# THE ARCHAEOLOGY OF OTAGO

Jill Hamel

Department of Conservation
*Te Papa Atawhai*

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Cover: Stone ruins of cottages at the ill-fated Pactolus Claim in the upper Nevis. The pond in the foreground was probably made by a hydraulic elevator.

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## PART 2 THE HISTORIC PERIOD

# Foreword

**by Professor Atholl Anderson**

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Consideration of regionality in New Zealand's prehistoric archaeology goes back to H.D. Skinner's research in the 1920s, when he set out to topple the prevailing traditionalist paradigm of pre-Polynesian settlement. Later archaeological studies have emphasised the local and regional adaptations of prehistoric subsistence activities, demography, settlement patterns and material culture to New Zealand's environmental variety. Some of this work has been published, in summary, for a broad readership. Nigel Prickett's *The first thousand years* (Dunmore Press 1982) and *Historic Taranaki: an archaeological guide*, (GP Books 1990), Atholl Anderson's *When all the moa ovens grew cold* (Otago Heritage Books 1983), and Aidan Challis' *Motueka* (Longman Paul 1978) are examples. However, detailed studies of regional evidence, covering both Maori and European archaeological remains, have until recently been lacking. It is this critical gap in the availability of data and their synthesis that the Department of Conservation's series now fills so admirably (see also Aidan Challis' *The archaeology of Canterbury in Maori times* (Department of Conservation 1995), and Tony Walton's *Archaeology of the Taranaki-Wanganui region*, Department of Conservation 2000).

Dr Jill Hamel is the ideal choice of author for the Otago volume. Through an active career that now extends for some 35 years, Jill has established herself in a line of distinguished field archaeologists of southern New Zealand which goes back through Leslie Lockerbie and David Teviotdale, under the general direction of H.D. Skinner, all the way to Walter Mantell. It was his excavations at the Awamoa moa-hunting site in north Otago, during the summer of 1852/53, that first brought the rich archaeology of the province to the attention of scholars. Jill also worked on sites of moa and moa-hunting, especially in the Catlins, and she was a pioneer in the application of ecological approaches to the elucidation of archaeological evidence in New Zealand. More recently, she has been instrumental through her work on the Protected Natural Areas and Pastoral Tenure Programmes, in bringing the recording and study of European historical remains up to essential standards of survey and description.

*The archaeology of Otago* draws substantially on this work. It focuses on the field evidence, as a good regional prehistory should do, but it also seeks to draw out the threads of the provincial pattern. Nicely balanced between Maori and European archaeological evidence, it is thoughtfully written in a narrative style which helps to keep the material in historical context. At the same time, Jill is concerned to open the contextual discussion to many facets of social and economic behaviour which can be inferred from the data. She also addresses some of the underlying issues of culture process, including coincidences of pattern before and after the advent of Europeans: people went for megafauna

and minerals in events separated by hundreds of years, but in a common manner that demonstrates the fundamental indivisibility of human motivation.

The book catalogues and illustrates the wonderful variety and abundance of historical remains strewn across the province of Otago—surely the richest archaeological landscape in New Zealand—and, implicitly, the commensurately heavy responsibility of their preservation and management. Issuing *The archaeology of Otago* in a new and handsome format is a just tribute to its author and a clear signal to its readership of the significance of archaeological studies to understanding New Zealand's historical development. I hope that in due course the whole regional series, including those already issued in rather stark departmental style, will appear similarly. A series of authoritative, well-written and attractively presented volumes, exemplified here by *The archaeology of Otago*, will be worth every bit of effort that goes into promoting the historical and heritage programmes of the Department of Conservation.

# Preface

This book has grown out of a need recognised by the Department of Conservation. The Department has to identify and actively conserve archaeological sites of high significance on the lands which it administers. The critical words are 'high significance', a trait which can be judged only if the nature of a site is understood. Some years ago the Department decided to commission reports for each conservancy 'describing the prehistory, history and the changing ways of life experienced by its people' (Sheppard 1989). This, along with descriptions of the full range of sites in the Conservancy, would provide a basis on which to judge the importance of those under departmental control. The first two reports prepared for the South Island were reviews of the archaeology of the Maori sites of Marlborough/Nelson and of Canterbury (Challis 1991, 1995). These had established a pattern which I was asked to follow in preparing a similar review for the Otago Conservancy.

It turned out that Otago was different from the other conservancies. For one thing, of the approximately 4,600 sites recorded in the Otago Conservancy, about 1,140 are Maori sites, but about 3,460 are European sites. Also a strong Dunedin tradition of archaeological research over the past 70 years means that Otago's sites have been particularly under the academic spotlight. The in-house Science & Research Series was not an appropriate vehicle for the massive amount of material that had to be reviewed in Otago, and the Department decided to produce the work as a stand-alone publication. It covers the archaeology of the Otago conservancy from the arrival of Polynesians in New Zealand in about the 12th century to the development of European settlements, roads, farms and gold mining in the 19th century. *The boundaries of the Otago Conservancy approximate to the old provincial boundaries, but do not include the upper Waitaki basin.*

The work is in two sections, the first dealing with Polynesian archaeology through to the protohistoric period, following a pattern similar to that of Challis (1995) for Canterbury; the second deals with the sites of early pastoral farming and the goldfields of Otago. The Challis pattern posed some problems, in that it was appropriate for the information about early sites, which comes mostly from scientifically excavated and analysed sites, but it was not so satisfactory for considering the information from the later sites. Our archaeological knowledge about recent Maori sites has been mostly derived from artefacts collected by 'curio' hunters and deposited—often poorly provenanced—in museums, and from accounts of the first European settlers. Detailed excavations of these sites have been relatively few and minor. For these, a site by site description proved more appropriate.

Maori traditional knowledge is not examined here as a body of work. Only where traditional material has been used by archaeologists in the past to elucidate archaeological or ethnographic patterns will that material be incorporated into the review. Traditional knowledge, as such, has been briefly summarised in the Natural Resource Management Plan (Ngai Tahu ki Otakou n.d.) and in the Otago Conservation Management Strategy, and is considered in

more detail in Dacker (1994), Evison (1993) and Anderson (1980b, 1988, 1998). Archaeological and ethnographic material on the one hand and traditional evidence on the other belong to two wholly different intellectual systems, the comparison of which requires a different approach from the descriptive/comparative one adopted in this review. Anderson (1980b) has shown the value to archaeology of exploring ethnographic and traditional evidence, and has produced a detailed ethnohistory of the Ngai Tahu (1998). His discussion, for instance, of Maori traditions about moa extinction show up the real problems of interpreting traditional material (Anderson 1989: 176). Much remains to be explored in the traditions of southern New Zealand, in order to relate archaeological sites to the spiritual and cultural world of the Ngai Tahu. Maori burial sites are not described, and the presence of human bone in sites is mentioned only where this is an integral part of past research on a large site.

The terms Archaic and Classic have had wide use and a complex history. When used for New Zealand Maori culture as a whole, with all its regional variations, their meanings become quite subtle, and do *not* refer to the same span of time throughout the country. Both terms are most satisfactorily used as describing an assemblage of adzes, fish hooks, and a life style, characteristic of a *phase* in a process of cultural change. Archaic has been used in the popular literature rather loosely and sometimes to mean less-advanced and undeveloped. (Considering just the complexity of Archaic adzes, this connotation is ridiculous.) Since this is a review of New Zealand archaeological work and literature, it would be false representation to drop entirely the concepts of Archaic and Classic Phases because of their unsatisfactory nature or even because of the value connotations in popular literature. The terms have been useful in the development of archaeological thought in New Zealand, and are used in this report in a limited sense, mostly derived from Golson's original definition (Golson 1959). The terms early and late refer to periods of time and are used throughout in that sense.

The second part of this volume deals with the archaeology of the second great wave of settlement in New Zealand, mostly by Europeans, but including substantial numbers of Chinese. Some of the 'Europeans' had lived and even been born in Australia and America, where cultures distinctly different from those of Europe had developed. The great majority of European archaeological sites in Otago were formed by goldminers, followed by a smaller, but interesting group comprising early farmsteads and early urban sites.

Recording European sites raises an argument about the definition of an archaeological site. The point that is difficult to interpret in the statutory definition[1] is the nature of archaeological methods. Several professional archaeologists have argued that these are not confined to digging in the ground, especially where European sites are involved. The description and analysis of standing structures are valid archaeological methods in most countries, but that has not been the case in most of New Zealand. In Otago this distinction has

[1] The definition of an archaeological site in the Historic Plaees Act 1993 says that it is '... any place in New Zealand that (a) either: (i) was associated with human activity that occurred before 1900; or (ii) is the site of the wreck of any vessel where that wreck occurred before 1900; *and* (b) is or may be able through investigation *by archaeological methods* to provide evidence relating to the history of New Zealand' (author's italics ).

been important because of our high proportion of European sites which are ruined buildings and structures, compared to the Maori sites which are mostly deposits and shapes in the ground. This in part is the explanation for the lack of archaeological interest in some of the industrial archaeology of Otago—its flour mills, freezing works and the old industrial buildings of the coastal towns—whereas the goldfields with their obvious archaeology have been a different matter. Recently the New Zealand Historic Places Trust has considered adopting the stance that a pre-1900 building or structure that has been abandoned and has little prospect of economic use shall be considered an archaeological site (Janet Stephenson pers. comm.).

Goldfields archaeology in Otago is founded on the largest and longest running archaeology project in New Zealand—the Clutha Valley Project—funded by the Ministry of Works on behalf of the New Zealand Electricity Department, as a mitigation for the loss of sites from the construction of the Clyde Dam (Ritchie 1990). Directed throughout by Neville Ritchie, it ran for 10 years (1977-1987), added 2000 sites to the Site Record file, and resulted in over 30 papers and a doctoral thesis by Ritchie and 17 papers by other authors. Surveys and excavations were carried out well beyond the confines of the area to be flooded, as far north as Lake Ruataniwha on the upper Waitaki power scheme and west to the Dart Bridge. There was a strong focus on investigation of Chinese sites, and many important Maori and natural sub-fossil bone sites were also reported.

The Department of Conservation had begun the Protected Natural Areas Programme in the early 1980s, focussing mostly on defining areas of high natural values on high country pastoral leases. At first the programme gave little attention to historic values, but as the implementation phases were reached in Otago and Southland, recreational, historic and landscape values were drawn in. Beginning in 1988, reports on the historic and archaeological values for those ecological districts with numerous pastoral leases were compiled. The process was overtaken by land tenure review of individual pastoral leases, and both programmes provided good opportunities to describe a wide range of historic sites, particularly those of early pastoralism and gold mining from early gold rush sites to the Depression mining of the 1930s. Copies of these reports, mostly by Hamel and, since 1995, by Bristow, are lodged in the Otago Conservancy and Head Office libraries of the department and in the library of the Historic Places Trust. Their public availability is similar to that of another important archive, the New Zealand Archaeological Association Site Record files, with some restrictions where negotiations with individual landowners are still in progress. (A number, such as S123/123, indicates a site record form.) These files and reports, as well as reports commissioned for the Otago Goldfields Park by the Department of Lands and Survey, and those of the Clutha Valley project provided most of the information on European sites.

