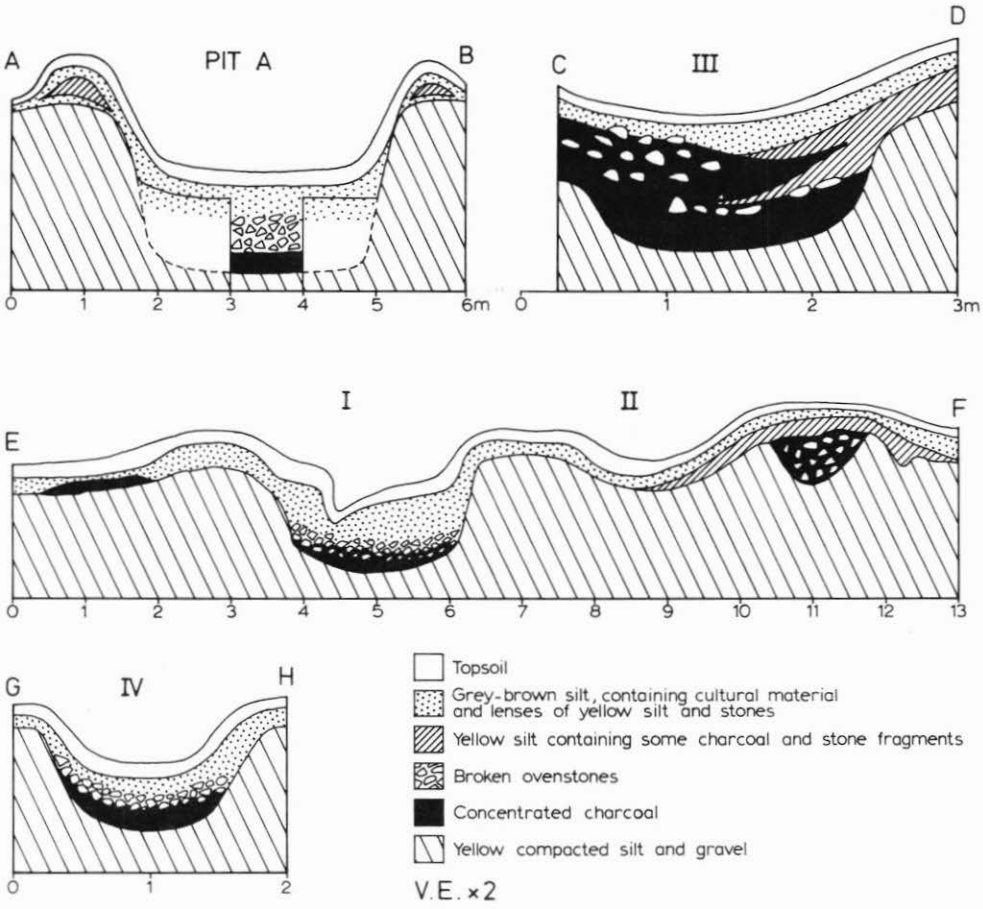

Figure 5: Cross-sections of features in Pit A and Complex B (see Fig. 4).

Simmons' first reaction to these results was to challenge the earlier views of Haines. He told Skinner (1967) that he (Simmons)

> ... went over the whole site ... and that there was certainly no moa bone there. He says the house with paved floor [apparently assuming that his paving in excavation B was a house floor and the same as that reported by Haines] was *late* Maori, contemporary with the introduction of the potato.

To these assertions, for which no evidence was provided, Simmons soon added others. Despite the very limited nature of the excavation he claimed that the site consisted of

> ... about twenty raised gravel or stone paved house mounds connected by paved pathways... [and that Haines' collection indicated] ... that it was a greenstone workers' village. The presence of raised half-house mounds, paved pathways and raised-rim pits make this site unique in New Zealand. (Simmons 1967b: 17)

Later he added further details. The "village" consisted of 20 houses (no longer "half-houses" whatever these were), each represented by a paved mound six feet by three feet by nine inches high (*c.* 2 m × 1 m × 0.23 m), and all connected by paved paths (Simmons 1969: 12, 1973: 175). The mound dimensions seem to recall Haines' comment about the size

TABLE 2

SIMMONS 1967 COLLECTION

NUMBER	ARTEFACT	PROVENANCE
D73.474	Porcellanite flake	Paved floor material
476	Silcrete flake	Paved floor material
477	Porcellanite flake	Paved floor material
482	Silcrete (2), Porcellanite (12) flakes	Paved floor material
483	Silcrete flake	
484	Porcellanite flakes (2), Moabone fragments (9)	Mound covering layer
485	Porcellanite flake	Paving area topsoil
486	Porcellanite flake	Paving area topsoil
488	Porcellanite flakes (4)	Topsoil
571	Porcellanite flakes (6) bone frags (3)	Mound, 2nd sq. top layer 3
572	Porcellanite flakes (6), Nephrite flake	M. Sq. paving stones
678	? Basalt flakes	Paved floor material

NOTE: Also quantities of gravel, ovenstone fragments, etc.

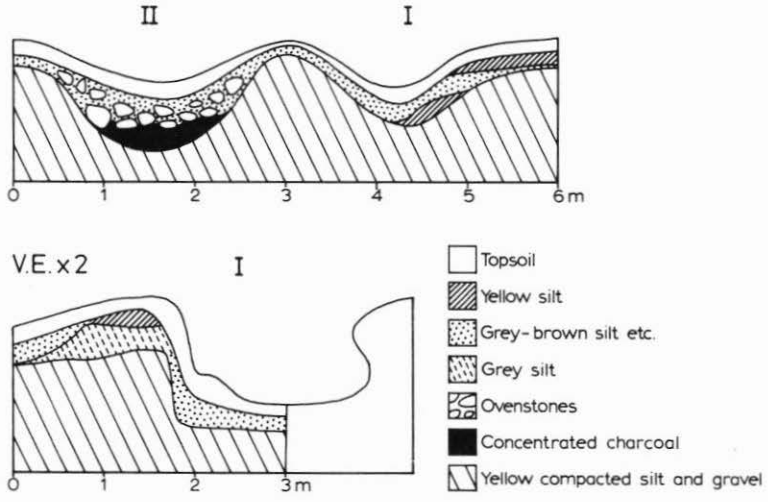

Figure 6: Cross-sections of features in Complex C(above) and pit I, Complex D(below)

of the paved area along the wall of the house he uncovered, rather than any measurements made by Simmons. Later again, he wrote that there was often a four-stone fireplace at one side of each mound, but off the paving, and that along the landward perimeter of the site was a partially destroyed ditch and bank feature, about 0.30 m in depth (Simmons 1980)

RITCHIE'S INVESTIGATIONS, 1975 AND 1980

In March 1975, Ritchie attempted a second sketch map of the site. It also accompanies the site record form and it shows: two raised-rim pits, fifteen other depressions or pits (of which seven are adjacent to mounds), ten mounds, two areas where there are large stones on the surface, and two low banks or elongated mounds.

