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A.J. Anderson

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A fourteenth-century fishing camp at Purakanui Inlet, Otago

A. J. Anderson*

Excavations at site S164/18, Purakanui, disclosed a concentrated midden which is dated to the later fourteenth century. This site was occupied on three occasions, but an analysis of the shellfish exploitation patterns, together with the extent and density of the shell midden, suggests that all occupations occurred within the space of a few years. Faunal and artefactual analyses indicate that the main function of the settlement was open-sea fishing for red cod and barracouta in particular. This is the first specialised fishing site of the Archaic period which has been reported in Otago, and its existence reinforces other evidence of functional variation in the settlement patterns of that time.

INTRODUCTION

Purakanui Inlet is one of five bays along the northern edge of the Otago Peninsula volcanic massif. Like the others — Kaikai's Beach, Murdering Beach, Long Beach and Warrington — it proved to be a rich source of artefacts for 19th century fossickers. One of them, Alfred Reynolds, recalled that "The first collectors in the field simply walked down from Dunedin to Purakanui and the other old Maori settlements and found various good specimens of native ingenuity exposed to view by the action of the northwest and southwest winds" (Renata, 1892a). Amongst the pieces he and his contemporaries recovered from Purakanui were numerous beads, *hei-tiki*, hoop-iron, flintlocks, parts of muskets and drilled shark teeth (Renata, 1892a, 1892b).

The heterogeneity of these finds is reflected in the Otago Museum assemblage of artefacts ascribed to Purakanui. Amongst it are several Archaic adzes (Duff (1956) types 1A and 4A), a moa bone adze (D46.554), 41 nephrite adzes and gouges, some 20 nephrite pendants including three magnificent examples of the bird-shaped form (Skinner, 1974:57), four *patu* fragments, 200 *Dentalium* sp. beads (Simmons, 1973: table 12), three bone flutes, a harpoon point or pendant (Skinner, 1974: 75) decorated with notching, fragments of clay tobacco pipes, and approximately 120 whole and broken fish hooks.

The task of evaluating this and similar collections from the northern beaches represents one of the more pressing and potentially instructive challenges of Otago archaeology, but it must await the formulation of a stratigraphically based chronology, on the one hand, and a deeper understanding of local differences in settlement functions, on the other. Research towards these ends has recently been undertaken at Long Beach (Hamel and Leach, 1977; Leach and Hamel, n.d.) and Purakanui. The excavations at the latter site (S164/18) are the subject of this paper.

STRATIGRAPHY AND SETTLEMENT HISTORY OF S164/18

The western shore of the channel to Purakanui Inlet has a complex stratigraphic history. In the southern part of the site (marked in black on Fig. 1), cobbles and beach-

* Anthropology Department, University of Otago, Box 56, Dunedin, New Zealand.

rolled boulders form a basal layer of unknown depth, which is exposed in section up to 30 cm above mean high tide. This feature can be traced for at least 150 m westward along the southern edge of the dunes and it may, in fact, be the distal end of a boulder bar upon which the original dune systems at Purakanui have developed. Exposed in front of the site on the intertidal area which has eroded since 1863 A.D. (Fig. 1) are patches of boulders littered with a variety of cultural debris including moa bone (a pelvis of *Anomalopteryx* or *Emeus*), *Diomedea* sp. bone, stone flakes, adzes, bottle glass, crockery, pieces of clay tobacco pipes and corroded iron.

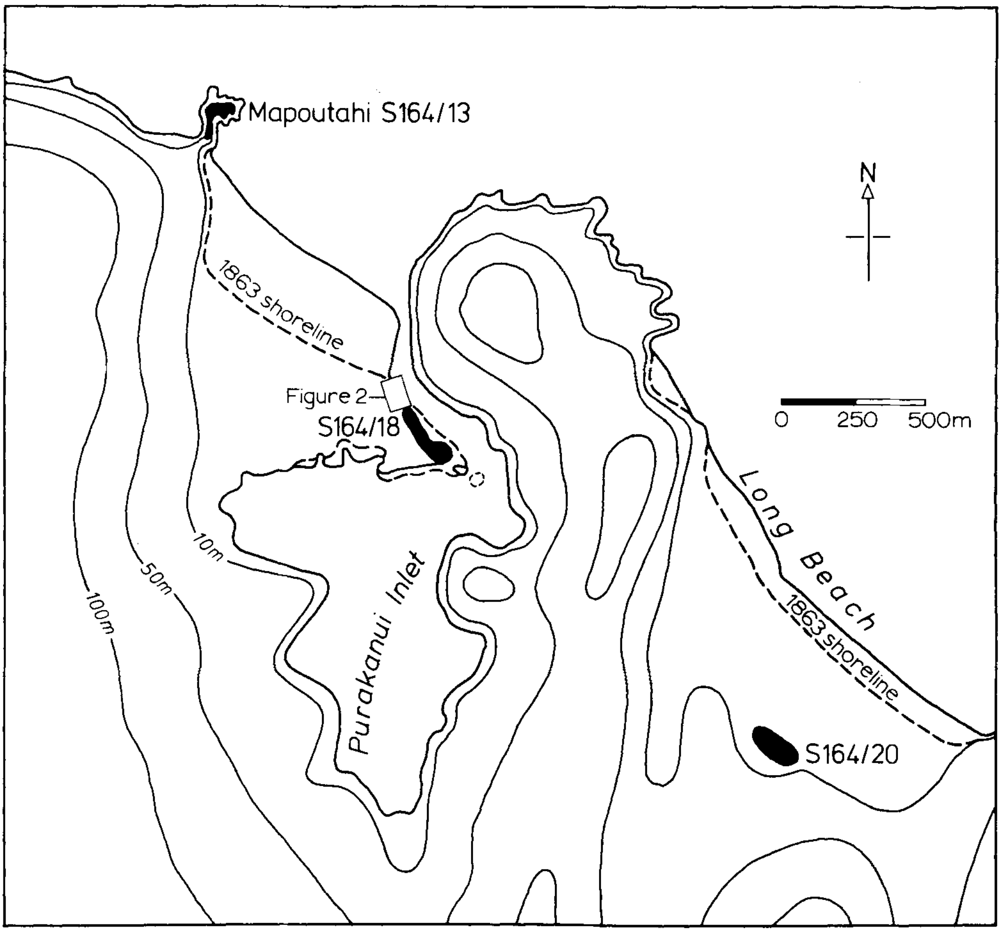

Fig. 1 — Location of S164/18 and adjacent sites on the Otago coast.

On top of the boulder beach is an old dune system, aligned ENE-WSW, which rises to 5 m above mean high tide below the northern part of the site. To the south it slopes down to an undulating surface 1-2 m high along the channel edge. In the dune section of this southern area are numerous patches of midden, blackened sand and ovenstones, some of which lie directly on top of the boulder beach. In addition to abundant shell (cockle, *Chione stutchburyi* in the main) and fish bone (particularly barracouta, *Leionura atun dentatus*), the middens contain a range of cultural material similar to that deposited on the intertidal area immediately in front of them.