# The archaeology of Otago

**by Jill Hamel**

ABSTRACT

The first Polynesian settlers of Otago, who probably arrived in the 12th century, settled at many places around the New Zealand coast and quickly colonised the whole of the Otago province. In the south, permanent villages were established close to rich patches of food resources such as seals and moa, especially along the Catlins Coast. Inland sites, for hunting moa or acquiring important stone resources such as nephrite and silcrete, were probably visited on a seasonal basis, as were specialised coastal sites for fishing or simple moa processing. Removal of the open inland forests by fire accelerated their natural reduction which had begun 2000 years ago, and contributed to the extinction of about eight species of moa and eleven species of small birds. The forests of the Otago coastline were reduced to those around the Dunedin hills and the Catlins coast. Hunting is likely to have been a factor in avian extinctions and the reduction of seal colonies along the coast. Material culture and fowling and fishing strategies show a strong continuity during a period of change in major subsistence activities to intensive fishing, especially for barracouta, preservation of birds and the production of kauru from cabbage tree roots and stems. This intermediate period in the 16th and 17th centuries is characterised by smaller seasonal camps and highly mobile groups. After about AD 1750, carefully planned gathering and processing of foods enabled the growth of coastal villages, which became places for permanent houses, the storage of preserved foods and a material culture linked to the development of chiefly status. Fortified pa sites became economically and culturally useful. With the arrival of Europeans, settlement patterns changed to take advantage of the trading opportunities presented by the new arrivals and to allow the rapid incorporation of the European potato and other vegetables into the traditional economic pattern. For the first 70 years though (1770–1850), the social pattern was basically Maori, and it was not until the growth of Dunedin and other coastal townships during the 1850s that the European way of life became dominant.

The first Europeans to be truly resident in Otago were whalers living at shore stations between 1831 and 1848. They were also the first storekeepers and farmers. Organised settlement began in 1848 with the Free Church of Scotland settlement at Dunedin and an influx of runholders, mostly from Australia. Runholders had built up flocks and begun to establish roads to their runs when the gold rushes of 1861 overtook them. Their large 19th century farmsteads are minor archaeological features compared to the massive changes made to the landscape by the alluvial miners. Otago is one of three major alluvial mining provinces in New Zealand and, because of its open landscape, its mining sites are the best preserved and most visible. Early gold rush sites with amorphous pothole tailings are scarce, but the next stage of long races, reservoirs and

ground-sluiced sites are well represented at Naseby and in the upper Clutha valley. Hydraulic sluicing and elevating by use of water under pressure in iron pipes was steadily developed from 1870 onwards, with major elevator systems built around the 1890–1910 period at Gabriels Gully and St Bathans. The most impressive sluiced site is at Bannockburn. Dredging of river beds and then adjacent flats was a major source of gold from 1890 up to the 1950s, with several important inventions developed on Otago dredges. Hard-rock mining was less important than alluvial in Otago, but the Bullendale mine was the site of the first industrial use of hydroelectricity (1886) in New Zealand. Chinese miners made an important contribution to gold mining as an industry, and the archaeology of their workings has added to our understanding of their culture as New Zealand Chinese. Miners left behind a legacy of mud and stone buildings which add a domestic dimension to the superimposed historic landscapes of Otago.

Keywords: Otago, New Zealand, Maori, archaeology, environmental changes, chronology, subsistence, rock resources, settlements, moa hunters, classic, protohistoric, continuity, European, Chinese, colonisation, whaling, farmsteads, gold mining, alluvial mining, hard-rock mining, sluicing, hydraulic elevating, dredging, hydroelectricity

# Part 1 The Prehistoric Period

# 1. In the beginning

> 'Polynesian settlement of New Zealand (c. 1000 years BP) led directly to the extinction or reduction of much of the vertebrate fauna, destruction of half of the lowland and montane forests, and widespread soil erosion. The climate and natural vegetation changed over the same time, but had negligible effects on the fauna compared with the impact of settlement. The most severe modification occurred between 750 and 500 years ago, when a rapidly increasing population over-exploited animal population and used fire to clear the land.' (McGlone 1989: 115)

There is an increasing body of evidence to show that the pre-human environment of Otago was very different from that recorded by Europeans in the early to mid 19th century. The information has been derived over the past 40 years from studies of past climates, present forest distribution, erosion cycles, fossil logs, pollen cores from bogs, forest dimples, cave and swamp deposits, buried podsols and charcoal in soils, as well as from analysis of middens and occupation deposits laid down by the first New Zealanders. A great deal of the environmental information is unambiguous, such as the increased rate of deforestation and the loss of breeding colonies of fur seals along the coast. Two sets of ideas, which are still subject to change as new research is carried out,are the *causes* of deforestation and the *timing* of ecological changes as derived from radiocarbon dating.

## 1.1 CLIMATE, DEFORESTATION, AND FIRE

A consideration of the causes of deforestation, particularly the effects of climate and fire provide useful background information on palaeoenvironments encountered by the first people to arrive in New Zealand.

The South Island has been described as a climatic jigsaw, where there can be a remarkable variability of climate over a short distance, even in the lowlands. This is especially true of Otago, where climates vary from the high-rainfall mountains of Glenorchy and west Wanaka to the semi-arid basins of Central Otago. The latter is the driest region of New Zealand, with the Conroys Gully rainfall station having the lowest mean annual rainfall for New Zealand: 330 mm for the period 1921–1950. Rainfall gradients are steep in both the western interior around Lakes Hawea, Wanaka and Wakatipu (400–2500 mm), and altitudinally (400–1240 mm) (Mark 1965). Rainfall gradients are also steep along the east coast from Inchclutha to Tahakopa, ranging from 'normal' annual rainfalls of 686 mm at Balclutha to about 1540 mm estimated for Tahakopa (Hamel 1977a: table 2.1). Therefore, anything dependent on rainfall is likely to be very differently affected in different parts of Otago.

The influence of storms on wind-throw of forests has become a matter of interest in discussions of deforestation over the whole of New Zealand. Grant (1989, 1994) has proposed a model for the last 2000 years of New Zealand's climate in which seven periods of increased warmth, increased rainfall, storms,

flooding and gravel deposition alternated with longer, tranquil, cooler periods when fresh erosion surfaces revegetated (Grant 1994: 177). Within the period of human occupation he postulates a period of high erosion and storminess around AD 1200–1350 and again between AD 1500–1600, with irregular periods of increasing storminess since AD 1800. His initial work was done in the Ruahines and he has carried out further work in the North Island and more recently in the South Island to test the model for New Zealand as a whole. In the South Island, however, Grant has recognised sediments from only one major period, the Waihirere (AD 1270–1350), about Kaikoura and near Christchurch (Grant 1994: 188). It seems unlikely that the periods dated for the North Island will apply specifically to the South Island, considering how differently the major weather systems affect the two islands. Analyses of rainfall deviations from normal show major differences between Westland, Canterbury and Otago and between these southern provinces and the northern, eastern and central North Island where highs and lows do show good correlation. (Long term trends in mean temperatures (Burrows & Greenland 1979: fig. 11) on the other hand do show good correlation nationwide.) Years of severe floods also show no correlation nationwide (Burrows & Greenland 1979: fig. 9, table 6).

Grant considers that erosion periods were correlated with both warmer temperatures and higher rainfalls, but Salinger's statistical analyses show that 'no general relationship exists between temperature and precipitation trends' (Salinger 1979: 113). Hence years of high temperatures and rainfalls in the North Island cannot be extrapolated to the South Island. This is confirmed by Burrow's flood data. Thus several separate analyses warn us that we should not apply research on North Island rainfalls and erosion events to Otago.

McFadgen has worked on shoreline sediments to produce models of depositional episodes along the North Island coasts and on D'Urville and Chatham Islands (McFadgen 1994). He considers these depositional episodes are linked to Grant's stormy periods, but since it can take hundreds of years for eroded material to reach the coast, this mechanism seems unlikely to apply to the basin topography of Otago (McGlone 1989: 122). The climatic variables discussed above also suggest that McFadgen's phases cannot be applied to the southern South Island. If Otago has experienced stormy periods of sufficient amplitude to cause widespread windthrow of forests since AD 1000, the evidence for the dates and amplitude of the erosive periods will have to be derived from the Otago sediments themselves, preferably from inland riverine deposits. Such investigations have so far proved complex (C. Landis, Geology Department, University of Otago, Dunedin pers. comm.)

It had been known since the 1860s that parts of Central Otago had in the past carried extensive forests in which totara was important. The early runholders used the logs they found lying in the tussock for fence posts and fuel, and pioneering botanists commented on them (Buchanan 1875). The first scientific investigation of semi-fossil logs, charcoals, forest dimples and buried podsols in Otago soils (Molloy et al. 1963) showed that podocarps, particularly Hall's totara *Podocarpus hallii*, and beech forest were once widespread over now treeless tracts of Otago. Most of the subfossil logs in Central Otago lay at elevations between 470 m and 1050 m on south-facing slopes. Egg-cup podsols (white and dark brown cup-shaped structures typical of forest soils), which can

be seen in road cuttings through the Catlins forests, have been found in the Lindis Valley and at the head of the Manuherikia Valley on the Hawkdun Range (Molloy et al. 1963: 73), in areas widely covered by an apparently pristine tussock grassland. Radiocarbon dating of soil charcoals and subfossil wood provided a wide range of dates, but it was concluded that much of the charcoal was the result of fires within the Polynesian era.

The 1963 work on forest indicators was later used to set up a model of Otago vegetation at the time of Polynesian arrival as consisting of a generally forested coastal region, open tussock basins in Central Otago, ringed by bands of forest between the altitudes of 500 and 1000 m with tussock grasslands at higher altitudes and a densely forested lakes region. Wells (1972) found evidence of a mixed forest of *Podocarpus hallii* and *Nothofagus menziesii* along the eastern face of the Pisa Range being present up to about the 12th century. Active regeneration from isolated stands of both species showed that this part of Central Otago is still capable of supporting forest, given sufficient freedom from fire (Wells 1972: 399). Refining of radiocarbon dating confirmed the conclusions of Molloy et al. (1963) (Appendix 1). The distribution of evidence for fires suggested 'a palimpsest of firing events extending into the pre-human era' (Anderson 1982a). Grant (1994) considers forest dimples to be good evidence for the prevalence of wind throw as a source of forest destruction, but they do not occur as widely as charcoals. Dimples can mark wind throw at an earlier stage than the last demise of a given area of forest, since dimples are well preserved in present-day beech forests (Alan Mark, Botany Department, University of Otago, Dunedin pers. comm. 1997).

Pollen cores from sediments deposited in bogs since the end of the last major period of glaciation have provided more detailed information on the vegetation history of Otago. The sites include Tahakopa Valley and Ajax Swamp in the Catlins, the Lammermoor Range, the Nokomai wetlands (two sites), Earnscleugh Cave and Shag River Mouth (Leslie & McGlone 1973; McGlone et al. 1995; Clark et al.1996; Boyd et al. 1996; McGlone et al. n.d.). Cores have also been taken from the Pleasant River and Karitane estuaries, but the data are not yet published (Ian Smith, Anthropology Department, University of Otago, Dunedin pers. comm. 1999).