In 1979 a large midden of southern oyster shell (*Ostrea lutaria*) was reported to be eroding along the river bank beside the site. In January 1980 Ritchie examined the area,

Figure 7: Features exposed by excavation of Complex D. The rectangle labelled "B" shows the approximate location of the Simmons (1967a) excavation B.

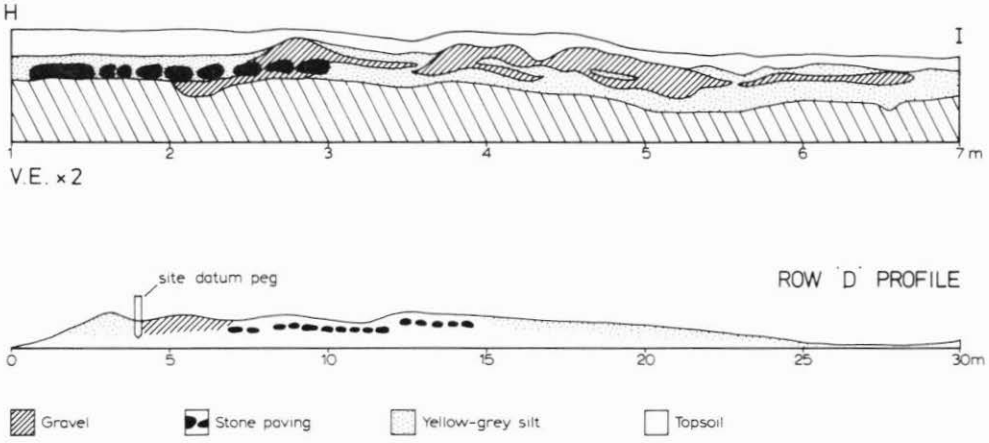

Figure 8: Cross-section of paving and gravel area in Complex D excavation and of probed row D outside the excavation. For locations see Fig. 9.

which had been freshly eroded by the river, and recovered one left (rounded) valve of this species. Later, in reviewing the sites of the Wakatipu region, Ritchie (1980: 251) suggested that the numerous pits might have been storage features, possibly for potatoes

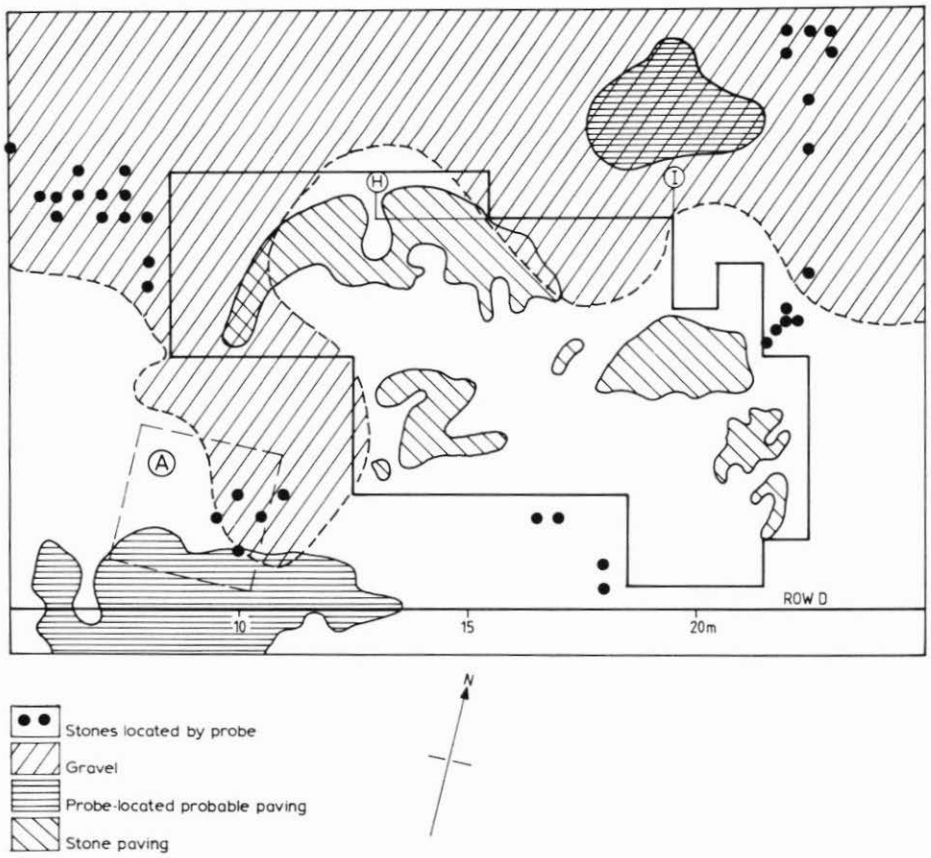

Figure 9: The relationship of features in, and near, the Complex D excavation. The rectangle labelled "A" shows the approximate location of the Simmons (1967a) excavation A.

(cf. Simmons, above). He also wrote that Haines had presented his material to the Otago Museum along with

> . . . a note and sketch indicating that the two "huts" in which he found many of the artefacts, were demarcated by low mounds of loess which had built up on three sides around the walls of the former structures. Both huts had fireplaces and one had a paved area (5.5 × 2.75 m) along one wall. (Ritchie 1980: 251)

This is confused. Simmons' (1967a) reference to Haines finding ". . . 2 huts with fireplaces one of which [sic] contained a paved area 6 × 3 along one wall" and Ritchie's imperfect recollection of the three-sided hearth sketched in the Otago Museum register (above) misled him into concluding that the dimensions were yards rather than feet and that the sketch was thus of mounds about a former house. There is of course, no reference by Haines to other than one hut.

Despite uncertainties about the data, exaggerated inferences and confusion over reportage, this earlier work managed to establish some useful facts about the type of structures to be expected in the site and the associated evidence of material culture. It was the

possibility that this had been, in fact, a greenstone working village of substantial houses associated with moa butchery, which persuaded us to undertake excavations in 1981.

THE 1981 EXCAVATIONS AND THEIR RESULTS

Since the ill-defined surface features of the site had proven so elusive in the past, and since we doubted the cultural status of some of them, we decided to forgo any attempt at a full plan and concentrate upon substantial area excavation. The two obvious areas to tackle were the complex of pits and mounds in the northeast quarter of the site and the area where paving had been located in the southwest quarter. There was a practical reason influencing this decision as well; the area between was largely under thickets of old, dense matagouri (*Discaria toumatou*), a fact of some significance in interpretation as well (below).

The site (Fig. 3) lies at the toe of a broad shingle fan formed by Stockyard Creek, which at present runs into the Dart River about 200 m to the north. There are old, deep, watercourses to each side of the site, and sections of shallower watercourses can be traced under the matagouri in the centre of the site. These latter features have gravel along the margins, and appear to be more recent channels than the deeper watercourses. There is reason to think, therefore, that fluvial events may have occurred during the span of occupation as well as before it.