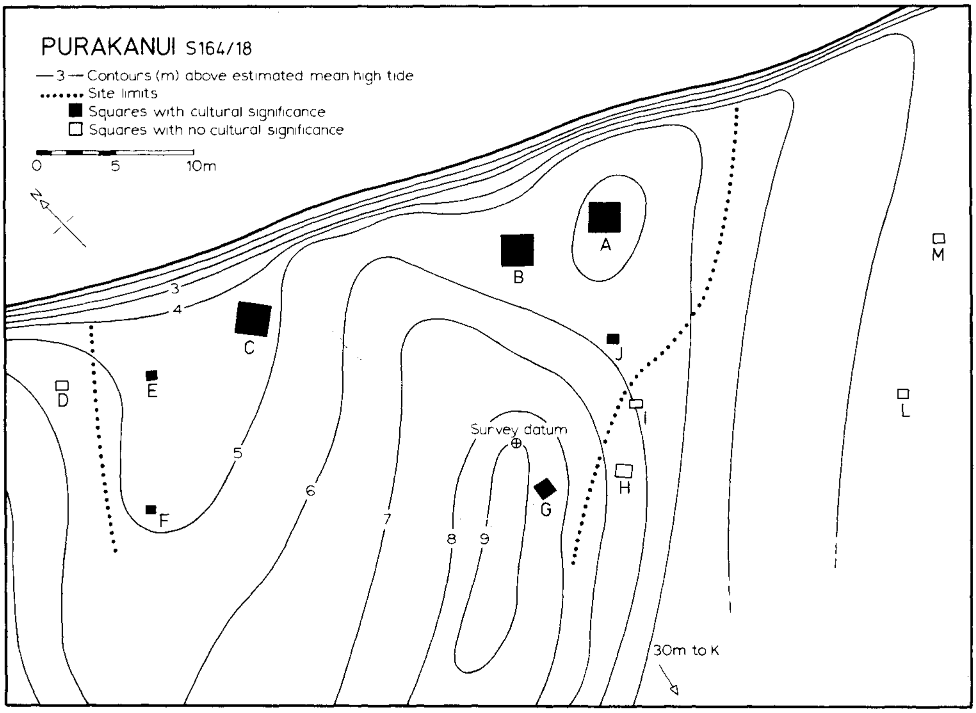

Fig. 2 — Plan of S164/18, northern area, showing excavated squares (A-C) and test pits (D-M).

The northern part of the site (Fig. 2), is stratigraphically unconnected to the southern area. It is exposed in the channel section as a 43 m long band of cultural material up to 1.5 m thick (Fig. 3). North of it again are three small, isolated lenses of shell midden lying in a similar stratigraphic position. The northernmost of these, 20 m from excavation C, marks the seaward extent of the crests of the old dune system, and of occupational evidence. Beyond it the dunes are post-1863 A.D. (Fig. 1, Block IV, North Harbour and Blueskin Map, June 1863). Sand of this later period has blown back over the northern part of the site, where it is up to 2 m deep at the channel section and reaches 4 m or more at the modern dune crest southwest of excavation B (Fig. 2).

The relationships between the cultural layers and lenses in S164/18, especially in the southern part of the site, are undoubtedly complex and representative of a lengthy settlement history. Both Archaic and Classic phase occupation can be inferred, and the latter was probably connected with the *paa* site at Mapoutahi (Fig. 1) which has been investigated on several occasions (summarised in Anderson and Sutton, 1973) and is traditionally linked with the southward migration of the Ngai Tahu people. From the 1820's the locality of S164/18, probably the southern area, was settled by families from a number of Ngai Tahu *hapu* (MacKay, 1873: 249, A.J.H.R., 1886). This village, which was visited by Watkins (n.d.), and Shortland (1851: 120), amongst others, was the main Maori settlement of the northern beaches throughout the mid-19th century (Bathgate, 1969). For a time, in the 1830's, the Weller brothers maintained a small whaling station at it or nearby, and the village remained occupied until approximately 1875 (Renata, 1894).

EXCAVATIONS AND RADIOCARBON DATING

In 1978 the channel edge of the northern part of S164/18 began to erode more rapidly than it had hitherto. Following discussions between archaeologists and representatives of local Maori authorities it was decided that part of this area should be excavated in order to ascertain its nature and significance. A series of test pits and excavations (Fig. 2) showed that the site extended at least 20 m southwest from the channel section. Beyond this point the sand overburden was too deep to dig a test pit with safety, but the cultural layer in square G was thin and diffuse, suggesting that the site may not continue more than a few metres farther west.

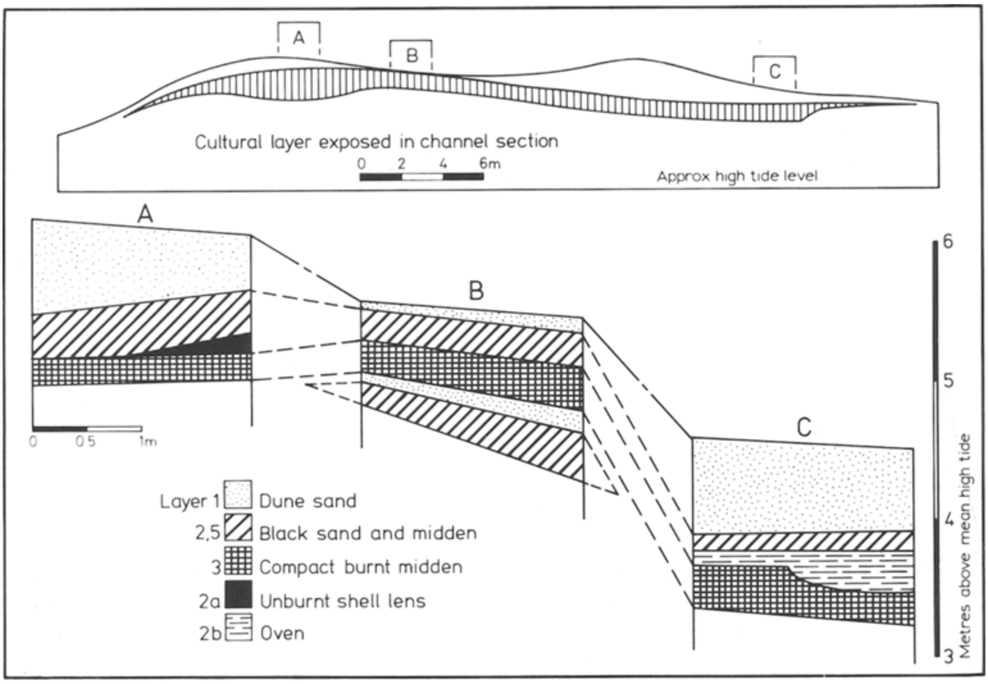

Fig. 3 — Stratigraphy of S164/18, northern area, at channel section and in excavated squares.

Squares A, B and C were fully excavated. Their orientation was determined by the need to avoid pines recently planted on the site. The typical cultural stratigraphy revealed in these squares (Fig. 3) comprises a layer of unburnt midden and blackened sand (layer 2) overlying a very dense and compact midden which has been heavily burnt (layer 3). In square B there was an additional lens of unburnt midden (layer 5), in square A a very compact lens of unburnt midden (layer 2a) and in square C an oven had been cut from layer 2 (layer 2b). With the exception of a small fossick hole in square B, the stratigraphy appeared intact.

Table 1 — Radiocarbon dates

R. no.	Material	Provenance	Estimate B.P. (Old $T^{1}/_{2}$)
5751/2	Charcoal	Square C, Layer 2B	1030 ± 60
5929/1	Cockle shell	Square A, Layer 2	562 ± 30
5929/2	Cockle shell	Square B, Layer 3	637 ± 30
5929/3	Cockle shell	Square B, Layer 5	571 ± 34
5929/4	Cockle shell	Square C, Layer 3	690 ± 35

Five samples were submitted for radiocarbon dating (Table 1). Three of the results must be regarded as suspect: R5751/2 because the charcoal proved to be entirely derived from old wood of *Coprosma* (60%) and *Podocarpus* (40%) species, and R5929/2 and

R5929/4 because the shell in these samples contained more than 80% calcite, suggesting that re-crystallisation had taken place (G. Law, pers. comm.). The estimates R5929/1 and R5929/3 can, however, be regarded as secure. They provide an average date of 556 ± 23 B.P. (G. Law, pers. comm.). Since these two estimates bracket the total cultural stratigraphy a short period of occupation in the later fourteenth century is suggested.