Reforestation of Central Otago after the last glaciation was a surprisingly brisk process in geological terms. Even so it was not completed until 2000 years after podocarp-dominated forest began to occupy the Catlins region and Dunedin coastline (McGlone et al. n.d.). McGlone attributes this to the drier climate of Central in the early Holocene, an interesting indication of the long-term climatic difference of Central from coastal Otago. Evidence from near Mt Tennyson, Nokomai, indicates that this forest was at first dominated by the conifer species which are favoured by warm moist conditions such as matai (*Prumnopitys taxifolia*) and kahikatea (*Dacrycarpus dacrydioides*), but after the mid Holocene there was an expansion of the hardier species—rimu (*Dacrydium cupressinum*), bog pine (*Halocarpus bidwillii*), celery pine (*Phyllocladus alpinus*) and beech (*Nothofagus* spp.). The rise of rimu and beech was a regional event throughout Southland and Otago, and suggests a wetter and cooler climate (McGlone et al. 1995). From about 3000 years ago the occurrence of beech and grass pollen and microscopic fragments of charcoal increase

and celery pine and matai pollens decrease. McGlone interprets this as showing that widespread fires were already destroying the drier lowland forests to the east at that time (McGlone et al. 1995: 10). Other sites in Eastern Otago confirm that the replacement of lowland podocarp forest by grassland was well under way by 2000 years ago. Considering that beech and rimu remained abundant and that peat accumulation continued at the high altitude site at Nokomai, McGlone et al.(1995) consider that rainfall remained high overall, but prolonged episodes of severe summer drought and drying fœhn winds became increasingly common by 2500–2000 years ago. Beech would also have been favoured by disturbance of forest from blow-downs caused by increased storminess. This pattern fits in a general way with Grant's warm erosion periods, without confining them to any given centuries.

At a level in the Nokomai bog dated to 553 ± 82 years BP (NZA541), i.e. about AD 1400, the occurrence of charcoal increases sharply to very much higher values than previously, and stays high to the top of the bog. The occurrence of bracken (*Pteridium esculentum*) rises sharply and then declines in percentage terms as grassland species spread and probably confined the bracken to the lower-altitude sites and deeper soils where it thrives. The podocarps and silver beech declined to much lower levels than previously, but levels of pollen likely to have come from the thick mountain beech forests to the west increase strongly. These changes represent an increased frequency of fires, presumably started by Polynesian colonists, that destroyed nearly all the lowland forests of the area, except for gully remnants of mostly beech (McGlone et al. 1995: 10). This was a New Zealand-wide pattern, dating mostly to about 650 years ago (McGlone 1983). In the dry Central Otago climate it is more difficult to be certain these fires were anthropogenic (Anderson & McGlone 1992). The continuing high frequency of bracken spores in the pollen cores after about 800 years ago is a distinctive feature which was not associated with earlier fires, and it is considered that this indicated regular and widespread fires started by Maori to maintain the bracken stands, provide open ground for cabbage trees, and clear useful lines of travel (McGlone 1983). The growth of the sphagnum bogs at Nokomai in the upper layers also indicates that fires may have spread well above tree-line, thinning the previously dense water-retaining vegetation and delivering more water to the bog complexes.

The coastal regions of Otago, especially the Catlins, have a wholly different climate from Central Otago, but the pollen analyses of sites along the coast show the same general pattern as inland. McGlone et al. (n.d.) have analysed cores from both an upland bog (Ajax Swamp) and a valley floor bog (Stott's Bog). Charcoal frequencies are very low at both, but become abundant in the uppermost zone, dated from about 700 years BP (661 ± 61, NZA3489) to the present. At Ajax Swamp, which would have been more susceptible to fires started in the drier inland region, bracken and grasses become much more abundant in this zone, and the occurrence of tall conifers decline. On the valley floor, as might be expected from the historic records of the Catlins forests, tall conifers, particularly rimu, maintain much the same abundance as they had throughout the previous 4000 years.

A thousand years ago the coastline of Otago would have been mostly forested as far as the eye could see inland. The composition of these forests probably varied

from north to south, but even on the drier northern hills podocarps such as matai and rimu show up strongly in pollen core analyses. Three short cores taken from near Shag River Mouth indicated that, at the time of the first human settlement, the adjacent hill forests included matai, rimu, totara (*Podocarpus totara/hallii*), miro (*Prumnopitys ferruginea*), and tree ferns, with kahikatea and ribbonwood (*Plagianthus regius*) on the alluvial terraces and a dense shrubland of coprosmas, *Muehlenbeckia australis*, bush lawyer (*Rubus* spp.), and daisy shrubs on the adjacent salt marsh (Boyd et al. 1996). Some pollen cores show that these northern forests were beginning to open into a mosaic of forest, shrubland, and grassland, similar to Central Otago.

Palaeovegetation and fossil fauna studies of the past 25 years have confirmed the view held in 1963 that throughout Central Otago natural fires of the previous 2000 years had established a mosaic of open dry forests, shrubland, and grasslands in the drier basins, with bands of beech, matai, miro, and totara forests on the surrounding hill slopes and gullies (Clark et al. 1996; Worthy 1998). The steep rocky faces of the Clutha gorges are likely to have carried dense shrublands, including kowhai, with taller forest in the gullies. The lower timberline would have extended down to 500 m on south facing slopes, with dense stands of manuka (*Leptospermum scoparium*) and kanuka (*Kunzea ericoides*) on the drier north slopes. Wherever natural fires had been relatively frequent during the late Holocene, beech forest would have expanded at the expense of podocarp forests. The Nokomai pollen cores (McGlone et al. 1995) indicate rapid spread of beech forest in this district from 3000 years ago. If natural fires had been low in frequency in the inland basins during the two or three centuries prior to the arrival of Polynesians, the latter would have found these basins covered with open forests and dense shrublands, with relatively few open tussock areas other than on the driest flats and above the tree line. The evidence from pollen core analyses is corroborated by small bird bones identified from assemblages excavated from Earnscleugh Cave and sites in the Cromwell Gorge (see below).

The distribution of natural deposits of moa bone—found at the time of European exploration (1850–1870) *around* the Maniototo Plain, Moa Flat, and the Manuherikia Basin, but *never* out on the open plains—suggested to the early settlers that the moa was a grassland bird (Anderson 1982a). Recent work indicates that most moa species were forest and shrubland birds, with the greatest concentration of species in open forest and shrublands (Anderson 1989: 59; Worthy 1998). The presence of entire skeletons lying where they apparently died among the low hills and terraces of edges of the plains suggests a mixed shrubland and open forest vegetation right to the edge of the plains prior to AD 1350. Anderson (1989) also correlates the distribution of moa-hunting sites with soil and rainfall distribution; showing a relatively high frequency of sites on yellow-grey earths, rather than on the drier brown-grey earths, and within the 500–800 mm precipitation band. These are environments which could carry open forests and shrublands.

The western lakes district was undoubtedly heavily forested, mostly with beech species and stands of podocarps around lake edges (Trotter 1970). Under a lighter fire regime the treeline was probably higher than at present. Shrublands

and grasslands would have been confined to above the treeline and to minor areas of disturbed soils along river and lake margins.

Worthy's analysis of fossil bones from swamps, pitfalls, and from the ancient roosting sites of falcons and the extinct owl confirmed these patterns. The fossil fauna of Central Otago contained moa species typical of upland and open habitats and other species such as kiwi, kokako, robin, and saddleback typical of forest and tall scrub, indicating a mosaic of habitats. Worthy interprets the dominance of *Emeus crassus* in North Otago as indicating large areas of swampy habitat there in the past (Worthy 1998: 477).

In the forested parts of Otago, cabbage trees (*Cordyline australis*) would have been confined to steep rocky slopes or open boggy shrublands where they were free of shade from taller trees. The higher pH of limestone areas also favours them, and the limestone cliffs of North Otago, as well as the swamps, may have carried numerous stands. There is an interesting occurrence of *Cordyline* pollen in both pollen sequences from Shag River Mouth. *Cordyline* pollen appears at the beginning of the sequence from a site close to Shag River Mouth and disappears in the next zone, which can be interpreted as showing localised human disturbance. At a site about 1.5 km from Shag River Mouth, *Cordyline* appears intermittently throughout the sequence, but declines in the upper layers which are interpreted as showing widespread destruction of forest by fire (Boyd et al. 1996). The more open forests and shrublands of the inland basins would have provided patchy habitat after about 3000 years ago. Cabbage tree seeds are readily spread by native pigeons which feed on them vigorously, and it is likely that the species spread reasonably rapidly into suitable habitat after fires had reduced the forest canopy. Bracken was probably confined to the deepest alluvial soils along river margins, before more frequent fires provided suitable disturbed habitat.

Since McGlone wrote the paragraph quoted at the beginning of this chapter, accumulating evidence has mostly supported his statements. He deferred in 1989 to the support that archaeologists then gave to a date of AD 1000 for the arrival of Polynesians, but he kept asking us why did Maori suddenly increase the use of fire around AD 1250. The next chapter supplies a likely answer to his question.

## 1.2 THE DATE OF THE FIRST HUMAN SETTLEMENTS

The date of arrival of human beings in New Zealand has been a contentious issue for over 150 years. Since most of the useful evidence suggests that Otago (Fig. 1) was settled by Polynesians at around the same time as the rest of the country and many Otago dates have been used to test settlement hypotheses, I will consider here the evidence for New Zealand as a whole.

At present there are three, separate, contending hypotheses, known as the Early Hypothesis, the Orthodox Hypothesis and the Short Prehistory. For the Early Hypothesis, Sutton (1987) suggested a date between 0 and AD 500 and that there was a flow of immigrants up until AD 1500. This was based partly on a re-

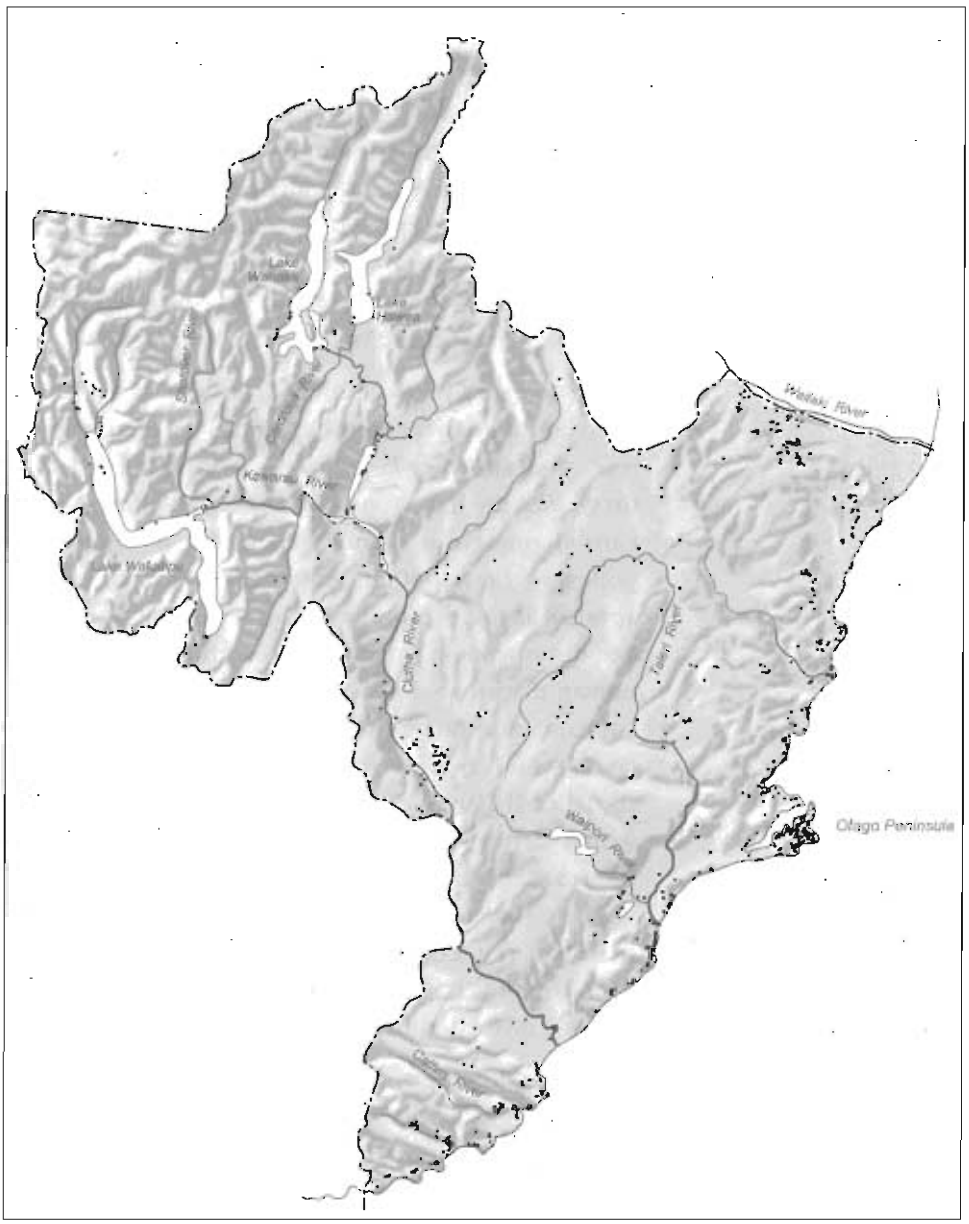



Figure 1. Distribution of recorded Maori archaeological sites in the Otago Conservancy (data from the New Zealand Archaeological Association site recording scheme).