STRATIGRAPHY AND STRUCTURES

Overlying the alluvial gravels is a thin layer of lightly weathered silt or loess, usually 7–15 cm thick (layer 3). Above it is a cultural layer, 10–30 cm thick, containing charcoal, burnt and shattered stone, other lithic materials and bone (layer 2). The cultural material is concentrated towards the bottom of the layer which is of variable colour although tending more often to a deeper brown in the area of Pit A and Complex B and to a lighter buff colour or yellow-grey in the area of Complex D (these differences may reflect weathering times). There are variations in this simple stratigraphy, largely as a result of pit construction. Thus pit rims often proved to contain blocks and lenses of the natural silt, and there were gravel lenses intermixed in the area of Complex D (below). The upper layer (layer 1) is a shallow topsoil of brown clay and silt or loess.

The Pit and Depression Features

Pit A (Figs 4 and 5) had been dug in a subrectangular shape about 1 m deep. At the base was a layer of dense, stone-free charcoal overlain by shattered ovenstones, mostly of schist. This material, the most common in ovens on the site, might seem an odd choice, given the availability of more durable stones amongst the schist in the Dart River but, as Gillies (1979: 49) observed, schist is not inferior in its heat acquisition or retention properties, only in its integrity. Provided it was only fired once it was not inferior to the less common but tougher materials which were available.

Complex B contained a variety of features. There is a large rimmed pit (I), and, cut on one side of it, a smaller pit (IV). To the north of these is a dense patch of charcoal; the remains of an open fire directly upon the silt floor (layer 3). The contents of the pits were the same as in pit A.

The western part of Complex B was more complicated. It consisted of a mound, into the top of which a small pit (II) had been cut, and another pit (III), cut partly into the side of the mound to the southeast. Although quite regular in shape the mound appears to be a natural feature. Pit II, at the top of it, is almost conical in shape and was filled with

shattered ovenstones and charcoal mixed together, amongst which were small fragments of heavily fired moa bone. Outside the pit, charcoal was pressed or mixed up to 5 cm deep into the surface of layer 3, and layer 2 contained abundant charcoal, and some porcellanite flakes and blade sections, along with small amounts of burnt moa bone.

Pit III has been used at least twice. The basal layer of charcoal was overlain by a single layer of ovenstones, then partly infilled by yellow loess or silt containing charcoal (cf. surface of layer 3 on the mound). Above was a layer of mixed charcoal and ovenstones containing fragments of burnt moa bone. Whether this represents a second cooking event, or is material raked out from pit II or, more probably from its distribution, from a pit in the unexcavated area to the south, was not determined (Figs 4 and 5).

Complex C contained two shallow pits side by side. Pit I had not been used and it was partly infilled by a thin lens of yellow sand overlain by gravel which has apparently come down the shallow watercourses in the centre of the site. Pit II contained charcoal overlain by shattered ovenstones as in pits I and IV of complex B, or pit A (Fig. 6).

On the southwest edge of Complex D was another pit with a slightly raised rim. This had been unused and it contained only a shallow layer of fill washed in from the sides (Fig. 6).

The Paving and Gravel Features

Several areas of stone paving were exposed in Complex D, as well as a number of other scatters of cobbles and slabs (Fig. 7). Schist is the most common rock represented and the paving stones are identical with material which can be picked out of the river today. Almost all the paving lies directly upon the compact silt "floor" (layer 3), which is here flat to gently undulating and slopes at about 3 to 5 degrees from west to east. In one place a slight depression in the floor was filled with gravel, whether deliberately or not is uncertain, before the paving was laid across it (Fig. 8). No other evidence of paving upon gravel or upon any artificially constructed feature was observed.

Systematic probing at 0.5 m intervals over the area surrounding the excavation defined further areas of probable paving, isolated stones and gravel (Fig. 9). So far as can be determined by this technique, the relationship of the paving to the gravel is the same as that noted above; that is, the gravel overlies the paving. The distribution of the gravel (Fig. 9) indicates that sheets and tongues of this material have been deposited over parts of the site in a way which has no apparent cultural significance. Certainly there is no evidence of separate gravel mounds or of gravel as paving on mounds constructed of other materials. A cross-section (Fig. 8) shows that the gravel is intermixed with the yellow-grey silt in a manner which indicates fluvial mixing and deposition. In addition, there is no indication of any cultural modification of the surface topography in the area where the gravel is laid; such mound and depression relief as exists appears to be natural.

THE LITHIC MATERIAL AND ARTEFACTS

Little more than 3 kg of artefactual stone (excluding oven and paving stones) was recovered during excavation (Table 3). Porcellanite (53 percent by weight, 69 percent by number of pieces), nephrite (12 percent, 12 percent), and silcrete (7 percent, 11 percent) are the main types, but amongst the miscellaneous category there is a considerable variety represented by a few pieces in each case: serpentine (1 piece), slate (2), siltstone or sandstone (3), greywacke (2), talc (2), talc schist (1), mica schist (3), quartz (6), indurated mudstone (1),

phyllite (1), chloritized mylonite (1), slickensided quartz vein (1), slickensided slate (1), aphanitic material, probably volcanic (9), and unidentified (7).

Amongst the porcellanite and silcrete there was little evidence of blade manufacture, although there are some examples and there is also evidence of platform preparation. Tools exhibiting systematic retouch are also rare; the only clear example is shown in Figure 10. Instead, this material had been finely fractured to produce numerous small flakes. The mean flake weight for porcellanite is only 1.0 g, and for silcrete it is 0.9 g. In so far as it is possible to tell by simple hand specimen inspection, most of these flakes (96 percent porcellanite, 98 percent silcrete), exhibited no unequivocal use-damage.

Most of the nephrite (95 percent) was also in small pieces (mean 1.4 g), and unworked beyond initial fracturing. Hand specimen analysis by Beck (pers. comm.) indicates that it is nearly all from the Routeburn source, although he comments that a few pieces are not so easily matched with Wakatipu district material. There are, however, none from the Dart (Slipstream) source. Leaving aside the uncertainty about a few fragments, and observing that some pieces have a water-rolled cortex, Beck concludes that all the material we recovered could have come from a single small cobble found in the Dart River.

The argillite (or meta-argillite as Mason (pers. comm.) prefers), is typical of Foveaux Strait and Western Southland (e.g., Mararoa) sources. It seems most likely that it all arrived on the site as finished adzes. In any event, a comparatively high proportion of pieces (33 percent) are from ground or polished implements.

The remaining material is probably all from the Dart River bed, where it had been transported from the complex Caples group of moderately metamorphosed materials containing some igneous lenses, which is drained by the Dart watershed (Mason, pers. comm.).

The lithic variety thus represents few sources. Further, there are some interesting omissions. There is no obsidian, a rare circumstance even although it is nowhere common in southern New Zealand sites. Also missing is any of the variety of cherts and chalcedonies which are common in most coastal sites, especially along the east coast of Otago.