FAUNAL ANALYSIS

During the excavation midden was retained for analysis according to the procedure adopted at Black Rocks, Palliser Bay (Anderson, 1973). In the laboratory the shellfish were identified with the assistance of G. M. Mason (Anthropology Department) and counted according to the Black Rocks procedure. The resulting minimum numbers are shown in Table 2. Of the fish bone the main jaw parts: dentary, premaxilla, maxilla, articular and quadrate (along with the pharyngeal clusters of *Pseudolabrus* sp.) were identified by R. Fyfe (Taranaki Museum). These were sorted into left and right sides and examined for possible 'no-match' sizes within excavation square and layer units, but not between them. The minimum numbers are in Table 3. The bird bones were identified by R. J. Scarlett (Canterbury Museum). They were also sorted by side and compared for unmatching sizes by square and layer, and then by layers alone. The resulting minimum numbers are shown in Table 4, with those from the latter sorting appearing in brackets. The mammal bones were identified by I. W. G. Smith (Anthropology Department). Except in the case of seals, post-cervical vertebrae, ribs and limb extremity elements were not counted because they were usually fragmentary and difficult to sort into anatomical position or by side. A broad appraisal indicated that they were significantly less common than ought to have been the case according to minimum numbers obtained on other elements.

Table 2 — Minimum numbers of shellfish

Species*	Excavation Square and Layer							
	A/2	A/3	B/2	B/3	B/5	C/2	C/3	Total
GASTROPODA								
Haliotis iris	11	3	1	12	—	—	—	27
Scutus breviculus	1	—	—	—	—	—	—	1
Cellana sp.	9	7	2	17	—	—	1	36
Diloma sp.	—	3	—	41	2	—	5	51
Melagraphia aethiops	1	2	2	8	—	—	—	13
Micrelenchus sp.	93	61	570	1171	23	29	301	2248
Umbonium zelandicum	28	14	38	253	—	15	98	446
Cookia sulcata	1	1	2	2	—	—	—	6
Turbo smaragda	76	109	83	119	30	3	17	437
Littorina sp.	—	3	—	—	—	—	4	7
Maoricolpus roseus	—	2	—	1	—	—	1	4
Sigapatella novaezelandiae	—	—	—	—	—	—	1	1
Lepsiella sp.	7	3	4	15	1	1	19	50
Lepsithais sp.	—	—	—	3	—	—	—	3
Xymene ambiguus	—	—	—	—	—	2	3	5
Muricid	3	2	2	14	—	—	28	49
Buccinulum sp.	—	—	—	3	—	—	1	4
Cominella glandiformis	3	—	1	5	—	1	9	19
Gadinalea conica	1	—	—	—	—	—	—	1
Benhamina obliquata	—	—	—	1	—	—	—	1

Table 2 — Minimum numbers of shellfish — *continued*

Species*	Excavation Square and Layer							
	A/2	A/3	B/2	B/3	B/5	C/2	C/3	Total
Siphonaria zelandica	—	—	—	—	—	—	1	1
Amphibola crenata	1481	524	463	2848	395	1	279	5991
BIVALVIA								
Aulacomya ater	—	2	—	3	2	—	14	21
Mytilus edulis	3695	817	785	5099	409	353	4343	15501
Ostrea sp.	13	24	4	11	5	23	322	402
Zenatia acinaces	—	1	—	—	—	—	—	1
Paphies australe	8940	1066	4420	6922	486	283	274	22391
Paphies subtriangulatum	4	—	1	4	1	1	—	11
Chione stutchburyi	1028	1004	529	3695	445	93	679	7473
Myadora sp.	—	—	—	—	—	1	1	2
CRUSTACEA								
Balanus sp.	1	—	6	16	—	—	5	28
Jasus edwardsii	—	1	—	—	—	—	—	1
Grapsid	—	—	—	2	1	—	—	3
ECHINOIDEA								
Evechinus chloroticus	—	—	—	1	—	—	1	2
TOTAL	15396	3648	6914	20266	1800	806	6407	55237

* Molluscan nomenclature after Powell (1979)

Table 3 — Minimum numbers of fish

Species*	Excavation Square and Layer							
	A/2	A/3	B/2	B/3	B/5	C/2	C/3	Total
Callorynchus milii	—	—	—	—	1	—	—	1
Physiculus bachus	221	119	115	491	59	53	215	1273
Colistium guntheri	—	—	—	1	—	—	—	1
Rhombosolea plebeia	—	—	—	—	—	—	1	1
Polyprionum oxygeneious	5	2	—	1	—	—	1	9
Latridopsis ciliaris	1	—	1	—	—	—	—	2
Latris lineata	1	—	—	1	—	—	—	2
Pseudolabrus sp.	3	1	2	7	1	4	9	27
Leionura atun dentatus	269	214	56	150	55	67	507	1318
Genypterus blacodes	17	15	7	25	6	7	34	111
TOTAL	517	351	181	676	122	131	767	2745

* Nomenclature after Whitley (1968).

Table 4 — Minimum numbers of birds

Species*	Excavation Square and Layer							
	A/2	A/3	B/2	B/3	B/5	C/2	C/3	Total
Dinornis maximus	1	—	—	—	—	—	—	1
Moa (cf. *Euryapteryx*)	—	1	—	—	—	—	—	1
Moa	×	×	×	×	×	×	×	×
Eudyptula minor	—	—	—	1	—	1	1	3 (2)
Diomedea exulans or *D. epomophora*	—	—	—	1	1	1	—	3
Diomedea cauta [1]	1	1	1	3[2]	2	1	1	10 (8)
Mollymawk	×	—	—	—	—	—	—	×
Pachyptila cf. *vittata*	—	1	—	—	—	—	—	1
Pacyptila turtur	—	—	—	1	—	—	—	1
Procellaria sp.	—	—	×	—	—	—	—	×
Puffinus gavia	1	—	—	—	—	1	1	3 (2)
Pelecanoides urinatrix	—	—	—	—	—	—	1	1
Petrel	—	×	—	—	—	—	×	×
Stictocarbo punctatus	2	—	1	—	2[3]	3	3	11 (8)
Large shag	1	—	1	—	1	1	1	5 (3)
Anas superciliosa	1	—	—	—	—	1	—	2 (1)
Duck	—	×	—	×	—	—	—	×
Coturnix novaezealandiae	—	—	—	1	—	—	—	1
Gallirallus australis	—	—	1	—	2[4]	—	1	4
Rallus philippensis	—	—	—	—	1	—	—	1
Rail	—	—	—	—	—	×	—	×
Larus scopulinus or *L. bulleri*	—	—	—	1	—	1	—	2
Gull or tern	—	—	—	—	×	—	—	×
Hemiphaga novaeseelandiae	—	1	1	—	—	1	—	3 (1)
Sceloglaux albifacies	—	—	—	—	—	1	—	1
Prosthemadera novaeseelandiae	1	1	—	—	—	—	—	2
Callaeas cinerea	1	—	—	—	—	—	—	1
TOTAL	9	5	5	8	9	12	9	57 (45)

* Nomenclature after Falla *et al.* (1979).
× present/not counted
( ) Minimum numbers when assessed by layers
1. Possibly *D. salvini* or *D. eremita*, but less likely
2. 1 individual sub-adult
3. 1 individual immature
4. 1 individual a chick

Calculated by square and layer the minimum number of dogs (*Canis familiaris*) is 13 (Table 5), but by layers alone it is 11. This latter total is made up of one very large adult, six other adults, two sub-adult dogs (unfused proximal tibiae indicated that they were less than 18 months old), one juvenile (deciduous teeth indicate 2-4 months), and one possibly foetal individual (5.5 cm long unfused humerus). No congenital abnormalities were observed. All the adult teeth had been extensively worn; for five carnassials the tooth wear index (Allo Bay-Petersen, 1979) was 3.5 (two individuals), 4.0 and 5.0 (two individuals) indicating a diet of resistant or abrasive food.