analysis of the colonisation of the islands of tropical Polynesia and dissatisfaction with the large suite of conflicting radiocarbon dates available for New Zealand. [Holdaway's (1996, 1999) dates of more than 2000 years ago from *Rattus exulans* bones are not used to support the Early Hypothesis, since Holdaway assumes transient contact only brought the rats at this early stage.] Dating of various environmental disturbances, including accelerated anthropogenic erosion, have been used to support early colonisation (Chester 1986; Elliot & Neale 1995). McGlone & Wilmshurst (1999) point out the difficulties encountered in dating lake and swamp deposits which are at risk from contamination with 'old' carbon, compared to bog deposits. In a list of pollen sites which have dates for the onset of Maori deforestation, they show that dates prior to AD 1200 are from sites at risk from contamination, and they provisionally accept the Short Prehistory.

The Orthodox Hypothesis accepts that there is a satisfactory suite of radiocarbon dates for early sites around the whole of New Zealand, centred on the 11th century, and, assuming there were only a few immigrants, that

colonisation must have occurred about AD 800 to have allowed time for population increase, discovery of obsidian and other stone sources, and development of a trade network (Davidson 1984). Both the Early and the Orthodox Hypotheses assume that pre-11th century sites will be too small to find and that early horticultural activity in the North Island could be confused with natural fires and non-cultural change in pollen cores. Both these assumptions suffer from the disadvantage that moa and seal hunting sites, even those created by small groups of people, leave substantial traces of large fires and large bones. Since no sites have been securely dated as earlier than the 11th century, and it is unlikely that the first arrivals would have ignored seals and moa for several centuries, the Orthodox Hypothesis is no longer favoured.

The Short Prehistory, starting about AD 1150, has received strong support in the last decade from refinement of radiocarbon dating. Anderson & McGovern-Wilson (1990), Anderson (1991a) and Higham & Hogg (1997) have established protocols for rejecting radiocarbon dates, and McFadgen et al. (1994) have improved our understanding of the effects of calibration curve variations and their interaction with the standard errors of radiocarbon dates. Work on the extinct avifaunas of the Pacific (McGlone et al. 1994) and intensive excavation of the large early site at Shag River Mouth (Anderson et al.1996a) have improved understanding of early subsistence strategies and population growth.

The culled radiocarbon chronology (Anderson 1991a: 785) provided an impressive array of reliable dates centred on the 14th century and a few reliable dates centred on the 12th century. More South Island dates were tested and more were found to be reliable than from the North island. Higham & Hogg (1997) assessed material measured at Waikato University and confirmed Anderson's findings, showing that acceptable early dates clustered in the 13th and 14th centuries and none extended back beyond AD 1250. They also assessed a much higher proportion of North Island sites than South Island ones, but still found very few early North Island sites. This may be an effect of the way in which samples were taken and treated in the two islands, but so far the evidence suggests that there was a focus of population and settlement in the South Island.

The orthodox view of the time needed for the growth of a sufficiently large population to have created all the large sites around the southern coasts is answered by Anderson's arguments for transient villages of only 20–50 years duration. Rather than many sites occupied at one time, the large sites were occupied one after another. These are seen as part of 'a pattern in which base settlements were focussed on localities rich in moa and seals, rapidly depleted these preferred resources, and responded to developing scarcity by moving on to other areas largely untouched by prior human exploitation' (Anderson & Smith 1996b: 290).

Early radiocarbon dating was carried out by Lockerbie (1959) to date excavations at Hawksburn, Papatowai, and Pounawea. Many more dates were obtained for Otago sites before it was realised that the charcoal from long-lived species gave spurious dates. Culling of charcoal dates has been based mostly on the removal of the latter, as well as of all unidentified wood.

Shell dates and moa collagen dates had been little used in Otago sites until the Shag River Mouth excavation, where moa collagen proved to give variable dates for unknown reasons (Anderson et al. 1996b: 66). During the Shag River Mouth

work, samples of charcoal, bone, and shell were collected wherever possible from the same square of each stratigraphic unit in each excavation, in order to provide comparable dates on each material. Moa eggshell was also collected for some groupings. Samples were pre-treated in consistent ways, and dates were calibrated using the programme CALIB 3.0.3 from the University of Washington (Anderson et al. 1996b: fig. 7.2). The corrected and calibrated dates from charcoal, cockle, pipi and blue mussel shells, and moa egg shells were statistically indistinguishable from one another (Anderson et al. 1996b: 65). The 14 dates on charcoal from short-lived species listed in Appendix 2 give a pooled mean (A'p as defined by Ward & Wilson 1978) of 620 ± 13 years BP [cal. AD 1s 1330–1346 (0.56), 1393–1408 (0.47)].[1] At Shag River Mouth, calcium from local limestones incorporated into shells had not affected the dates, but further work may be needed to determine if this holds true for other Otago estuaries.

Rat (kiore, *Rattus exulans*) bones from Shag River Mouth have also been used to show that there have been technical problems with the dating of kiore bones from natural deposits such as those used by Holdaway (1996). Rat bones from natural deposits and from Shag River Mouth were dated by AMS radiocarbon determinations on collagen at the Rafter Laboratories, Lower Hutt, and produced dates of more than 2000 years ago. Rat bone collagen from the same layers at Shag River Mouth, which were given a different pre-treatment at the Oxford Research Laboratory, produced dates closer to the main suite of dates from Shag River Mouth than the Rafter Laboratory dates (Anderson 1996). Further testing of inter-laboratory differences using rat bone from Pleasant River (Anderson & Smith 1998: 90) showed that bones which appeared to be from the same animal and which were sent to two different laboratories gave dates 500 radiocarbon years apart. The date from the Oxford Laboratory (OxA6744) fell within the expected range and that from the Rafter Laboratory (NZA6532) was 500 radiocarbon years older.

An isotopic analysis of modern kiore bone and items of rat diet from five different habitats on Kapiti Island showed that the bones were not in equilibrium with atmospheric values of radiocarbon and that their diet was the likely source of the divergence. Bones from rats that were probably consuming sea foods produced older dates (Beavan & Sparks 1998).

Even before Beavan & Sparks (1998) carried out their isotopic analysis, it was apparent that the early rat bone dates were not philosophically acceptable as indicators of the date of Polynesian settlement. If the relatively few divergent dates on rat bone from Shag River Mouth were accepted in preference to the suite of dates on other materials, this would have implied that acceptable dates from other early sites in New Zealand and similar types of sites in East Polynesia (involving results from 12 different radiocarbon laboratories) were wrong. Other robust hypotheses concerning vegetation change, linguistics and physical anthropology would also be upset. Beavan & Sparks (1998) have suggested ways in which the divergence due to diet can be managed in the processing of material for dating. If, when these problems have been solved, it is shown that rats did arrive at an early date, their arrival here cannot easily be attributed to arrival and settlement by Polynesians. Holdaway (1999) accepts

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[1] Some conventional dates quoted in this report differ from previously published figures, having been derived from more recent data bases of the laboratories involved.

that rats were probably brought by transient visitors, and the focus of interest will be their effect on vulnerable indigenous plants and animals.

Discrepancies in rat bone dates could be due to diet, post-mortem contamination of the bones, quality of bone preservation, or differences in pre-treatment procedures in laboratories. Since so much more is now known about factors which can give rise to discrepancies in dates from rat bones, it would be useful to re-collect and date a range of bones with good stratigraphic provenance from the natural sites which produced controversial early dates prior to 1996. An examination of how criteria for dating rat bone has developed over the past six years should provide a better set of procedures for the reliable dating of other novel materials.

On balance, radiocarbon dating and environmental analyses support a Short Prehistory starting about AD 1150, with the establishment of transient villages, especially along the southern coasts of the South Island. The problems which such a late date suggests with respect to traditions, settlement patterns and population dynamics will need to be explored.

# 2. Natural resources

## 2.1 MOA HUNTING

### The birds themselves

Moa have been a source of many surprises, a major one being that they should have evolved on islands rather than on a continent and that there were so many species. New Zealand seems to have been 'the locus of a grand experiment in evolution' (Oliver 1949: 1). The bones of the different species are difficult to distinguish, and grade in size between species. Previous taxonomists have distinguished many species (Scarlett 1974), but recent workers such as Cracraft and Worthy have reduced these to a manageable 13, of which 6 had major populations in Otago and 3 (*Anomalopteryx, Pachyornis australis,* and *Dinornis novae zelandiae)* were rare (Worthy 1998). Only three species, though, were hunted in large numbers by the Maori (*Pachyornis elephantopus, Euryapteryx geranoides*, and *Emeus crassus*).[2]

Nearly every swamp in Otago and many alluvial deposits have yielded moa bones. Natural sub-fossil bone is occasionally mixed with midden material, especially in rock shelters. Analysis of the *abundance* of each species in sites has enabled Worthy to suggest their habitat preferences. He considers that it is likely that the three *Dinornis* species were found in forests at different altitudes. *Pachyornis elephantopus* was widely distributed except in wet tall forests and high-altitude shrublands. *Euryapteryx geranoides* preferred dry inland shrublands and forests and *Emeus crassus* the coastal areas and swamplands. *Anomalopteryx* preferred wet lowland forests and *Megalapteryx* montane to subalpine habitats (Worthy 1990, 1998).