Artefacts

The flake implements (Table 4), chosen only by inspection, have been sorted according to the predominance of one of three broad types of use-damage flake scars: step, scalar and crescentic (Keeley 1980: 24–25). These were distinguished from retouch scars on the grounds that the latter are usually larger (>3 mm according to Kooyman, pers. comm.), more regular, and often bifacially struck to produce a sinuous saw-toothed edge.

Several interesting points emerge from this unsophisticated analysis. Firstly, the use-damage is almost equally divided between a predominance of either unifacial scalar or crescentic patterns. Secondly, there is, as might be expected, a correlation between crescentic damage and low mean edge angle (13 degrees), on the one hand, and scalar damage and a higher mean edge angle (52 degrees), on the other, although there is also a good deal of overlap. Thirdly, tools with crescentic damage tend to be smaller (30 mm mean maximum length), than those with scalar damage (38 mm mean maximum length). Fourthly, crescentic edges are more uniformly convex (76 percent) than scalar used edges (44 percent).

These results indicate two broad types of flake implements. The first is a small, generally thin and sharp-edged flake upon which a convex edge has been used; most probably in a sawing or slicing fashion against resistant material, which has produced crescentic breakages (e.g., Keeley 1980: 36. But note that scraping or treading can produce similar

TABLE 3
CULTURALLY MODIFIED STONE

AREA + SQUARE	PORCEL-LANITE	SILCRETE	NEPHRITE	ARGIL-LITE	QUARTZ-ITE	MISCELL.	TOTAL
PIT A							
15			1				1
16	1						1
COMPLEX B							
54	1						1
56	1						1
66	3						3
73	1						1
74	1						1
75	1						1
76	1						1
84	1						1
85	3						3
86	1						1
COMPLEX C							
2	2						2
COMPLEX D							
E19		1					1
E20	3	1					4
E21	5	6					11
F19	20	2	1	1	1	3	28
F20	72	15	3	3	7	6	106
F21	190	29	11	4	7	2	243
F22	10	1				1	12
G13	1						1
G14	1						1
G15		1					1
G16	2					1	3
G18	17	2	1				20
G19	64	15	6	1		7	93
G20	261	33	9	3		2	308
G21	196	28	7	2		1	234
G22	84	9	7			2	102
H14	2						2
H17	2						2
H18	7	2	28			1	38
H19	37	5	47	1		1	91
H20	86	11	10	2		3	112
H21	49	5	2	4	1		61
H22	15	1	1	2		1	20
I14	2						2
I15	10						10
I16	9				1		10
I17	14						14
I18	10		14				24
I19	12	1	15	1			29
I20	9	1	1	1	1		13
I21	31	6	23	48	3		111
I22	20		1	10	2	1	34
J12	2						2
J13	2	1				1	4
J14	9	3	1				13
J15	86	5	4				95
J16	5						5

J17	23				1		24
J18	39	1	32				72
J19	2	1	1				4
J20	7	1	14				22
J21	5	4	8	2	5		24
K11	2						2
K12		4					4
K13	7	23					30
K14	9	1				1	11
K15	14		1				15
K16	39	2				2	43
K17	16	1	4				21
K18	2						2
K19	7	5	7				19
K21	7	4	10				21
L12		12					12
L15			1				1
L16	3			1			4
L17	1	2					3
L19		2	1				3
L21	1	1	5			5	12
M12	1						1
M14		4					4
M15	1						1
NO. PIECES	1536	253	276	86	29	41	2221
WEIGHT (g)							
PIT A and COMPLEX B	155	41					196
COMPLEX C	2						2
COMPLEX D	1663	229	399	187	72	680	3230
						TOTAL	3428

damage). The second is a somewhat larger, thicker flake in which a steeper edge has been used in a scraping mode against resistant material (e.g., Keeley 1980: 38).

The scarcity of step fracturing might indicate that wood rather than bone was being scraped (Keeley 1980: 44–45). It ought to be emphasised, however, that these results can only be regarded as a broad and tentative description of the flake implements. There remains a great deal of research still to do on the flake and blade industries of southern New Zealand before we will know the most appropriate analytical methods or how to assess the results. The only detailed and systematic functional research undertaken so far on such implements, from Central Otago moa hunting sites (Kooyman, pers. comm.), has shown that both microscopic flake scar, and use-polish, patterns indicate that woodworking was the principal function involved.

The stone pieces worked beyond the flaking stage, most of which are assumed to be adze fragments, are shown in Table 5. The argillite fragments belong to at least eight adzes, of which only one (Fig. 10) can be sufficiently reconstructed to show that it was a small (30 mm wide, 22 mm deep), quadrangular cross-sectioned adze, probably about 120 mm long and with some grip reduction (Duff (1956) 1A type). Face and side junction angles (the angle between two ground faces on a single piece) on other fragments indicate that most probably came from adzes of quadrangular cross-section as well. However, one piece appears to be from a large trapezoidally cross-sectioned adze where the front was much wider than the back (Table 5). These ground fragments were probably detached by use; in any event, where it is possible to tell there are no butt fragments. The damaged adzes may

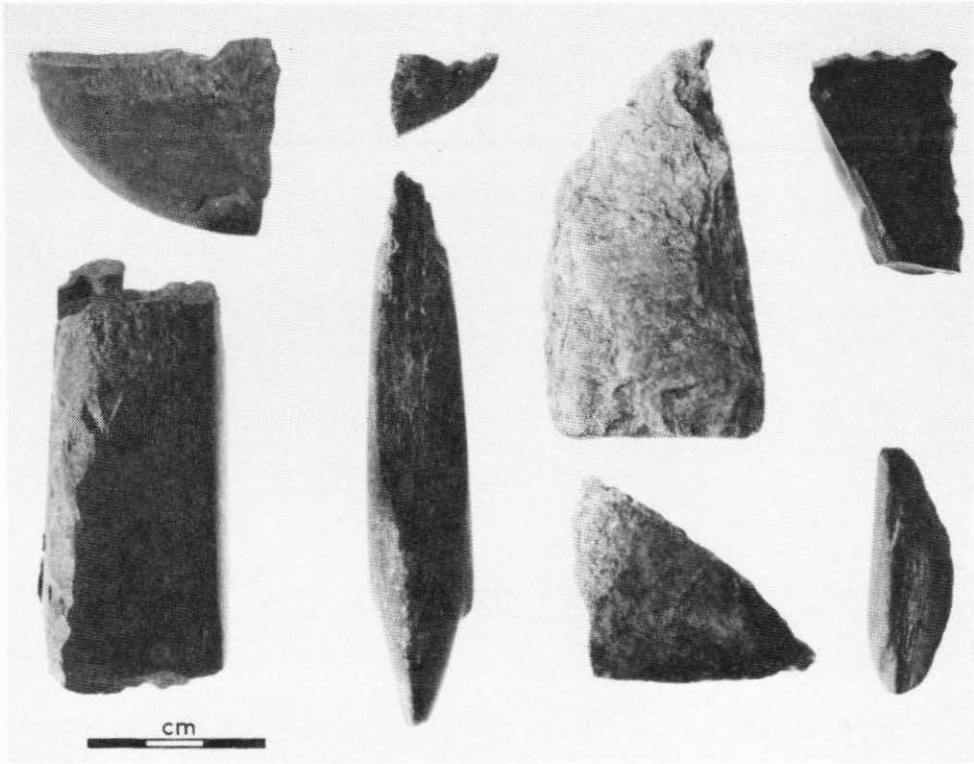

Figure 10: Artefacts recovered during the 1981 excavation at Dart Bridge. Above (left to right): two ulu fragments, a nephrite adze blank, porcellanite scraper with retouch on horizontal edge. Below (left to right): argillite adze section, unfinished minnow lure, nephrite adze blade, schist file.