Table 5 — Minimum numbers of mammals

Species	Excavation Square and Layer							
	A/2	A/3	B/2	B/3	B/5	C/2	C/3	Element Total
Canis familiaris								
Premaxilla	1			1	1		1	4
Maxilla	1	1		1	1		1	5
Mandible	1	1		2	3	1		8
Nuchal crest	1	1			1	1		4
Foramen magnum	3	1				1		5
Atlas	3	1			1			5
Axis		3						3
Scapula		1	1	2				4
Humerus	2		1	2		1	2	8
Ulna	2	1	1	1	1			6
Radius		1		1				2
Pelvis	2	2	1	1	2			8
Femur	4			1			1	6
Tibia	5	1	1	4	1		1	13
Calcaneum	1					1		2
Astragalus	1							1
Mirounga leonina								
Canine		1						1
Rib (fragment)	1							1
Arctocephalus forsteri								
Vertebra	1							1
Sternum	2							2
Radius	1							1
Rib	1							1
Os penis		1						1
Tibia	1							1
Marine mammal								
Bone fragments	×	×					×	×
Sus scrofa								
Molar						1		1
Rattus exulans								
Mandible	7	3						10
Humerus	5	1						6
Femur	1	7			1	1		10
Tibia	5	3	1	1				10
Rattus cf. *norvegicus*								
Humerus	1							1
Radius	1							1

× present/not counted

The elephant seal (*Mirounga leonina*) is represented by a small fragment of rib and a single canine. It is unlikely that these are dietary remains, and they have not been included in the estimations of food supply (below). Bones of the New Zealand fur seal (*Arctocephalus forsteri*) were more common and indicate three individuals when counted by layers. However, the single os penis and the few other fragments of marine mammal bone in layer 3 probably belong with the layer 2 material. On this basis an adult and a juvenile are represented, the latter only by a single sternal fragment. A single adult is assumed in the food supply estimates (below).

The Polynesian rat bones (*Rattus exulans*) are strongly concentrated in square A (Table 5), and the distribution of elements through the layers there suggests that the material belongs to a single assemblage of 10 individuals (counted on right mandibles) of which three are markedly smaller than the remainder and are possibly juveniles. Nearly all the layer 2 rat bones were found in lens 2a, where there were also two fragments of dog bone found to match pieces from layer 3. On these grounds layer 2a may belong chronologically with layer 3 despite the fact that it is unburnt.

The pig (*Sus scrofa*) molar and the large rat bones, possibly from *Rattus norvegicus*, indicate intrusions of European material on to the surface of layer 2, as is the case with some of the artefactual remains as well (below).

Two pieces of human bone came to light during laboratory analysis: a fragment of an adult incisor and a piece of child's cranial bone bearing traces of red ochre. Both were from layer 2 and the latter, which had been concealed between two paua shells nested one inside the other, probably represents a secondary interment.

ARTEFACTUAL ANALYSES

Stone flake implements

The type and stratigraphic distribution of the stone flakes is shown in Table 6. All were examined under X10 magnification for retouch and use wear. Higher magnification might reveal more details of use wear on obsidian, but experience with coarser grained materials (porcellanite and silcrete) from South Island sites has not been encouraging (Bain, 1979). Twenty-four of the flakes (14%) exhibited use wear, in three cases on two edges, and two flakes had been retouched. Edge angles were determined by the use of a protractor and straight edge. This is not the most precise method available but it was regarded as satisfactory in the present case because nearly all the flakes were of simple form — i.e. with unmodified dorsal and ventral faces — and because the differences between the edge angles were plainly apparent. The error margin, by repeated measurement, is approximately ± 3°, and the angles in Table 7 are thus given to the nearest 5°.

Table 6 — Type, probable source and distribution of stone fragments

	Layer 2	Layer 3	Layer 5	Total
Red/yellow Chert (Oamaru district)	8	6	3	17
Red ochre (local)	5	1	—	6
Streaky chert (North Otago)	1	4	—	5
Basalt (local)	5	5	3	13
Porcellanite (Moeraki)	1	—	—	1
Chert (Moeraki)	2	—	—	2
Chalcedony (North Otago)	10	—	3	13
Sandstone (cf. Caversham Series)	—	—	1	1
Schist (Otago)	1	2	—	3
Puddingstone (Cape Saunders)	13	4	4	21
Silcrete (North Otago)	14	17	19	53
Obsidian — grey (central North Island)	21	4	10	35
Obsidian — green (North Island)	3	—	—	3

Note: Numbers include modified flakes but not other artefacts.

Table 7 — Unretouched flake implements

AG No.*	Material	Maximum length (cm)	Used edge length (cm)	Edge angle (°)	Type of damage	Likely function
381	Obsidian	3.3	3.0	5	Unifacial Strations	Fibre Scraping
386	Obsidian	4.0	4.0	5	Denticulation	Slicing
387	Obsidian	3.6	2.0	5	Denticulation	Slicing
388	Obsidian	2.5	1.5	5	Denticulation	Slicing
467	Chert	2.2	2.0	5	Denticulation	Slicing
472	Chert	3.0	2.0	5	Denticulation	Slicing
475	Chert	2.5	1.6	5	Denticulation	Slicing
			1.2	5	Denticulation	Slicing
485	Chert	4.2	4.0	20	Unifacial Flaking	Light Scraping
			4.0	20	Unifacial Flaking	Light Scraping
489	Chert	4.7	2.0	5	Denticulation	Slicing
461	Puddingstone					
		4.0	2.0	25	Unifacial Flaking	Light Scraping
455	Porcellanite	4.2	2.0	15	Denticulation	Slicing
			2.5	70	Unifacial Flaking	Light Scraping
430	Basalt	3.5	3.2	85	Unifacial Chattering	Heavy Scraping
296	Silcrete	3.6	2.5	25	Denticulation	Slicing
323	Silcrete	4.0	4.0	10	Denticulation	Slicing
325	Silcrete	6.5	5.0	20	Unifacial Flaking	Light Scraping
333	Silcrete	4.0	3.0	20	Denticulation	Slicing
351	Silcrete	4.8	2.5	35	Unifacial Flaking	Light Scraping
399	Silcrete	3.5	1.0	10	Denticulation	Slicing
401	Silcrete	4.5	4.0	15	Denticulation	Slicing
403	Silcrete	3.6	3.6	30	Unifacial Flaking	Light Scraping
405	Silcrete	3.0	1.5	10	Denticulation	Slicing
413	Silcrete	7.0	5.0	20	Unifacial Flaking	Light Scraping
446	Silcrete	3.8	2.0	70	Unifacial Chattering	Heavy Scraping
540	Silcrete	7.3	2.0	20	Unifacial Flaking	Light Scraping

* AG numbers refer to Archaeological Laboratories (University of Otago) accession records.

The largest group of flakes (15) exhibited a denticulated type of use damage. This consisted of an unevenly saw-toothed edge along which the scars were usually less than 1 mm deep. Interspersed amongst these were shallow 'scallops' formed by the removal of crescentic pieces up to 4 mm long. The damage did not extend on to either face of the cutting edge, although it probably would have had the edge angles been steeper. The mean edge angle of this group is 10° (range 5° -25°) and such a sharp edge associated with denticulate damage is characteristic of an implement used for slicing through or against resistant materials (Wilmsen, 1970; Ferguson, 1980; Keeley, 1980). Few of the Purakanui examples have continuous denticulation along the used edges, which suggests that they were discarded after a very short period of use. This is consistent with their small size and short used edge length (mean = 2.3 cm), since it would have been difficult to exert the extra pressure needed to maintain cutting efficiency on implements held only between the finger tips.

The second group of implements consists of larger flakes with longer used edges (mean = 3.2 cm) on which the damage appears as a row of overlapping flake scars along one face of the cutting edge. Although the low edge angles (mean = 29° and range 20° – 70°) fall within the range typical of cutting implements (Wilmsen, 1970; Tainter, 1979), the unifacial damage indicates that pressure was applied across, rather than along, the cutting edge. Damage of this kind can be replicated by light scraping of even resistant surfaces.

Heavier scraping produces step fracturing or 'chattering' marks (Ferguson, 1980) and is normally associated, as in the two Purakanui examples, with steep edge angles (Table 7). One of these scrapers (AG 430) has a concave face indicative of bone or wooden shaft scraping, and the other (AG 446) is an end scraper.

One of the obsidian flakes (AG 381) has a straight cutting edge, finely abraded, from which numerous thin striations run back 0.8 mm along the ventral face. Damage of this kind suggest the scraping of non-resistant but abrasive materials, such as tough fibres. Hair cutting or shaving might also have produced it.