These habitat preferences were defined for New Zealand generally; in Otago there is some variation. The two common *Dinornis* species were widely distributed with little altitudinal variation, and were less common on the east coast and in inland middens. *Pachyornis elephantopus* was the dominant species in a large assemblage from a Paerau swamp (upper Taieri River) and less common in the North Otago swamps. It is, however, widely distributed through all Otago middens. It was the third most abundant in numbers at Waitaki Mouth and Coal Creek, and fourth most abundant at Pounawea and Papatowai (Anderson 1989: appendix D), but it is doubtful whether or not it was even present at Shag River Mouth (Anderson et al. 1996c). *Euryapteryx geranoides* and *Emeus crassus* are the two most abundant species in midden deposits in Otago, with *Emeus crassus* by far the most abundant moa from natural deposits in North Otago (Worthy 1998). *Anomalopteryx* is rare in Otago middens, and judging by natural deposits it was confined to the forested regions of the Wanaka area (Worthy 1998). *Megalapteryx* is an upland moa in Otago (Worthy

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[2] Writers prior to about 1985 would have used the following synouyms, some of which are approximate only and marked ≠. *Dinornis maximus = D. giganteus, D. robustus ≠ D. novaezealandiae, D. torosus ≠ D. struthoides, Euryapteryx gravis = E. geranoides.*

1998), and so rarely occurs in middens which are mostly lowland. At an unusual site in a cave in Takahe Valley, Fiordland, it was the only moa taken. Its bones have been found in the Aviemore sites and at Hawksburn as might be expected, but its occurrence at Pounawea and Papatowai may be due to a misidentification (Anderson 1989: appendix D).

## The camps and villages of those who hunted moa

The evidence of moa hunting varies from a single bone among charcoal in a rock shelter to very large numbers of birds at well-documented sites such as Shag River Mouth and Papatowai (Appendix 3). Anderson's (1989: 131 ff.) summary of about 100 moa hunting sites in Otago divides them into coastal and inland sites. The list includes all known sites where moa bones or egg shell are associated with occupation material which may be in the form of charcoal and/or flakes and other artefacts. Other information used here includes a table from Anderson (1982a) and a table of species identified from 37 sites (Anderson 1989: appendix D).

A map of moa hunting sites (Fig. 2) shows the coastal/inland division is a valid distinction, since there is a dearth of sites in the coastal hills. Coastal sites of Otago with evidence of moa hunting fall into two major groupings—the dense band of sites along the northern coasts from Brighton to Oamaru and a smaller group on the Catlins Coast. Both include large and small sites, many of the larger sites lying at the mouths of rivers, e.g. Waitaki, Awamoa, Shag Mouth, Pleasant River, Kaikorai Estuary, Kaka Point, Pounawea and Papatowai. The other large to medium sites (Tai Rua, Warrington. Harwood, Papanui Inlet, Cannibal Bay, and Hinahina) are either on open bays or well inside estuaries. The small sites along the coasts were mostly in some sort of shelter rather than on headlands, but some sites were relatively open to the weather, e.g. Papatowai (Hamel 1977a) and Kaikorai Mouth (Harding 1957).

The four sites which have contributed most to our understanding of the moa hunting period are Papatowai, Pounawea, Shag River Mouth and Waitaki River Mouth. Pounawea has been destroyed by river erosion and Waitaki River Mouth badly damaged by ploughing and marine erosion.

Shag River Mouth has provided the most information from the large integrated research programme carried out by the Department of Anthropology, University of Otago, from 1987 to 1995 (Anderson et al.1996a). Careful examination of the 3 ha site (Fig. 3) showed that the volume of midden deposited was about 15,000 $m^3$, of which less than 1% was excavated during the 1990s work. The distribution of midden over the sand spit was patchy, but totals of bones and artefacts for the whole site were estimated from the excavated material. Excavations, totalling 114 $m^3$, were placed across the whole of the site, which lies on a sand spit adjacent to an estuary and rocky shorelines.

Intensive radiocarbon dating showed that the site was occupied for about 20–50 years in the 14th century. Pollen analysis was used to demonstrate that the adjacent hills were covered by a forest dominated by matai and totara with ribbonwood and kahikatea beside the river and areas of dense shrublands around the salt marsh. Midden analysis indicated that the rocky shoreline had one or more flourishing fur seal breeding colonies, as well as numerous blue penguins, and colonies of Stewart Island and spotted shags. The forests carried a

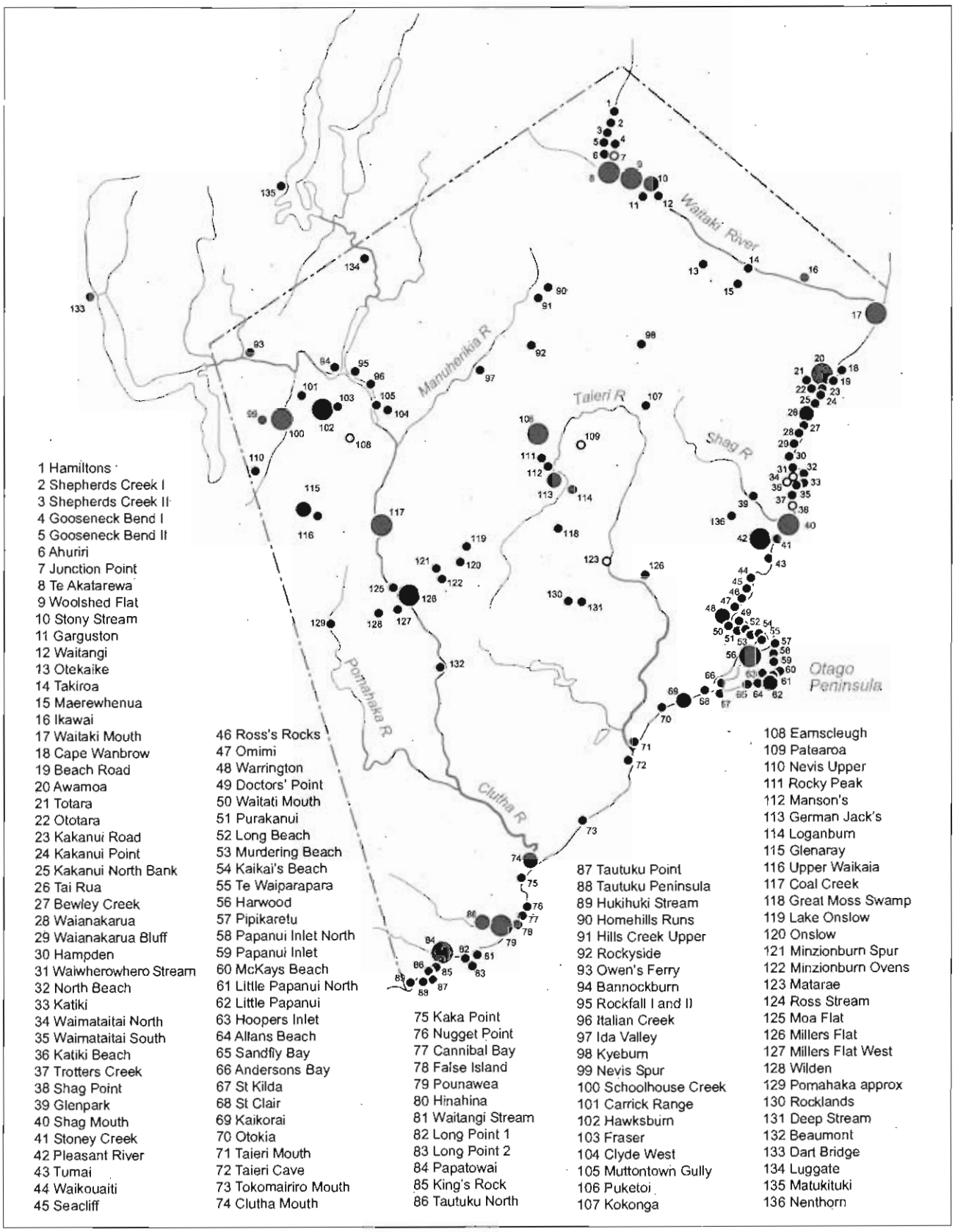



Figure 2. Distribution of large, medium and small moa hunter sites (indicated by dot size) in Otago (after Anderson 1989: figs 9.1 and 10.1). The open circles are sites where there is a possibility that the moa bones are natural. Only 106 of the 132 sites shown here are known as archaeologically recorded sites (see Appendix 3).

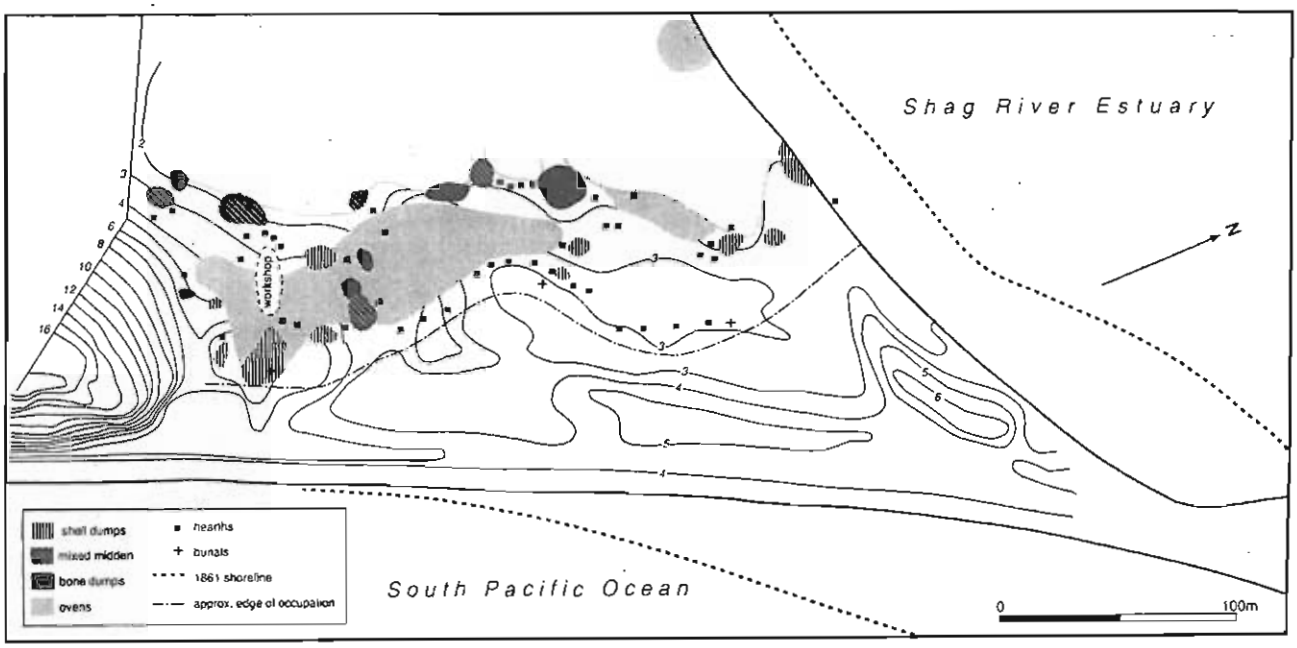



Figure 3. Plan of the moa hunter village at Shag River mouth in the mid 14th century. (Reproduced with the permission of ANH Publications, ANU, from Anderson et al. 1996: fig. 20.1.)

full suite of moa species from the medium sized moa (*Emeus crassus* and *Euryapteryx geranoides*) to the larger ones (*Dinornis* spp.), as well as the smaller forest birds. Some open grassy areas were rich in the now extinct New Zealand quail. At sea not only large numbers of barracouta and red cod were taken, but also shy mollymawks.