have been re-sharpened on the site, but there are far too few argillite flakes to indicate any substantial re-shaping or any adze manufacture from cores or primary preforms.

The nephrite fragments (Table 5), indicate at least one preform and four finished adzes. Quadrangular cross-sections are predominant, but there may be one piece from a trapezoidally cross-sectioned adze. One thin, blade-like fragment and another where a cortex flake has been lightly ground around the edges, may represent some other implement types, possibly ulu. One piece, in which the bevel, side and part of the face have survived, shows it to have come from a fairly large (at least 38 mm wide), deep (60 degree bevel angle), quadrangular cross-sectioned adze which probably exceeded 200 mm in length.

It is likely that all the adzes were made on the site from material collected in the Dart River (above). However, there is a curious disparity between our material, consisting of fragments from finished adzes and small flakes, and the material in the Haines collection which is predominantly blanks. This might indicate that his site is, in fact, different from ours, or a different part of it. It is also worth noting that there is no evidence of rounded or circular cross-sectioned shapes or of *any manufacture by sawing*; both characteristic features of Classic Maori greenstone working.

Other stone artefacts recovered by excavation are shown in Table 6 (and some in Fig. 10).

TABLE 4
USED FLAKE IMPLEMENTS

SQUARE	LAYER	MATERIAL	MAX. LENGTH	PREDOMINANT EDGE DAMAGE	USED EDGE	USED EDGE ANGLE SHAPE ± 5 degrees
PIT A						
{15	2	Silcrete	35	Unifacial scalar	10	convex
{15	2	"	35	Crescentic	10	straight
COMPLEX B						
54	1	Porcellanite	38	Unifacial step	90	convex
66	3	"	24	Unifacial scalar	80	concave
76	2	"	39	" "	60	straight
COMPLEX D						
E21	2	Silcrete	33	" "	80	convex
F20	1	"	27	Crescentic	10	"
F20	1	Porcellanite	22	"	15	"
F20	1	"	23	"	10	"
F21	1	"	24	Unifacial scalar	35	straight
F21	1	"	32	" "	80	convex
F21	2	"	44	" "	30	concave
F21	2	"	46	" "	70	straight
G16	2	"	49	Crescentic	20	convex
G18	1	"	24	"	10	"
G18	1	"	23	Unifacial scalar	10	"
G18	1	"	43	" "	55	straight
G18	1	"	48	" "	20	convex
G19	1	Silcrete	40	" "	40	concave
G19	1	Porcellanite	39	Crescentic	10	convex
G19	1	"	20	"	10	"
G19	1	"	25	"	10	"
G20	1	"	41	Unifacial scalar	60	"
G20	1	"	25	" "	15	concave
G20	1	"	29	Crescentic	15	straight
G20	1	"	24	"	10	convex
{G20	1	"	22	"	20	straight
{G20	1	"	22	Unifacial scalar	35	concave
G20	2	"	31	Crescentic	10	convex
G20	2	"	33	Unifacial Scalar	40	"
G20	2	"	28	Crescentic	10	"
G21	1	"	25	"	10	"
G21	1	Porcellanite	29	"	15	"
G21	1	"	26	"	10	"
G21	1	"	24	"	20	"
{G21	2	"	52	Unifacial scalar	25	straight
{G21	2	"	52	Crescentic	15	concave
G21	2	"	32	Unifacial scalar	75	straight
G22	1	"	23	" "	65	"
G22	1	"	40	" "	40	"
G22	1	"	29	Crescentic	10	"
G22	1	"	23	"	10	convex
G22	2	"	29	"	15	"
H18	2	"	45	Unifacial scalar	40	"
H18	2	"	32	" "	60	"
H19	2	"	54	" "	70	"
H19	2	"	62	Crescentic	25	"
H20	2	"	27	Unifacial scalar	35	concave
H20	2	Silcrete	32	" "	70	convex
H21	1	Porcellanite	27	" "	40	"
I17	2	"	49	" "	80	"

{J14	1	Silcrete	55	" "	60	concave
{J14	1	"	55	Crescentic	10	straight
J15	2	Porcellanite	48	Unifacial scar	30	convex
J17	2	"	23	Crescentic	10	"
J17	2	"	27	"	10	"
J18	2	"	30	Unifacial scalar	65	straight
J21	2	"	29	Crescentic	15	convex
K16	2	"	29	Unifacial scalar	30	"
K16	2	"	25	Crescentic	25	"
K17	1	"	45	Unifacial scalar	80	straight
K19	2	"	28	Crescentic	10	convex

Note: { = same artefact, different edges

FAUNAL REMAINS

A further examination of the river bank beside the site resulted in the recovery of another section of southern oyster shell (right valve) from approximately 0.8 m above the river bed and 0.3 m deep in the silt bank. These finds, and the earlier reported oyster shell midden are as mysterious as ever. The situation is compounded by the fact that the Haines collection contains eight perforated oyster shells, one from Camp Hill, about 10 km from Dart Bridge (D44.379) and seven others which are unlocalised but most probably from the same site, or at least this district (D44.380–86). They are all right valves (i.e., flat) and the holes have been roughly punched rather than drilled. Oyster shells are rare in coastal middens, almost unheard of in inland sites, and exist nowhere else as pre-European inland shell middens so far as we know. Perforated oyster shells are also a rare artefact type in any context.[1]

All the bone recovered from Complex B was from moa (49 fragments weighing 68 g). It was heavily burnt and concentrated about the slopes of the mound into which pit II was cut. There were also several fragments of moa bone in the fill of pits I and IV and 21 fragments in the upper fill of pit III. The moa cooking pit (II) is thus later than the other three, although possibly by only an insignificant lapse of time. Two moa individuals are represented: one by a distal fragment of the left tibio-tarsus of a small moa (probably *Anomalopteryx didiformis*, but possibly *Megalapteryx didinus*); the other is a medium-sized moa, probably *Euryapteryx gravis*, which is also represented by a distal left tibio-tarsal shaft fragment (Scarlett, pers. comm.).