Of the retouched implements one is a section of a large silcrete blade (Fig. 4viii). The steeper edge of it has been retouched to increase the effective edge angle to between 45° and 70° (variation along the edge). The other is a silcrete flake bifacially retouched along two edges to form an effective edge angle of about 70° in each case. Implements with these characteristics are typical of heavy cutters, scrapers and shredders (Wilmsen, 1970). They may have been used, as Walker (1978) suggests of similar examples, for skinning; the retouch ensures that the shoulder of the cutting edge presses the skin away from the flesh and avoids the danger of accidentally slicing through it. No edge damage, as might have been expected if they had been used on resistant materials, was observed on the two Purakanui specimens.

Other stone implements

There is little evidence of adze manufacture amongst the excavated assemblage, although characteristic debris of it can be observed lying on the intertidal area in front of the southern part of the site. Two secondary trimming flakes (Leach and Leach, 1980: 114) and a section of a small triangular cross-sectioned chisel preform from layer 2, all in basalt, were the only indications noted. From the same layer came a bevel fragment of a nephrite adze (Fig. 4iii) and a small black basalt or argillite adze. The latter had been fashioned by grinding a flake struck off a larger adze which had, itself, been hammer dressed and ground (Fig. 4ii). In layer 3 there was an adze flake of basalt, polished on one side.

In layer 5 two joining fragments of a small sinker were found (Fig. 4u). This had been ground from siltstone of a kind known to outcrop at Shag Point (Mason, pers. comm.). Also recovered from layer 5 were a large schist burnisher (Fig. 4iv) and a block of soft sandstone ground on one side. Three smaller schist files were found in layers 2 and 3 and five pieces of red ochre in layer 2.

Shell and bone implements

Two small beads of scaphopod shell were recovered; one 4 mm in diameter and 6 mm long from layer 2 and the other 5 mm in diameter and 14 mm long from layer 3. The genus from which these were fashioned is unknown but it is most likely to have been *Dentalium* or *Fissidentalium* (G. M. Mason, pers. comm.). *Dentalium* beads are regarded by Simmons (1967: 39) as a predominantly late Archaic fashion in Otago.

Most of the bone implements are pieces of fish hooks made, where it is possible to tell, of moa bone (with several exceptions, below). Seven pieces appear to be from Hjarno (1967) type A.1. points, which are believed to have been attached to barracouta lures (Fig. 4a-c, k-m, s). The large point section (Fig. 4d), which has an angled base, might also belong to this group. Such points were used at all periods in Otago prehistory, although they tend to be more frequently found in Archaic levels (Hjarno, 1967: 17). Two minnow-lure points (Fig. 4p,t) are of Hjarno type B.2.a., regarded as an Archaic form, as

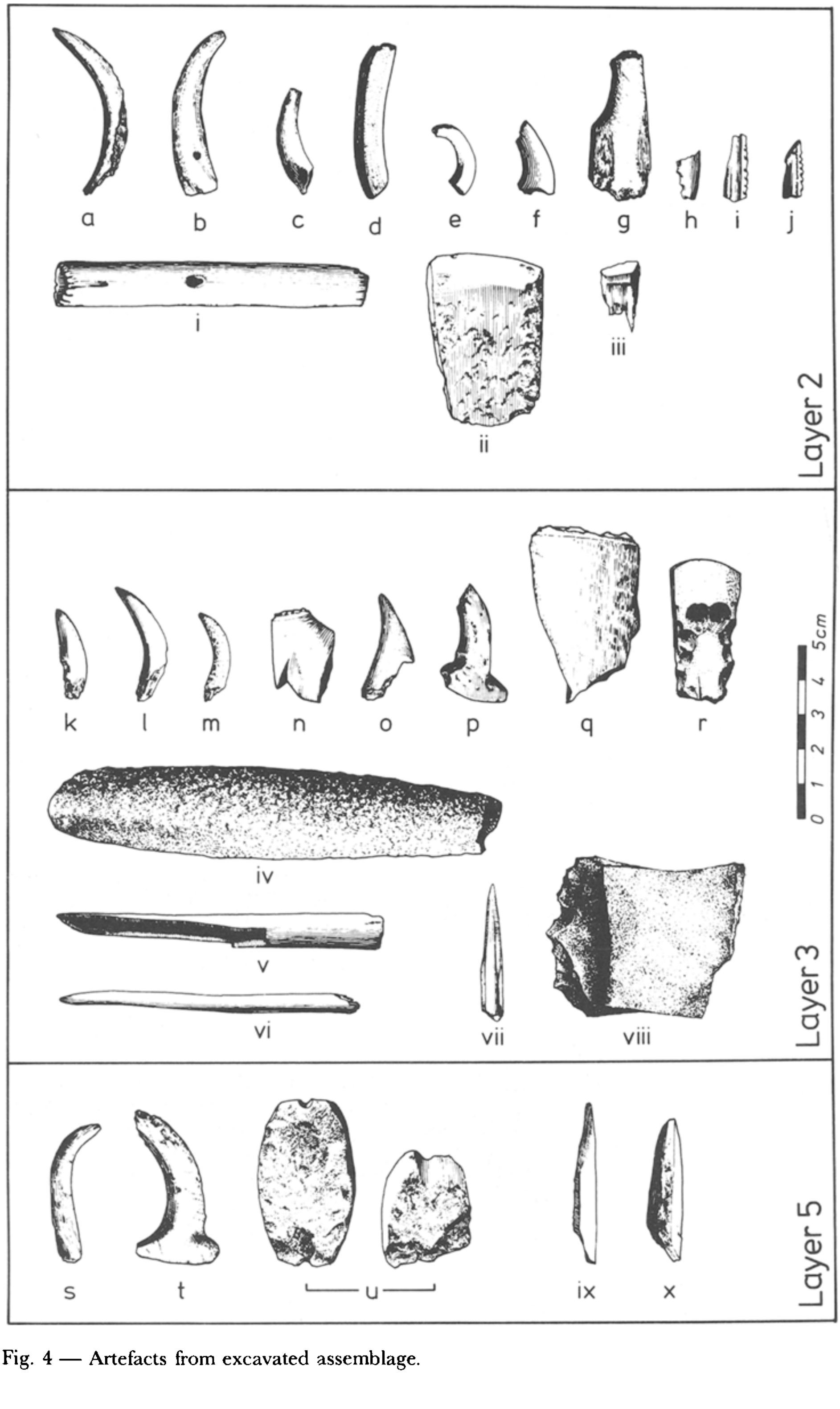

Fig. 4 — Artefacts from excavated assemblage.

is the base of a Hjarno type C.1.c. point (Fig. 4h) fashioned from dense, semi-lustrous bone, possibly human.

One piece, unbarbed bait hooks are represented by Hjarno types D.1. and D.2. (Fig. 4f,e), both of which are Archaic forms (Hjarno, 1967). The externally barbed point fragment (Fig. 4o) might have come from a type D hook, but too little of it has survived to distinguish it from his type C.3.b, a late Archaic or Classic form of composite bait hook point (Hjarno, 1967: 29). The point leg section of a one-piece bait hook with a basal barb (Fig. 4n, Hjarno type D.4c), a late Archaic form (Hjarno, 1967: 35), although found at Shag River and thus possibly early Archaic as well, has been sawn to remove the point. No doubt this occurred after the hook had broken at the bend; the leg removed would have served as a simple barracouta point without requiring any further modification.

There are three pieces of composite bait hooks. Two have been fashioned from the limb bones of small birds (Fig. 4i,j) and are Hjarno types C.3-5. and C.4. respectively. These forms are predominantly found in Classic contexts, although examples of them have been assigned to the lower layer at Little Papanui (Simmons, 1967:45). The third is a large point fragment (Fig. 4g) from a Hjarno type C.3. hook, a form most common in late Archaic contexts, but also found in Classic levels (Hjarno, 1967: 27; Trotter, 1965: 354).