The excavations produced 57 silcrete blades, but there may have been more than 6,000 in the whole site. Other important artefacts found were 19 complete adzes, 59 drill points, 168 fish hooks, 59 awls, and as wide a range of other tool types as found anywhere in prehistoric New Zealand. The faunal material excavated included the remains of up to 70 moa, 57 fur seals, 76 dogs, 510 small birds, 1,442 fish and about 75,000 shellfish. The site as whole was estimated to have contained the remains of between 3,300 and 9,240 moa and similarly large numbers of the other groups. From the presence of 44 hearths, it is estimated that a population of 100–300 people consumed the 1000 or so tonnes of meat from these animals, supplemented by starch from bracken rhizomes and cabbage tree stems.

An important finding from Shag River Mouth was that, though the site was occupied for such a short time, change in subsistence could be detected. The lower layers included more of the larger moa than the upper layers did. The weight of meat from moa and seal dropped dramatically and the amount from fish rose equally dramatically at the time when the upper layers were deposited, and there was a marked increase in the occurrence of shellfish. Among small birds, a lower proportion of shoreline birds compared to open country birds, particularly quail, were deposited in the upper layers. A reduction in megafauna seems to have initiated a shift to another site close to other unexploited populations of moa and seals (Anderson & Smith 1996a).

Waitaki River Mouth. The numerous ovens of the site appeared after ploughing of the terraces near the former course of the river. They form a curve of darker soil from the bottom to the top of the photograph, with various outliers.

*Photograph: Hardwicke Knight, Dunedin, 1959*

The largest site of all, Waitaki River Mouth, was estimated in the 1930s to cover an area of about 50 ha, and, taking into account present rates of erosion by the sea, may have originally covered twice that area (Teviotdale 1932; Anderson 1989: 131). It is quite different from all other sites in Otago, in that it comprised over 1200 ovens scattered in groups of three or more over gravel river terraces. When first ploughed, the ground was white with moa bone. No deep stratigraphy was recorded by Teviotdale (1939b) who carried out the main excavations there. The site also differs from other coastal moa hunter sites in that it has neither large numbers of seal, fish, and bird bones, nor vast heaps of shell midden. The local landowner found impressive numbers of adzes, mostly in buried caches, which have been recently catalogued and reported on by Turner (n.d.). Teviotdale and Anderson considered that Waitaki Mouth was not a permanent settlement, but rather a repeatedly occupied campsite for butchering moa (Anderson 1989). Turner considers that the artefactual evidence is sufficient to support a concept of permanent settlement (Turner n.d.).

By contrast, Papatowai and Pounawea were much more like Shag River Mouth, with indications of short occupancy (Anderson & Smith 1992), deep

stratigraphy of shell mounds and black layers with abundant bone, exploitation of seal colonies as well as of moa, and a wide range of abundant artefacts (Hamel 1977a). Anderson (1989) provides the fullest analysis in the literature of Waitaki River Mouth and useful analyses of sites between Waitaki Mouth and Papatowai. Extra details are provided on Pleasant River, Warrington, Harwood, Little Papanui, Pounawea, and Papatowai (Anderson 1989: 134 ff.).

Two other sites also deserve attention: Cannibal Bay and Papanui Inlet. Among Otago moa hunting sites, Cannibal Bay was probably second only to Waitaki River Mouth in extent, covering about 18 ha of sand dunes, sheltered from the south by the peninsula of False Island. It appears to have been largely destroyed by wind erosion with layers of blackened sand, bone, shell, and flakes in every hollow. The finding of such artefacts as a necklace of 19 bone reels with a burial (Lockerbie 1959: 88), and the area covered by the site, indicate that this was an early occupation site. Faunal material identified shows the exploitation of seals, moa, at least six species of forest and shoreline birds, barracouta in large numbers and six other fish species. The evidence places the site with Pounawea and Papatowai rather than Waitaki Mouth. Another major moa hunting site lies well inside the mouth of Papanui Inlet on the outer side of Otago Peninsula, a location similar to that of Pounawea. No materials from this site have been analysed, but surface material eroding from the edge of the site indicate that it is a large moa hunter site.

It was the analysis of Shag River Mouth site that indicated that many of the coastal moa hunter sites were true villages—occupied the whole year round and for a number of years. Anderson & Smith (1996a) consider that Papatowai, Little Papanui, Warrington, and probably Pounawea, Hinahina, and Harwood fall into this category. Cannibal Bay and Papanui Inlet also have similar characteristics: large in area, with burials, dwellings, abundant and varied artefacts, extensive middens, and established close to seal colonies (Anderson & Smith 1996a). Smaller sites along the coast are considered to be campsites associated with nearby villages. Purakaunui seems to have been a specialised fishing camp which, judging by a revised calibration of radiocarbon dates (Ian Smith, Anthropology Department, University of Otago pers. comm. 1998), was slightly later than the large village at Shag River Mouth, i.e. 15th century (Anderson 1981a, 1981b; Anderson et al. 1996a). Pleasant River, though a campsite, was not so specialised, since a broad range of species (moa, seals, small birds, dogs, and fish) were being consumed at brief campsites there at any time of year in the 14th to early 15th century. By the 16th century the site had become mostly a fishing camp, used only in summer and less often than in the previous centuries (Smith 1999).

Inland moa hunting sites are also well described by Anderson (1989: 143 ff.). They include several large sites, such as Millers Flat and Coal Creek on the Clutha River, Hawksburn and the lower Nevis on tributaries of the Clutha and Puketoi on the upper Taieri River. Many have been badly damaged, e.g. lower Nevis (George 1937), Millers Flat, and Coal Creek. Smaller sites are widely scattered, mostly along waterways, with a few spectacular high-country exceptions such as one at Lake Onslow and the Glenaray site on the Old Man Range (Anderson 1980a). A site at the head of Lake Wakatipu, near the Dart River Bridge, indicates how extensively moa was hunted. Four of the inland

sites have been excavated and analysed in the last 15 years—Hawksburn, Coal Creek, Dart Bridge, and Owens Ferry. The first two of these sites contained very large quantities of burnt and crushed moa bone, but at the latter two only a few moa had been cooked. At Hawksburn five species were identified on the broken bone (Worthy 1998: 432), which was considered to represent up to 400 ± 50 birds. At Coal Creek there were seven species represented by 18 birds in the small area excavated. Among the nine individuals in the midden at Owens Ferry, seven different species were present (Anderson 1989). At Dart Bridge the bone was burnt and fragmented and only two individual moa of two different species were distinguished (Anderson & Ritchie 1986). All four of these were butchery and occupation sites.

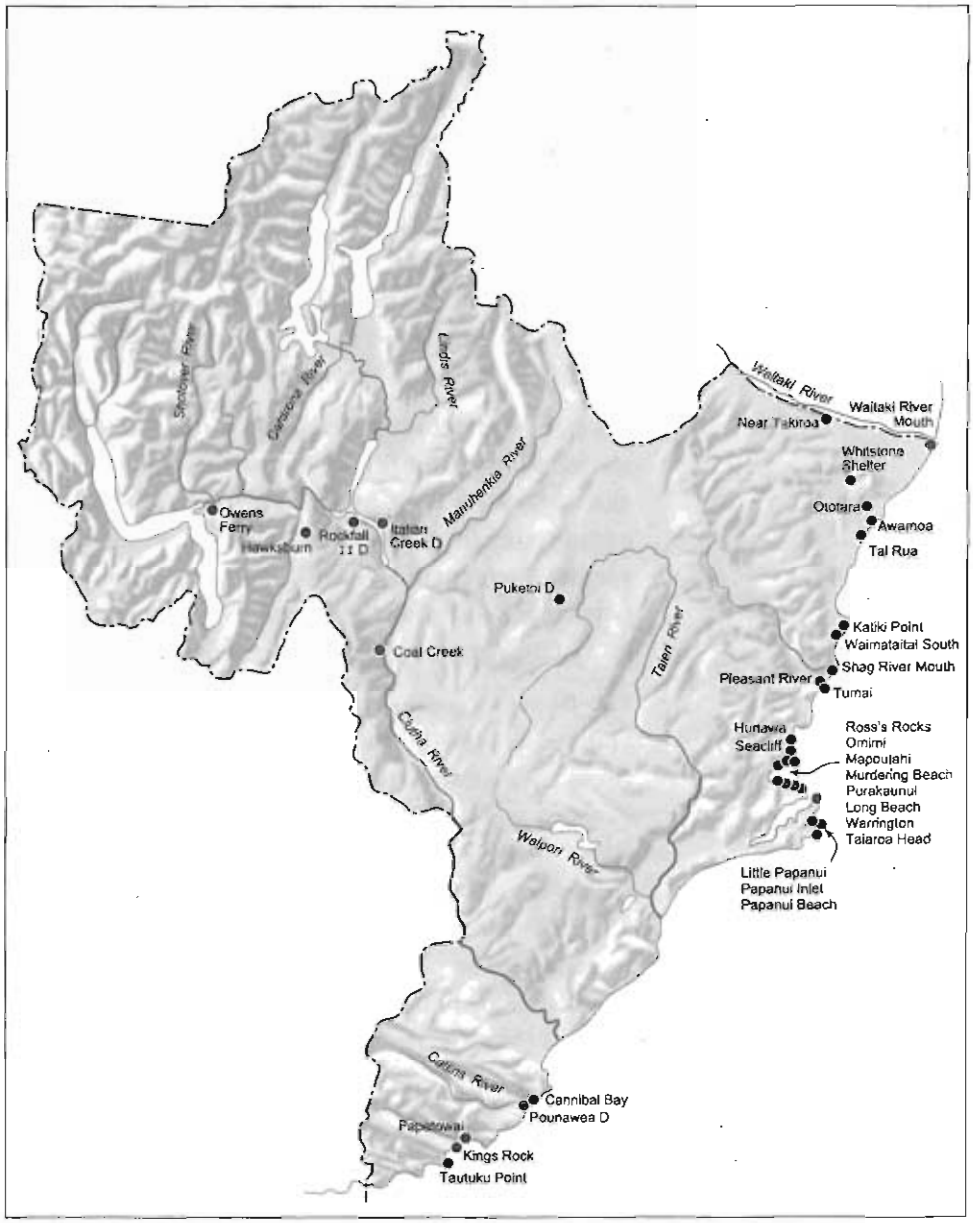
## 2.2 BIRDS OTHER THAN MOA

At any coastal Otago midden where small bird bones have been identified, the evidence indicates that they were hunted opportunistically, resulting in middens containing many species, each represented by only one or two individuals. Relatively few species seem to have been hunted deliberately and, compared to a fish species such as barracouta, numbers and meat weights were low. Birds were taken from a wide range of habitats with some emphasis on shoreline birds, such as shags and penguins, in a few sites, e.g. Long Beach (Site Record I44/23) and Pounawea (H47/1). Compared to moa, fish and seal, small birds were a minor part of diet, and there may have been as much interest in feathers as in flesh. Shag River Mouth (J43/2) and Long Beach are the only sites analysed in Otago which show some signs of focus on a few species. In southern New Zealand, McGovern-Wilson (1986) distinguishes only four other specialist sites—Tiwai Point, Southport 1, Southport 4 (Chalky Inlet) and Lee Island (Te Anau). Sites from which small bird bones have been identified are listed in Appendix 4. Worthy (1999) provides a similar list for the whole of New Zealand.

The frequency and distribution of terrestrial species that are now extinct or much more limited in range provide valuable indicators of the nature of the environment contemporary with the site which contained them. Interest in this aspect of bird-bone analysis tends to outweigh other types of information to be gained from them, since small birds seen to have been such a minor part of the diet at sites so far excavated. The presence/absence of extinct species in sites which have been radiocarbon-dated provide useful information on extinction of particular species.