There was more moa bone recovered from Complex D (463 fragments weighing 385 g), but no species were able to be identified. There was also some small bird bone (26 g), from which the following identifications were made: from square F21 a distal right tarso-metatarsus of Southern Crested Grebe (*Podiceps cristatus australis*; from the same square a phalanx, probably from the South Island Kaka (*Nestor meridionalis meridionalis*); and from square G21 a distal left tibio-tarsal fragment from Tui (*Prosthemadera novaeseelandiae*).

Apart from some rabbit bone, no mammal bone was recovered.

CHRONOLOGY

There is some doubt about the provenance of the radiocarbon dates reported by Simmons. They are published as dating "Mound B", which seems to refer to the preceding sentence; "Mound sectioned and connecting pathway cleared down" (Simmons 1973: 175) and which would tie them to excavation B (Simmons 1967a and Fig. 7 above), *the paved*

TABLE 5

WORKED STONE FRAGMENTS

A. ARGILLITE

SQUARE	LAYER	PROBABLE LOCATION ON ADZE	FINISH	JUNCTION ANGLE (degrees)	PROBABLE ADZE CROSS-SECTION	PIECES OF SAME ADZE
E19	2	bevel	ground			
E21	2	bevel & side	ground	90	quadrangular	
E21	2	face	ground			
F20	2	bevel	ground			
F20	2	face & side	ground	90	quadrangular	
F20	1	mid-section	ground	80–100	quadrangular	A (Fig. 10)
F21	2	face & side	hammered	90	quadrangular	
F21	1	face	ground			
F21	1	face	ground			
F21	1	face	ground			
F22	1	face	ground			
F22	2	bevel & side	ground	30–40	trapezoidal	
G20	1	face	hammered			
G20	2	face	hammered			
G20	1	face & side	ground	90	quadrangular	A
G21	1	face & side	ground	90	quadrangular	A
G21	1	face	ground			
H19	2	face & side	ground	90	quadrangular	
H19	2	face	ground			
I15	2	face	ground			
I18	2	face	ground			
I21	2	face	hammered			B
I21	2	face	hammered			B
I21	2	face & side	ground	80	quadrangular	B
J21	2	bevel	ground			
K16	1	face & side	ground	90	quadrangular	
L16	3	face	ground			B
L17	2	face & side	ground	80	quadrangular	

B. NEPHRITE

G19	1	bevel	ground			
G19	1	bevel & side	ground	40	trapezoidal	
G20	1	face & side	ground	90	quadrangular	
G20	1	face, side & bevel	ground	90	quadrangular	
G22	1	preform	ground		quadrangular	
H20	2	thin (3 mm) blade	ground			
H20	2	face	ground			
I19	2	face	ground			
I20	2	convex	ground			
J15	2	face	ground			
J20	2	face & side	ground	90	quadrangular	
K17	1	face	ground			
K21	1	face	ground			
K21	1	face & side	ground	100	quadrangular	
L21	1	bevel	ground			

TABLE 6

ADDITIONAL STONE ARTEFACTS

AREA & SQUARE	LAYER	MATERIAL	DESCRIPTION
F19	2	Serpentine	Unfinished, finned minnow lure shank (Fig. 10).
F19	2	Schist	?File. Stick 55 mm × 22 mm, hollow-ground on one face.
F20	1	Schist	?Hammer. Stick 100 mm × 35 mm. Crushing along one edge.
F20	1	Schistose slate	?Hammer. Flat pebble 70 mm × 50 mm. slight flaking damage around one edge.
F20	1	Schistose slate	?Cutter. Subcircular spall, 55 mm diameter. Slight flaking damage on edge.
F20	2	Siltstone	Ulu fragment (Fig. 10).
G16	2	Greywacke	?Cutter. 95 mm × 60 mm spall. Slight flaking damage on one edge.
G20	2	Schist	?File. Pebble, 56 mm × 21 mm, showing slight wear.
G22	2	Greywacke	?File. Pebble, 53 mm × 15 mm. Wear on one edge.
H22	2	Schist	File. Grooved schist pebble 40 mm × 12 mm.
I19	2	?Slate	Ulu. Edge fragment.

area. Simmons (1967a) refers to charcoal for dating being collected from under the paving and from among the stones in a mound.

However, Simmons (1980) later wrote that the dates are from the mound in excavation A (Fig. 9) where,

> there was a fire on top of the mound sealed by the soil horizon, charcoal of which gave a radiocarbon date of A.D. 1518 ± 60. The base of the artificial construction was resting on a soil horizon which contained a lot of charcoal. This was collected and gave a date of about 300 B.C. . . . [correct dates below].

There is no reference in the excavation notes (Simmons 1967a) to a fire on the top of the mound in excavation A, or to a charcoal layer underneath it, but in the absence of alternative evidence we must accept the later and more detailed explanation. The two dates, now attributed to excavation A, were:

R1982/5 1980 ± 177 (30 B.C.) Beneath the mound
R1982/6 438 ± 79 (A.D. 1512) Top of the mound

Both are Old T1/2, uncorrected estimates (Leach, pers. comm.).

Our radiocarbon dates are shown in Table 7. The first three, all on predominantly short life span material, were samples from the dense charcoal layer at the bottom of each of the pits represented. The NZ 5323 date was from a patch of charcoal and stone lying on the west rim of pit I, Complex D. Since there was no charcoal in the pit, this patch may have only a coincidental association with it. The date may be regarded as an estimate of the age of the cultural layer in Complex D. In this it is remarkably similar to R1982/6, assuming that to be correctly provenanced to excavation A. If, however, it is actually from excavation B, it could be from the same concentration of charcoal (Fig. 7), our "hearth" of NZ 5327, which gave a post-bomb result estimated at A.D. 1959 to 1961! This result was not totally unexpected since there was some tin foil in the turf on top of the charcoal. The

TABLE 7

RADIOCARBON DATES

NUMBER	FEATURE	UNCORRECTED OLD T1/2	CORRECTED NEW T1/2	MATERIAL DATED
NZ 5323	Complex C Pit II	337 ± 56	442 ± 58	*Sophora* sp. (small stem), *Nothofagus* sp. (larger stem)
NZ 5324	Complex B Pit IV	587 ± 57	615 ± 58	*Coprosma* sp. (all short life span stems)
NZ 5325	Pit A	723 ± 57	714 ± 59	*Coprosma* sp. (small stems) dominant. *Sophora* sp. (small stems) sub-dominant
NZ 5326	Complex D Pit I	442 ± 42	470 ± 43	*Nothofagus* sp. (largish stems) dominant. *Hebe* sp. (small stems) minor
NZ 5327	Complex D "hearth"	Post-Bomb	Post-Bomb	*Leptospermum scoparium* (short life span) dominant. *Northofagus* sp. minor

sample was submitted because we could not rule out the possibility that the tin foil was simply a chance discard upon an ancient fireplace, and because we had no other material for dating from the paved area.