The remaining bone artefacts consist of three examples of bird bone awls, one in *Diomedea* sp. bone (Fig. 4v,vii,ix), a toggle of *Diomedea* sp. bone (Fig. 4i) and a long straight point of dense, semi-lustrous (?human) bone (Fig. 4vi). Toggles are normally found in Classic contexts, although several have been assigned to the lower layer at Little Papanui (Simmons, 1967: 53). The notching at either end of the Purakanui example is an unusual feature, but notching may have been locally fashionable since it is found around the entire edge of the harpoon point or pendant from Purakanui (Otago Museum D32. 1979). The long point is difficult to interpret. It might have come from a bone comb, another typically Classic type, but it is rounded in cross-section and reminiscent of the Hjarno type C.1.c. point, an Archaic type which is represented at Purakanui by a base fragment of similar material (above). Helen Leach (1979) has argued that such points belong to octopus lures.

Uncompleted bone artefacts were confined to the distal half of a dog mandible, sawn and snapped between premolars 2 and 3, and two tabs of moa bone (Fig. 4q,r) exhibiting the filing and drilling characteristic of hook manufacture. The mandible has also been divided in a place typical of hook manufacture (Coutts and Jurisich, 1973).

European artefacts

Lying on the surface of layer 2 and found in it to a depth of 5 cm were a number of European artefacts, identified by N. J. Prickett (Auckland Institute and Museum). Representative of the early to mid-19th century is a piece of an iron 'go-ashore' pot (AG 438), and of the mid to late 19th century, fragments of 'black' beer bottle glass (AG 561). A small green glass bead (AG 544) is probably of this age as well. Other pieces of colourless glass (AG 563-566) are of early 20th century manufacture.

INTERPRETATION

Subsistence activities and seasonality

A variety of subsistence pursuits are represented by the faunal remains, and these can be broadly localised in terms of the historical and present-day environment at Purakanui. All the commonly represented species of shellfish can be found close to the site. A dense bed of *Chione stutchburyi* extends along the channel edge for 400 m upstream from the site, with *Amphibola crenata* occupying the higher intertidal area. A small population of *Ostrea* sp. is dispersed along the channel floor 250 m south of the site, and a *Paphies australe* population is subtidally distributed in front of the site and along the channel to the north. Directly across the channel on a rocky shore are *Mytilus edulis, Turbo smaragda* and other species. It is likely that all the rocky shore species could have been found in this area and around the headland to the east (Fig. 1) before the progradation phase of the 19th century and later. Generally subtidal species (*Haliotis iris, Evechinus chloroticus, Jasus edwardsii*) are rare in the site, and this suggests that diving was seldom employed in shellfish collecting. The small species, particularly the comparatively numerous *Micrelenchus* sp. and *Umbonium zelandicum* were probably collected accidentally. Their presence suggests that molluscs were scooped from the sand, or stripped from rock and kelp, into a woven bag, washed in it and taken to the site without being sorted.

Of the fish, moki (*Latridopsis ciliaris*), flounder (*Rhombosolea plebeia*) and *Pseudolabrus* sp. can be netted in the channel immediately seaward of the site. The remaining species are normally found in deeper water and must generally have been taken by fishing from canoes in the open sea. With the exception of barracouta, which was captured with the trolling lure, they are all species taken by the bait hook.

The main fish species suggest an occupation between November and June. The barracouta usually disappears from the surface in Otago waters between July and October (Graham, 1956: 313), and the ling (*Genypterus blacodes*) and red cod (*Physiculus bachus*) are less plentiful between July and September (Graham, 1956: 170,338). Elephant fish (*Callorhynchus milii*) and trumpeter (*Latris lineata*) are usually caught in the warmer months, and hapuku (*Polyprionum oxygeneios*) are more plentiful at that time (Graham, 1956: 68,226,258). Most of these species, and certainly the main ones represented in the site, spawn in the late winter and early spring so that an optimal balance between abundance and condition is likely to occur in the summer and autumn.

The birds are predominantly coastal and marine species. Except perhaps in the case of spotted shag (*Stictocarbo punctatus*), the general lack of juveniles indicates that breeding colonies were not being exploited. Many of the sea birds may well have been accidentally caught in fishing nets, as shags frequently are in the same area today (R. Fyfe, pers. comm.), or captured on the water around fishing canoes. The shy mollymawk (*Diomedea cauta*), one of the most commonly represented species in the site, is well known for its propensity to alight close to fishing craft (Oliver, 1955: 172). Suitable habitats for ducks and rails are found in the rushes and salt marshes along the southern edge of the sandspit, while the quail (*Coturnix novaezealandiae*), and the laughing owl (*Sceloglaux albifacies*), may have come from the rocky slopes to the west of the inlet which were covered in flax and silver tussock at the time the Europeans arrived (Sime, 1950: 26). Elsewhere the lower slopes of Purakanui Inlet were heavily wooded during the 19th century (Davies, 1980: 38), providing suitable habitats for pigeon (*Hemiphaga novaeseelandiae*), tui (*Prosthemadera novaeseelandiae*) and kokako (*Callaeas cinerea*). Both the moa species are known from other coastal sites around Otago Peninsula (Davies, 1980). Since the bird remains are all from species which can, or could formerly, be found along the Otago coast throughout the year, and are mostly from adult individuals, they provide little seasonal information. Only the presence of a weka chick suggests a catch between spring and early winter, although this species has an extended breeding season (Falla *et al.*, 1979: 97).

Rattus exulans was probably trapped in the forest, or at the site where a number of bird bones had been gnawed. The dog remains are presumably from a domestic population. If sexual dimorphism was characteristic of the Polynesian dog, then the Purakanui material could indicate a typically domestic population of one adult male, six females and three or four juveniles. Both the fur seal and elephant seal are casual visitors to Purakanui today; I have seen a young individual of each inside the inlet during the past 18 months.

From this information it may be concluded that there is a strong probability that all of the approximately 70 species represented in the site were obtained within Purakanui Inlet and from the open sea to the north. Occupation between November and June is indicated, mainly by the fish species, but other times of the year cannot be ruled out.

The purpose of the settlement

Finding out why people settled at Purakanui during the Archaic phase depends upon the inferences drawn from evidence of the frequency and length of occupation and the degree of specialisation evident in the functions performed there.

Frequency and length of occupation: Since the site is in unconsolidated sand, it is very likely that any hiatus in occupation of more than a few months would be stratigraphically observable as a barren sand layer or lens. In fact, with the exception of the layer 5 lens, the stratigraphy is continuous in depth. From the dune face exposure it appears to be almost entirely continuous in plan as well, and the phase of intense burning which distinguishes layer 3 can be found along the entire exposure as well as in each of the excavation squares. Three briefly separated occupations are implied.

The radiocarbon dates indicate that the total settlement phase was not prolonged, but whether it was measured in a few years or a few decades they cannot reveal. For an indication of which scale is more likely it is necessary to consider the patterns of shellfishing. Shellfish are frequently a comparatively limited resource and exploitation of them can provide inferences about the pressure of collection (Swadling, 1976, 1977; Anderson, 1979, in press). How large the stocks of the major species were at Purakanui cannot be determined; if the present populations are representative of former conditions they are very modest compared with those of the larger bay to the north (Waitati Inlet) or Otago Harbour to the south, and they are insignificant compared with those of the large North Island harbours in which exploitation effects have been observed (e.g., Swadling, 1977).