Small bird bones have been analysed from 26 archaeological sites along the Otago coast and from 9 inland middens (McGovern-Wilson 1986: fig. 2.1 and table 2.1; McGovern-Wilson et al. 1996b; Anderson & Smith 1992; Worthy 1999). These sites are shown on Fig. 4 and listed in Appendix 4, and McGovern-Wilson provides a detailed analysis up to 1986. The only archaeological sites for which small bird bones have been identified and published since 1986 are Shag River Mouth, Papatowai (G47/50) and Pleasant River (J43/1) (McGovern-Wilson et al. 1996b; Anderson & Smith 1992). Trevor Worthy (1998) has re-examined the Hawksburn and Ototara assemblages, as well as carrying out an extensive analysis of natural deposits in Otago as part of his work on Quaternary fossil

Figure 4. Distribution of archaeological sites from which small bird bones have been identified.




faunas of New Zealand. He has also re-examined the interesting natural deposit from Earnscleugh Cave which was excavated by archaeologists in 1996 (Clark et al.1996). Like some moa species, some small bird species, such as a small weka and a small kaka, are no longer accepted by taxonomists as separate species (Challis 1995: 16; Worthy 1999). (See glossary for scientific names.)

At Awamoa (J41/3), Ototara Glen (J42/2) and Tai Rua (J42/1) in the dry country of North Otago, there were species now associated with forests and/or the western mountains, such as kiwi, kaka and/or kea, New Zealand pigeon, takahe and red-crowned parakeet (Trotter 1965, 1967b). Extinct species from these sites included the flightless goose *Cnemiornis*, the spectacular extinct giant rail *Aptornis*, Hodgen's rail, a goshawk, a crow, the laughing owl (ruru-whenua) and New Zealand quail (koreke), the latter indicating the presence of some grassland (McGovern-Wilson 1986: tables 3.1 and 3.2). Ototara was particularly rich in bones of water fowl, reinforcing Worthy's finding from his work on natural deposits that swampland was once a common habitat in North Otago

(Worthy 1998: 430). Of the bones analysed from Tai Rua (Trotter 1979), only the blue penguin (korora) was represented by more than one individual out of the 25 species identified.

Of this group Awamoa has the special distinction of having been the site of the first archaeological excavation in New Zealand. Mantell excavated there at Christmas 1847 and 1852, identified the moa and small bird bones that he excavated and published his results in the local newspapers (Mantell 1853). One of his collections was deposited in the British Museum of Natural History in 1856, but none of the bone material there can be securely provenanced to Awamoa because of Mantell's poor labelling (Site Record Form, Awamoa, J41/3).

Further south along the coast at Waimataitai (J42/18) and Katiki (J42/20), there is less evidence for forest, but the assemblages are small. Red-crowned parakeet and *Aptornis* are the only forest indicators (Holdaway 1989), and the only other extinct species is the laughing owl. At all these five coastal sites, the other species are penguins, shags, the petrel family (mollymawks and shearwaters in particular), ducks and gulls. All five sites are likely to be pre-16th century, based on radiocarbon dates or the presence of moa bones (McGovern-Wilson 1986).

The floors of some of the inland rock art shelters were excavated in the 1960s and 1970s and the information deposited only in the site record file. One of these, Whitestone shelter (J41/9), contained bones of *Euryapteryx*, New Zealand quail, red-crowned parakeet (kakariki), Hodgen's rail, ?Finsch's duck, three other species of ducks, South Island saddleback (tieke), tui, pipit (pihoihoi), two waders, dog, moa eggshell and numerous kiore bones (Scarlett 1966). These lay in a matrix about 30–40 cm deep that had been badly disturbed by rabbits. The presence of extinct birds, along with kiore, flakes of silcrete and obsidian and shells, indicate this is an early occupation site rather than a natural deposit (McGovern-Wilson 1986).

The largest assemblage of small bird bones for Otago comes from Shag River Mouth (510 individuals). Other medium-sized assemblages, such as Long Beach and Pounawea, contained 140 and 128 individuals respectively (McGovern-Wilson 1986). (These figures vary according to the midden units chosen as significantly separate entities, but the order of magnitude is comparable.) At Shag River over 50 species were present, including New Zealand swan, New Zealand quail, brown teal, banded rail, South Island weka, New Zealand snipe, South Island kaka, red/yellow-crowned parakeet, laughing owl, South Island kokako, South Island saddleback and South Island thrush—all birds which either have a reduced range now or are extinct (McGovern-Wilson et al. 1996b). Eleven species from the petrel family, ranging from albatross to storm petrel, were probably taken at sea, shy mollymawk (36 individuals) being the most popular. This mollymawk is also one of the commonest storm-wrecked species along our beaches today, and may have been picked up in order to use the bones for tool-making. Four species each of penguins and shags were probably taken from the shoreline, blue penguin (46) and spotted shag (21) being the most numerous. Five species of gulls and terns could have been taken from shoreline or estuary. Twelve species of swans, ducks, rails and waders probably came from the estuary and wetlands. In terms of numbers of individuals, the extinct New Zealand quail topped the list at 120 individuals, presumably hunted on open ground inland of the estuary. As well as the extinct or reduced-range forest

birds listed above, the presence of New Zealand pigeon (keruru), bellbird (koparapara) and tui indicated nearby forest. Laughing owl, morepork (ruru) and the New Zealand falcon (karearea) were predators of both open ground and forests (McGovern-Wilson et al. 1996b: table 16.3).

There were sufficient numbers of mollymawks, blue penguin, spotted shag, quail, pigeon and parakeets taken that deductions about changes in bird hunting strategy and vegetation at Shag River Mouth can be made. Bird hunting in the early phases of the site was focussed on coastal bird species, but in the later phases there was an equal emphasis on coastal and open-country species. Species which now live in dense forest continued to be hunted throughout, suggesting a change from a mostly forested local environment to a mosaic of forest, scrub and grassland.

This change tallied with evidence from pollen analyses of the nature of the palaeovegetation around the site. These analyses were able to show that early in the phase of human occupation the landscape was partially deforested, but the pollen sequence was too short to show whether this was the result of natural or anthropogenic fires. The sequences showed further localised removal of forest vegetation from around the immediate environs of the site, followed by more regional firing of the forest in the following century. By the time of European arrival, grassland dominated the landscape with some areas of shrubland (Anderson et al. 1996a).

Worthy's work on the fossil avifauna confirms this picture of North Otago as containing a much richer diversity of forested and swampland habitats than at present (Worthy 1998). Using new material from rock clefts around Ngapara and Earthquakes, Worthy identified a rich fauna from between 0 and AD 500. The bones from the Earthquakes clefts included abundant tuatara (*Sphenodon punctatus*), forest birds and extinct or rare species such as Hodgen's rail, an owlet-nightjar, New Zealand quail, South Island kokako, South Island thrush and South Island saddleback. The Ngapara site included two species of kiwi, South Island weka and takahe (McGovern-Wilson 1986).

Continuing south along the coast, the Pleasant River (J43/1) assemblage is generally similar, but with fewer species, to that at Shag River Mouth, with New Zealand coot added to the list of extinct species, though possibly intrusive from a disturbed deposit (Smith 1999). Though 27 species are present, 55% of the identified bones belong to three shoreline species (pied and spotted shags and yellow-eyed penguins) and sooty shearwaters. Numbers taken were too small to suggest that there was a deliberate focus on these species, and, as elsewhere along the coast, fowling at Pleasant Point appeared to be sporadic and opportunistic.

North of Dunedin, there is a cluster of coastal midden sites—Huriawa (I43/1), Seacliff (I43/4), Ross's Rocks (I43/22), Omimi (I44/1) , Warrington (I44/177), Mapoutahi (I44/17), Purakaunui (I44/21), Long Beach (I44/23), Whareakeake (Murdering Beach) (I44/20), Taiaroa Head (J44/4), Papanui Beach (J44/117), and the lower levels of Little Papanui (J44/1)—from which small bird bones have been analysed. It is typical of the distribution of small bird bones in middens that the greater the quantity of midden analysed, the greater the number of species of birds identified. Though the 1977 excavation at Long Beach yielded 52 species from a stratified midden in a 50 $m^2$ excavation, the

excavations of Dawson & Yaldwyn (1952) added nine more species, both extinct and living. Using Long Beach as the main set (Table 1), the other sites in this list are generally subsets, containing birds from all the main habitats: maritime, shoreline, forest, and estuary. Huriawa and Whareakeake had more *Diomedea* species—six and five respectively, compared to three at Long Beach.

Ross's Rocks, Warrington, and Purakaunui had New Zealand quail which was absent from Long Beach. Ross's Rocks and Warrington had kakapo, again absent from Long Beach. Purakaunui and Warrington had brown teal (pateke) and New Zealand falcon, which were absent from Long Beach. Seacliff (Blake-Palmer 1956) had South Island saddleback, one of five Otago sites to include this species. The impression gained from this tenuous data is that the coast north of Dunedin carried dense podocarp-coastal forest, well-supplied with trees and shrubs which carried regular heavy crops of fruit needed to support such species as kakapo, kokaka and saddleback. At the same time, there was both more open ground and richer estuary life around Blueskin Bay and Warrington than at present. Considering the Dunedin sites as a group, the list of extinct and reduced-range species is impressive (Table 2) (McGovern-Wilson 1986).

The occurrence of takahe, kakapo, and three species of kiwi in the forests of the Dunedin hills is particularly evocative evidence of how much the local avifauna has changed. The present-day fragmented forests of Dunedin coast still have relatively good populations of New Zealand pigeon and native passerines. Brown creeper (pipipi) are common, for instance, but yellowhead (mohua) are absent. There are isolated populations of morepork, native parakeet, and robin

TABLE 1. BIRD SPECIES PRESENT AT LONG BEACH.
(From McGovern-Wilson 1986 and Dawson & Yaldwyn 1952.)

| | | |
|---|---|---|
| South Island brown kiwi | White-faced storm petrel | White-fronted tern |
| Little spotted kiwi | Diving petrel | New Zealand pigeon |
| Great spotted kiwi | Pied shag | South Island kaka |
| Yellow-eyed penguin | Little shag | Red-crowned parakeet |
| Blue penguin | Stewart Island shag | Yellow-crowned parakeet |
| Fiordland crested penguin | Spotted shag | Morepork |
| Snares crested penguin | Paradise duck | Bellbird |
| Erect-crested penguin | Grey duck | Tui |
| Albatross sp. | Black teal | South Island saddleback |
| Bullers mollymawk | Teal sp. | South Island kokako |
| Shy mollymawk | New Zealand shoveler | South Island thrush |
| Giant petrel | Australasian harrier | |
| Petrel sp. | South Island weka | Extinct small weka* |
| Mottled petrel | Takahe | Extinct giant rail |
| Cook's petrel | Oystercatcher sp. | Extinct coot |
| Broad-billed prion | Banded dotterel | Snipe, exrinct mainland variety |
| Fairy prion | Large wader, cf. eurlew | of the suh-antarctic sp. |
| Sooty shearwater | Stilt sp. | Extinct small kaka* |
| Short-tailed shearwater | Southern black-backed gull | Laughing owl (extinct) |
| Fluttering shearwater | Red-billed gull | Extinct crow |
| Little shearwater | Black-fronted tern | |

* Species which are no longer accepted as good species
Species are listed in check-list order. See glossary for scientific names.

(kakaruai), but kaka and weka have not been seen for many years, indicating the on-going processes of extirpation.