Overall it seems most likely that there are two periods of occupation represented at Dart Bridge. The earlier, dating to about A.D. 1250–1350, is represented by the pits and associated features of Pit A and Complex B. The later, dating to about A.D. 1500–1650, is represented by the shallow pits of Complex C and the paving and associated features of Complex D.

INTERPRETATION

There are three types of pits on the site. The first type is rimmed, cut 0.5 m or deeper into the natural, has more or less vertical walls, a shallow dish-shaped floor and is 3 m or more in diameter (Pit A; Pit I, Complex B; Pit I, Complex D). The second type is similar but smaller (*c.* 2 m in diameter), shallower, and cut in a bowl shape (Pit IV, Complex B; Pits I and II, Complex C). Both of these types, where they show evidence of use, have the same contents: a dense layer of charcoal overlain by shattered ovenstones, largely charcoal-free. The size, shape and contents of these types conform with *umu-ti* or ovens for cooking the root of the cabbage tree (*Cordyline australis*) (Fankhauser, pers. comm.).

The third pit type, represented by Pit II, Complex B, is a small (1 m in diameter), deep structure filled with mixed charcoal, shattered stone and burnt bone fragments. It is typical of *umu-moa* (to coin a term), from throughout Central Otago (e.g., Anderson 1979).

Pit III, Complex B, is rather odd, but is probably an example of the second type which has been used once as an *umu-ti* and subsequently partly filled with debris from Pit II and another pit to the south. The shallower pits of this second type may be more common on the site than appears from the excavations. Several test pits of shallow depressions near Complex C disclosed shattered stone and charcoal, although others did not. Thus while at least some of the subtle mound and depression topography on the site is undoubtedly cultural and, on our evidence, connected with *umu-ti*, some is more probably natural. Only extensive area excavations would clearly resolve the degree of cultural activity represented in the topography.

The gravel sheets overlying the silt surface in the western part of the site, and especially northwest of Complex D, add a further complication to this issue. The plan and

stratigraphic character of the gravel clearly indicate a natural origin. Since some paving is partially covered by gravel, and there appear to be areas of paving totally covered by it, we suggest that the western part of the site, which is the downslope end, has been flooded by fast-moving water at some stage during the span of occupation. Since such an event would wash away anything such as bone, small flakes, etc., except where these were trapped by paving, it follows that the evidence of this kind concentrated in the eastern part of Complex D must *post-date* any vigorous fluvial activity.

That evidence is, in fact, much the most interesting on the site. As Figure 11 shows, the major categories of cultural materials are very strongly concentrated into a small area several metres to the south of the eastern patch of paving. Figure 12 shows that the artefactual remains have the same pattern of distribution. In addition, the fact that the bone was all burnt, and was clearly associated with nearly all the instances of burnt silcrete, raises the strong probability that a fireplace of some kind once existed within squares F20, 21; G20, 21, and particularly G20 (Fig. 12).

A fireplace, although not, we admit, a hearth, unless it was that vaguely circular stone structure in square G21; a concentration of domestic artefacts such as ulu, small adzes, used flake tools, files and red ochre; and a stone paving area to the north with an indistinct curving line of slabs bounding the concentration of cultural material to the east, add up to a plausible case for a dwelling of some kind. Of the various potential alternatives, the southern round hut or *whare porotaka* is, perhaps, the most likely (see further evidence in Anderson in press).

However, no such explanation can be reasonably advanced in the case of the other patches of excavated paving. The reason may lie in the impact of fluvial action as suggested above, but it could also be the case that different patches of paving served different ends. Although it is somewhat far-fetched, the rather symmetrically double-curved paving in the western part of Complex D could be an art work. There are a few other instances where possible art forms have been created upon river terraces by the placing of stones and gravel; the effect of which is largely appreciated by climbing to higher ground nearby. One such was near Lake Pukaki (Trotter 1969) and there were said to be others in the vicinity. Another was in Hawkes Bay (Colenso 1878: 85).[2] This possibility aside we are on safer ground in arguing that the feature is not, at least, a pathway since it does not connect any known cultural features. The same is true of the other paved areas covered by excavation.

Turning to the view that Dart Bridge was a greenstone working settlement, we note that only a small quantity of nephrite was recovered, although Haines may have found more substantial amounts somewhere on or near the site. But quantity is, in any case, difficult to assess since nephrite worked to a certain stage, if not rough blanks, was probably removed from the site each time its occupants moved on. All we can say is that there is little evidence of actual working, in the form of small flakes and chips, there is nothing to suggest any quarrying of sources or other systematic acquisition of material, and the site was clearly occupied for other reasons (Pit A and Complex B) long before any greenstone working took place there. When it did occur it seems to have involved only rudimentary "smash and bash" techniques to reduce a few cobbles to roughly adze-shaped blanks which were then laboriously ground into shape. Since sawing as a technique, and probably nephrite sawing, although it is difficult to document the point, were probably well established elsewhere by the sixteenth or seventeenth centuries, the Complex D situation appears anachronistic. Could it be a local manifestation of some southern preference for flaking over sawing analogous to similar preferences in the manufacture of one-piece