Grab samples averaging 144 valves each (range 105-201) were taken from the cockle and pipi (*Paphies australe*) collections from each layer, these species being the only ones providing sufficiently intact shell for adequate samples. The layer 2 and 3 samples were

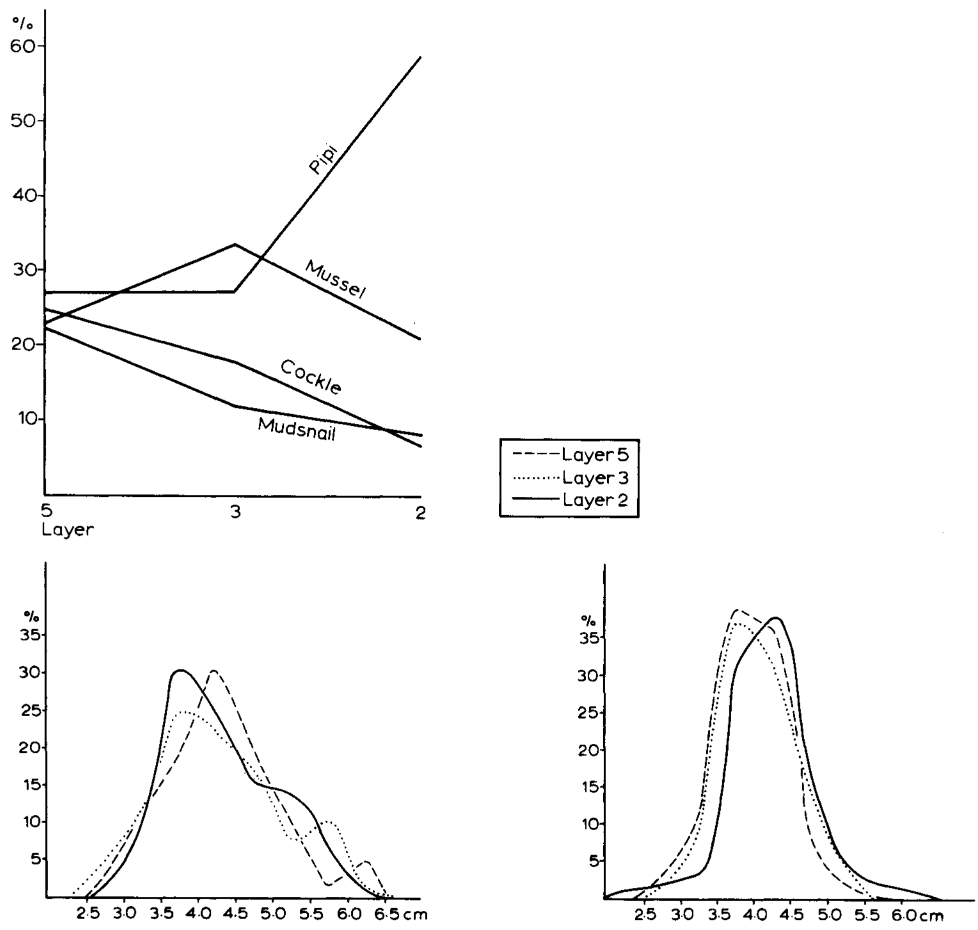

Fig. 5 — Proportions of major shellfish species (above) and size-frequency curves of pipi and cockle (below).

obtained by random splitting of the total collections of each species and layer. The pipi were measured from end to end and the cockle from lip to umbo (cf. Swadling, 1977). The resulting size frequency curves are shown in Figure 5, and the important results were that the pipi mean size remained the same (4.3 cm) despite a small decrease in the larger individuals, while the cockle mean size increased from 3.9 cm in layer 5 to 4.2 cm in layer 2. From the same samples 50 cockle valves were selected from each layer and the striae on them were counted according to the technique in Swadling (1976). The means resulting were 8.37 per centimetre for layer 5, 8.68 per centimetre for layer 3 and 8.32 per centimetre for layer 2.

If these trends are the result of collecting practice, and not of environmental change or alterations in food preference, neither of which can be ruled out, then heavy and prolonged exploitation can be discarded, since that should have produced a lowering of the mean size of the samples accompanied by a lowering of the striae count (Swadling, 1977: 12). If it is assumed from the size and striae counts of the cockles that mature, unexploited populations were available at the beginning of occupation (cf. Swadling, 1977: Table 1) then light and prolonged collecting can be discarded as well since although the mean size could remain the same by the increased growth rate matching the collection rate, the striae ought to have become more widely spaced. Light, prolonged exploitation can also be discounted in view of the density of the shell midden. If midden density in unconsolidated sand environments can be regarded as a broad measure of the rate of deposition, then the 18,412 molluscs per m^3 at Purakanui were accumulated at least as rapidly as in the Black Rocks middens (13,942 molluscs per m^3), which are also thought to have been briefly occupied (Anderson, 1979).

Table 8 — Estimated edible flesh weight (kg) per individual

ESTUARINE GATHERING		ROCKY SHORE GATHERING	
*Amphibola crenata**	0.001	*Haliotis iris*	0.150
Ostrea sp.*	0.002	*Turbo smaragda*	0.004
Paphies australe	0.001	*Mytilus edulis**	0.003
Chione stutchburyi *	0.002	Data: Anderson (in press)	
Data: Cassels (n.d.)			
INSHORE FISHING		OFFSHORE FISHING	
*Rhombosolea plebeia**	0.250	All other species	1.750
Latridopsis ciliaris	1.500	Data: Graham (1956), Sutton (1979)	
Pseudolabrus sp.	1.000		
Data: Sutton (1979)			
		OPEN GROUND/FOREST EDGE FOWLING	
COASTAL AND MARINE FOWLING			
Eudyptula minor	1.050	*Dinornis maximus* (1 leg)	32.200
Diomedea exulans	5.600	*Euryapteryx* sp. (1 leg)	8.400
Diomedea cauta	3.150	Data: Smith (n.d.a.)	
Puffinus gavia	0.560	*Anas superciliosa*	0.770
Stictocarbo punctatus	0.630	*Gallirallus australis*	0.700
Data: Sutton (1979), Williams (n.d.)		*Larus* sp.	0.200
		Data: Sutton (1979), Williams (n.d.)	
FOREST FOWLING		FOREST HUNTING	
Hemiphaga novaeseelandiae	0.100	*Rattus exulans**	0.100
*Callaeas cinerea**	0.150		
Data: Williams (n.d.)			
DOMESTIC CULLING		COASTAL HUNTING	
Canis familiaris — adult	5.600	*Arctocephalus forsteri*	88.000
juvenile*	2.000	Data: Smith (n.d.b.)	
Data: Allo Bay-Petersen (1979)			

* = Estimated weight by comparison with other species.

Taken together, therefore, the evidence relating to the length and frequency of occupation at Purakanui suggests that the site was occupied on three occasions separated by no more than a matter of months in each case and all within the space of several years. If the few seasonal data are representative, then successive late spring to early winter settlements can be proposed.

Settlement functions: Except in the case of the shellfish, where there is a progressive divergence in the proportional representation of the main species (Fig. 5), and in the case of the seal remains which are concentrated in layer 2, the contents of the site are remarkably uniform from layer to layer. This is particularly true of the fish, amongst which the proportions of the main species are virtually identical one to another and between the layers. Red cod constitutes 48% of the total fish in layer 5, 46% in layer 3 and 47% in layer 2, while the barracouta proportions, in the same order, are 45%, 49% and 47%. Given this homogeneity in contents and a brief settlement phase, the functions of the site can be considered as a whole.

While a varied local subsistence effort has been inferred from the faunal remains (above) it is clear that this did not produce a food supply in proportion to the habitats and species exploited, as is more nearly the case in some other coastal Archaic sites (Pounawea (Hamel, 1980) for instance). If the minimum numbers are translated into the available meat weight represented by the various food gathering activities a strongly specialised economic focus is apparent.

Estimating meat weights is a procedure fraught with potential sources of error, the most important of which is that the data with which to calculate the mean individual live weight of a species are seldom adequate. In Table 8 are the data used here; 'estimates' are based on comparison with other species in the table. Available meat weight has been assumed to be 70% of live weight in the case of fish, birds and mammals, after Sutton (1979).

The results are illustrated in Figure 6. Although they are open to modification in the event of more precise data becoming available, they plainly demonstrate that open sea fishing was the primary source of flesh represented in the Purakanui site.

Consideration of the artefact assemblage reinforces the conclusion that fishing was the principal function of the settlement. Of the bone and shell artefacts 80% are pieces of finished or partially prepared hooks. The ratio of trolling to bait hooks is 10:9 (finished hooks only) which closely matches the proportions of pelagic and demersal species in the faunal remains. Similarly, hooks from Purakanui in the Otago Museum collection consist of 45 trolling and 34 bait hooks.

The flaked stone implements are indicative of light preparation and maintenance functions. Amongst these it would not be unreasonable to suspect the shaping and smoothing of barracouta lure shanks, composite bait hook shanks and floats of wood. The schist files and sandstone may have been employed in shaping bone points and small sinkers of the type recovered. The awls were probably used in preparing the dog and seal skins for clothing. The denticulated flake implements could have been used to cut fish, a surprisingly resistant material (Keeley, 1980). Unmodified flakes, or valves of pipi and mussel (*Mytilus edulis*), could also have been used. There is no evidence, either in the form of large or abundant adzes or in stratigraphic features, of the construction of houses or other such major structures.

DISCUSSION

The extent of the northern part of S164/18 cannot be precisely determined but a surface area of about 1000 m^2 was indicated by digging test pits. The site may have been up to 50% as large again before erosion along the channel edge. At its present size, and assuming that the contents of the excavations are representative, it contains something of the order of 4.5 million mollusc and 230,000 fish remains, these being the two components most evenly distributed within it. Since it has been argued that this area represents a specialised fishing camp occupied for only a few years, there is clearly a

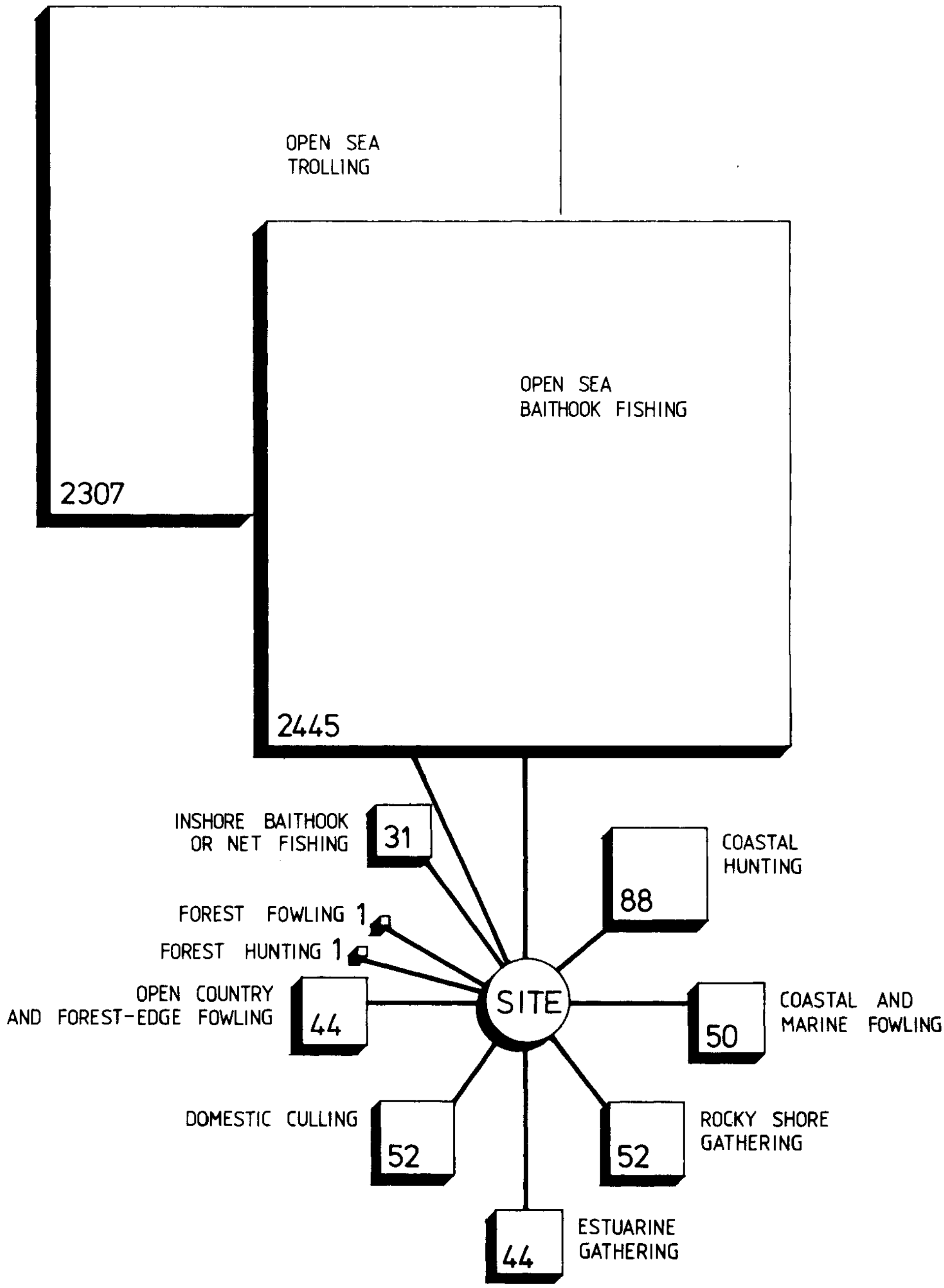

Fig. 6 — Contribution of edible flesh (kg) by represented subsistence activities.

question raised of whether that huge quantity of fish could have been caught within such a short period, and if so, what was done with the catch.

Until early this century red cod and barracouta, the main species, occurred in vast numbers around the Otago peninsula. Graham (1956: 18) reports red cod being so abundant at times in Otago Harbour that a boat load could be speared in 1½ hours. By hook and line fishing outside the harbour the largest catch for one man was 78 in an hour and 360 in a short day (Graham, 1956: 170). Of barracouta fishing with the trolling lure or 'paw' he mentions reliable records of one man catching four fish per minute continuously and taking up to 1150 per day (Graham, 1956: 310). At these rates a single fishermen could have caught the approximately 100,000 of each species estimated to be represented in the site in 278 and 87 days respectively. There is no need to speculate about pre-European catch rates, frequency of fishing days or number of fishermen to conclude that several years ought to have provided ample time to catch the Purakanui fish.

On the other hand, consuming the approximately 400,000 kg of flesh thus obtained on the site and during that period would require a resident population of several hundred people. Neither the size of the site nor its structural and artefactual remains lend support to any such proposition. It is much more likely that the bulk of the catch was preserved for later consumption elsewhere. Certainly that was what was happening at the historical Maori settlement at Purakanui. Renata (1894) recalled ". . . Maori ovens at work baking barracouta, with some of the baked fish strung up on poles 30 ft high to get sun dried and preserved for winter use". Thus the Archaic settlement at Purakanui may be regarded as a fishing station for people whose main base or village was situated elsewhere. Precisely where is a question which cannot yet be answered, but the predominance of north Otago sources amongst the imported stone may be a general cue.

Turning to wider issues, the inference of a specialised Archaic fishing camp has interesting implications for Otago archaeology. In this region models of cultural variability have strongly emphasized the diachronic dimension. Working within a tradition which goes back to Haast (1874), Lockerbie (1959), Hjarno (1967) and especially Simmons (1967, 1973) have attributed economic and artefactual differences almost exclusively to the passage of time. Specialised fishing and shellfishing is regarded by them as a late adaptation compelled by resource depletion among moa and marine mammals. The single case of Purakanui may not overturn this general hypothesis, but it does indicate that specialised fishing was already present during the Archaic phase, and it reinforces other recent evidence of marked differences in the functional status of Archaic sites in southern New Zealand (Leach and Leach, 1979; Sutton and Marshall, 1980; Anderson, 1980). Elucidation of the artefactual patterns and of their significance amongst the rich collections from this region will therefore need to be undertaken within a broader framework which adds synchronic functional variability to the influences of cultural change.

CONCLUSIONS

The northern area of site S164/18 is a concentrated and largely undifferentiated midden dating to the later fourteenth century. Stratigraphic and faunal evidence indicate that it represents three short and probably seasonal occupations within the space of a few years. Analysis of the faunal and artefactual remains together prompt the conclusion that the site was a specialised fishing camp for the catching and processing of red cod and barracouta in particular. Much of the catch was probably preserved for later consumption.

Specialised fishing sites have not been previously recorded for the Archaic phase of Otago, and this addition to the range of limited-function settlements suggests that synchronic variability in artefactual and economic evidence is of greater importance than is presently recognised.

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