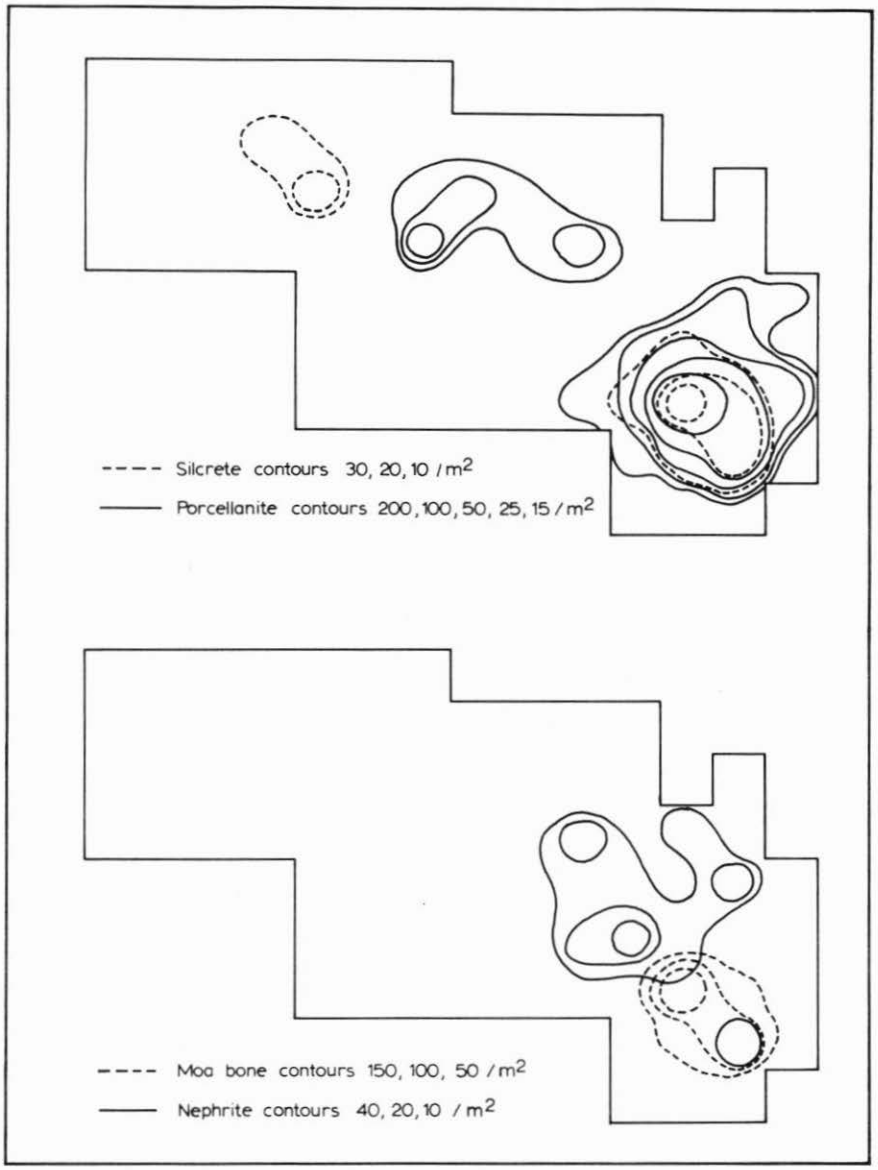

Figure 11: The concentrations of cultural lithic remains and moabone in Complex D. The figures refer to numbers of pieces.

bone hooks (Hjarno 1967: 31), or is it that the material is so "fibrous" and inferior that a conservative technique like sawing was judged unnecessary? Whatever the case, Dart Bridge was not in the quantity of nephrite remains or the workmanship evident on them, comparable to the greenstone working centres of the east coast.

Figure 12: The distribution of artefactual remains in the eastern half of Complex D.

It was not the local nephrite, in our view, that was mainly responsible for bringing people to the Dart Valley during the Archaic phase (pre A.D. 1650) but rather a direct routeway from Central Southland, along Lake Wakatipu, up the Dart to the Harris Saddle from the Routeburn into the Hollyford Valley, and thence to the West Coast or Fiords (Beattie (1945: 66) provides a list of Maori names relating to this route). The particular locational

advantage of Dart Bridge was, we suggest, that it is at a point along this track where the *ti* was especially plentiful as it is today, upon the river banks and islands close to the site. *Ti*, and to a small extent, other forest-edge resources such as moa were important attractions in the otherwise food-scarce environment of the beech forest and their utilisation is what the archaeology of the site largely attests.

It seems likely that further excavation would reveal a number of probably short-term occupations sustained primarily by the cooking of *ti* but during which fowling and the occasional working of nephrite cobbles were subsidiary activities. Within our data we may have, in fact, five occupations represented; in chronological order: Pit A, Complex B, Complex D (pre-flooding), Complex D (post flooding) and Complex C. As to where the people generally came from, the evidence of the Southland argillite and the lack of east Otago lithic remains tend to favour Foveaux Strait (we leave aside the oyster shell). Ethnographic evidence, particularly that associated with the Ngatitama Raid in 1836 (Anderson and Ross n.d.), also shows that Foveaux Strait was the point of origin for most foraging parties in the interior of Otago and Southland.

CONCLUSIONS

In regard to the interpretations offered by Simmons we could find:

(i) No evidence of deliberately fashioned mounds, with or without associated depressions. On the contrary, the gravel sheets uncovered in our excavations appeared entirely natural in character.

(ii) No evidence of deliberate stone placement at the corners of mounds, depressions or any other features natural or cultural, and no evidence of mounds paved by slabs or gravel.

(iii) No evidence that any mounds or any other features of the relief had been used as dwellings.

(iv) No evidence that the areas of paving connected any other structural features or that they had been used as a network of paths, and:

(v) Little evidence to support the view that this was a settlement devoted largely to the working of nephrite.

Instead, our findings are that Dart Bridge was a repeatedly settled location throughout the Archaic phase at which the cooking of *ti* was a major function, and to which the exploitation of other forest edge resources, such as moa, and of nephrite cobbles found in the nearby river, were subsidiary activities. We suggest that the site may have generally operated as a transit camp for travellers passing between the western coast and the interior by way of the Routeburn.

There are data indicative of a dwelling associated with slab paving in one part of the site and also paving which has no readily explicable function. The archaeology of the site is complicated by evidence, in the form of gravel sheets, of vigorous fluvial action across the western area between two periods of occupation.

ACKNOWLEDGEMENTS

We wish to thank Mr Russell Hamilton (Routeburn Station), and the Huirapa Maori Committee for permission to excavate the site. Mr John Stevenson was most hospitable in

allowing us to stay at the Dart Valley homestead. For specialist assistance we thank the following: Mr Russell Beck (nephrite identification) of Southland Museum; Mr Brian Kooyman (edge-damage advice); Dr Foss Leach (advice on radiocarbon dates), Mr Graeme Mason (lithic sourcing and shell identification), Mr Barry Fankhauser (*ti* cooking) and Mr Rick McGovern-Wilson (small bird bone identification), all from Otago University; and Mr Ron Scarlett (moa bone identification) from Canterbury Museum. We also acknowledge the assistance of Ms Wendy Harsant (Otago Museum), and Mr David Simmons (Auckland Museum) whose earlier work, although we disagree with aspects of it, was instrumental in bringing the site and its potential to our notice. We also thank Martin Fisher, Richard Newell and Lynn Marsh for the illustrations and typing.

NOTES

1. Since some of the nephrite blanks in the Haines collection exhibit evidence of modern damage, including at least one instance of recent grinding (D19.235), the possibility that some of the oyster perforations are also modern cannot be ruled out; nor can the possibility that the several examples of large smoothed holes are actually natural.

2. Colenso's (1878: 85–6) description of the Hawkes Bay example is worth quoting in full:

> I have also more than once seen another curious spot in this neighbourhood (Hawke Bay), which deserves recording, the more so, perhaps, from the fact of its being no longer to be seen as I saw it. It was on the low undulating grassy banks of the river Waitio. There, at that time, was a huge earthwork representation of a *ngarara*, or *ika*, *i.e.*, a lizard, or crocodile, which, several generations back, had been cut and dug and formed in the ground by a chief of that time named Rangitauira, who, in doing so, had also dexterously availed himself of the low alluvial undulations in the earth. It had the rude appearance of a huge Saurian extended, with its four legs and claws and tail, but crooked, not straight, as if to represent it wriggling or living, and not dead. It was many yards in length, and of corresponding thickness, and by no means badly executed.

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Received 4 September 1985