There is a geographic gap in the sites analysed for bird bones between Dunedin and the Catlins. There are sites known to have contained moa bones, such as Kaikorai Stream Mouth, Otokia, Taieri Mouth, Tokomairiro Mouth, and Kaka Point (Harding 1957; von Haast 1879; Anderson 1982d; Teviotdale 1931; George 1944), where it is likely that midden would have included bird bones, and small fish and shell middens are even more frequent.

The group of Catlins sites comprise Cannibal Bay (H46/28), Pounawea (H47/1), Kings Rock (G47/51), Papatowai (G47/50), and Tautuku Point (G47/64), all with moa bone material, though Kings Rock had some post-Archaic material. The largest assemblage of small-bird species analysed for South Otago comes from the few square metres of midden excavated at Pounawea—34 species (McGovern-Wilson 1986: table 3.21). Two excavations at Papatowai produced lists totalling 15 species (McGovern-Wilson 1986; Anderson & Smith 1992), and Papatowai is unusual for containing no extinct species of small birds, though this was a major moa hunting site. The surface-collected material from Cannibal Bay did not include extinct species either, but the small group of bones represented only nine species. Extinct and reduced-range species found at Pounawea, Kings Rock, and Tautuku are shown in Table 2.

As at sites to the north, the people of the Catlins sites were taking birds from maritime, shoreline, forest, and estuarine habitats. Pounawea was the only site with New Zealand quail, suggesting tussock grassland on frosty flats of the local valley floors (Hamel 1977a). Penguins of a wider range of species than is common on the coast at present, were taken at Pounawea and Papatowai, and other than native pigeons they were the only group represented by more than one to four individuals. As in the northern sites, the presence of parakeets, saddleback, kaka, New Zealand thrush (piopio), and kakapo indicate a forest avifauna even richer in species than at present.

The inland archaeological sites containing small bird bone are Hawksburn (G42/13), Italian Creek (G43/183), Rockfall II (G41/453), and Owens Ferry (F41/60) in the Central Otago/Lakes District, and Nenthorn (I43/51) in North Otago. The most surprising aspect of these dry inland sites is the frequency of forest birds in them. The Hawksburn site lies now in a wide tussock grassland, though there was likely to have been a broad band of podocarp and beech forests along the 900 metre contour before AD 1250 (Hamel 1978). Small bird bone retrieved from this large moa-hunter site included kiwi, weka, kaka, laughing owl, parakeet, and South Island thrush, implying the presence of relatively large areas of species-rich forest. The presence of bones of three species of duck, including blue duck which inhabits swift flowing crecks in forests, suggests a range of ponds, streams, and wetlands. Small bird bone was sparse at the other Central Otago sires, but they were all from forest birds: a bellbird and a kaka from Italian Creek, a bellbird from Rockfall II, and a New Zealand pigeon from Owens Ferry (Worthy 1998).

Nenthorn, in North Otago had a very different assemblage: 2 New Zealand quail, 12 petrels of three different species, and 2 weka. Bones of petrels occur also at the Hawksburn site—a mollymawk and a sooty shearwater—among the 14 species of small birds found there. Bones of petrel species have been identified

TABLE 2. OCCURRENCE OF EXTINCT AND REDUCED-RANGE SPECIES OF SMALL BIRDS IN ARCHAEOLOGICAL SITES OF FOUR REGIONS OF OTAGO.
Derived from McGovern-Wilson (1986), McGovern-Wilson et al. (1996b), Anderson & Smith (1992) and Clark et al. (1996).

| EXTINCT SPECIES | NORTH OTAGO | DUNEDIN AREA | CATLINS COAST | INLAND |
|---|---|---|---|---|
| Swan | x | x | x | |
| Goose | x | | x | x |
| Finsch's duck | x | | | x |
| Coot | x | x | x | |
| Goshawk | x | | | |
| Eagle | x | x | x | |
| Hodgen's rail | x | | | |
| Aptornis | x | x | | |
| Crow | x | x | x | |
| Quail | x | x | x | x |
| Laughing owl | x | x | | x |
| South Island kokako | x | x | | x |
| N.Z. thrush | x | x | x | |
| SPECIES WITH REDUCED RANGE | | | | |
| Brown kiwi | x | x | x | x |
| Little spotted kiwi | | x | | |
| Great spotted kiwi | | x | | |
| Brown teal | x | x | x | x |
| South Island weka | x | x | x | x |
| Takahe | x | x | | |
| Banded rail | x | x | | x |
| South Island kaka | x | x | x | x |
| Kakapo | | x | x | x |
| Native parakeets | x | x | x | x |
| South Is. saddleback | | x | x | |

from other inland southern sites, such as Gooseneck Bend in the Waitaki Valley and at Lee Island, Lake Te Anau (Anderson & McGovern-Wilson 1991). Though it has been suggested that the preserved bodies of these birds were carried inland, the smaller petrels may have had inland breeding colonies, and the Bullers mollymawk could have been storm-blown. The coastal-breeding species, such as penguins and spotted shags, are not represented in the inland sites, yet coastal people preparing for an inland trip would have been much more likely to have these species available for preserving. Also, all these inland sites are moa-hunting sites and belong to a period when food preservation was less important.

On the other hand, petrels do not appear in the bones analysed from the natural deposits in Central Otago, nor from the large deposit at Castle Rocks in Southland (McGovern-Wilson 1986; Worthy 1998). Forest species are relatively common in the deposits from Earnscleugh Cave and other natural sites around Cromwell and Alexandra. Radiocarbon dates for these sites fall mostly between 1000 and 3000 years ago (Worthy 1998: 482), indicating that they provide a useful picture of the avifauna immediately prior to Polynesian arrival. Though

the Earnscleugh Cave assemblage was dominated by Finsch's duck, it also contained bones of takahe, parakeet, rifleman, and robin. The Firewood Creek site contained bones of a parakeet and a robin, and the Station Deposit had little spotted kiwi, the extinct owlet-nightjar, weka, New Zealand pigeon, tui, robin, and saddleback (McGovern-Wilson 1986). There can be no doubt that the forest birds in the archaeological deposits in Central Otago could have been captured locally.

The excavation of Earnscleugh Cave has provided an interesting sequence (Clark et al. 1996). The site is famous as the location of a dried moa neck and other well-preserved moa bones found in 1871. The cave was excavated stratigraphically in 1994, and the deposit both dated and sampled for pollen analysis. Unlike archaeological sites in the region, the assemblage of small bird bone was dominated by species which probably nested in the rocky cleft of the cave, especially Finsch's duck. As well as other extinct species (goose, New Zealand quail, Hodgen's rail, laughing owl, owlet-nightjar, as well as bones of the extinct greater short tailed bat), there were species which no longer live nearby (takahe, a mainland form of the Auckland Island snipe, kea, parakeet, rifleman, robin). Bones of kiore, tuatara, and giant Otago skink (*Leiolopisma grande*) were also present. The presence of forest birds, both in this site and in the two natural deposits in the Cromwell Gorge, and the result of the pollen analysis show that around 2000 years ago there were stands of podocarp forest (matai, rimu, totara, and celery pine) present nearby, probably in the gullies.

The middle layers of the cave show a decline in podocarps and an increase in *Nothofagus* and trees of more open habitat such as ribbonwood and kowhai. The upper layers of the cave, which probably represent the impacts of both Polynesians and Europeans, were dominated by grasses, speargrass and bracken. Most of the bird bone came from the lowest layers dated to about 2000 years ago (Clark et al. 1996).

The lists of extinct species and those of reduced range from the inland sites are as impressive as those for the coastal sites, even though smaller and more poorly preserved quantities of midden bone have been obtained from inland sites. One species, the owlet-nightjar, has not been found so far in archaeological sites and another species, Hodgen's rail, only in a badly disturbed site. It is apparent from Table 2 that extinction was as rife in inland sites as coastal, and the only habitat unaffected was that of the maritime and shoreline birds. In a way this is puzzling, since fire and predation affects breeding habitats of petrels, penguins and shags. Fur seal and sea lion colonies were affected. Why not sooty shearwater, penguins, and shags? These marine species, as well as New Zealand pigeon, New Zealand quail, and parakeets would have been most affected by Maori fowling strategies. Of the 13 species listed (Table 2), plus the owlet nightjar, all except four became extinct during the prehistoric period. Following European settlement, the New Zealand quail, South Island thrush, laughing owl and probably the South Island kokako have gone, though it is likely that introduced mustelids and habitat modification were the major a factors in these extinctions, rather than human predation.

The processes which *can* lead to extinction happen continuously, and changes in the *rates* of extinction provide clues as to how it happens. New Zealand provides a useful testing ground for theories about the relative effects of

TABLE 3. THREATENED BIRD SPECIES IN OTAGO.
(Derived from the Conservation Management Strategy for the Conservancy.)

| NAME | COASTAL | INLAND |
|---|---|---|
| Yellow-eyed pengnin | A | |
| Crested grebe | O | |
| Sonthern royal albatross | A | |
| Northern royal albatross | A | |
| Stewart Island shag | A | |
| Australasian bittern | O | |
| White heron | O | |
| Rcef heron | O | |
| Royal spoonbill | O | |
| Blne duck | | A |
| New Zealand falcon | A | A |
| Variable oystercatcher | A | |
| Banded dotterel | A | A |
| Wrybill | | A |
| Caspian tern | O | |
| White-fronted tern | A | |
| Black-fronted tern | | A |
| New Zealand pigeon | A | A |
| Yellow-crowned parakeet | A | A |
| Kea | | A |
| South Island kaka | | A |
| Rock wren | | A |
| Yellowhead | A | A |
| South Island kokako | | X |

A = threatened species.

O = New Zealand populations are threatened, but overseas populations are secure.

X = may be extinct.

predation and habitat destruction. Ever since Mantell in the 1840s decided that the extinction of the moa was caused by Polynesian hunting, there has been a general acceptance that human predation was a major factor in their demise (Worthy 1999). The importance of habitat destruction and predation by Polynesian rat (kiore, *Rattus exulans*) and dog (kuri, *Canis familiaris*) on moa populations is more difficult to interpret. The evidence from archaeological sites has made it fairly clear, however, that human predation is unlikely to have been a major factor in the extinction of the smaller bird species. In all Otago sites fowling appears to have been minor and opportunistic, with no greater focus on species now extinct than on living species.[3] The devastating effect of early Maori settlement on the populations of smaller birds seems to have been mostly through habitat destruction and the introduction of the kiore and kuri. It would be interesting, however, to know if even light hunting affected some

[3] At Marfells Beach, Marlborough, Worthy was able to test the frequency of occurrence of 42 species of small birds in contemporaneous large deposits from middens and nearby dunes. Only three species were more common in the middens than in the dunes, one of which, the New Zealand coot, is extinct and the other two, spotted shag and New Zealand scaup, still survive. The 42 species included 8 other species, besides the coot, which are extinct.

species and not others, because the former were slow-witted, shy breeders or could survive only in places where even children could catch them. Unfortunately the archaeological evidence has not been able to tell us.

Out of 129 species of birds, including moa, known from late Holocene natural deposits throughout New Zealand, 33 became extinct during Polynesian occupation, another 6 since Europeans arrived and another 30 species are threatened (Worthy 1999: 125). The major factors driving these species to extinction comprise continuing destruction of habitat and thriving populations of mustelids, possums, and the two European species of rats (Table 3). The list of threatened species includes marine and shoreline species, as well as those that nest on braided river beds, indicating the widening impact of human damage.

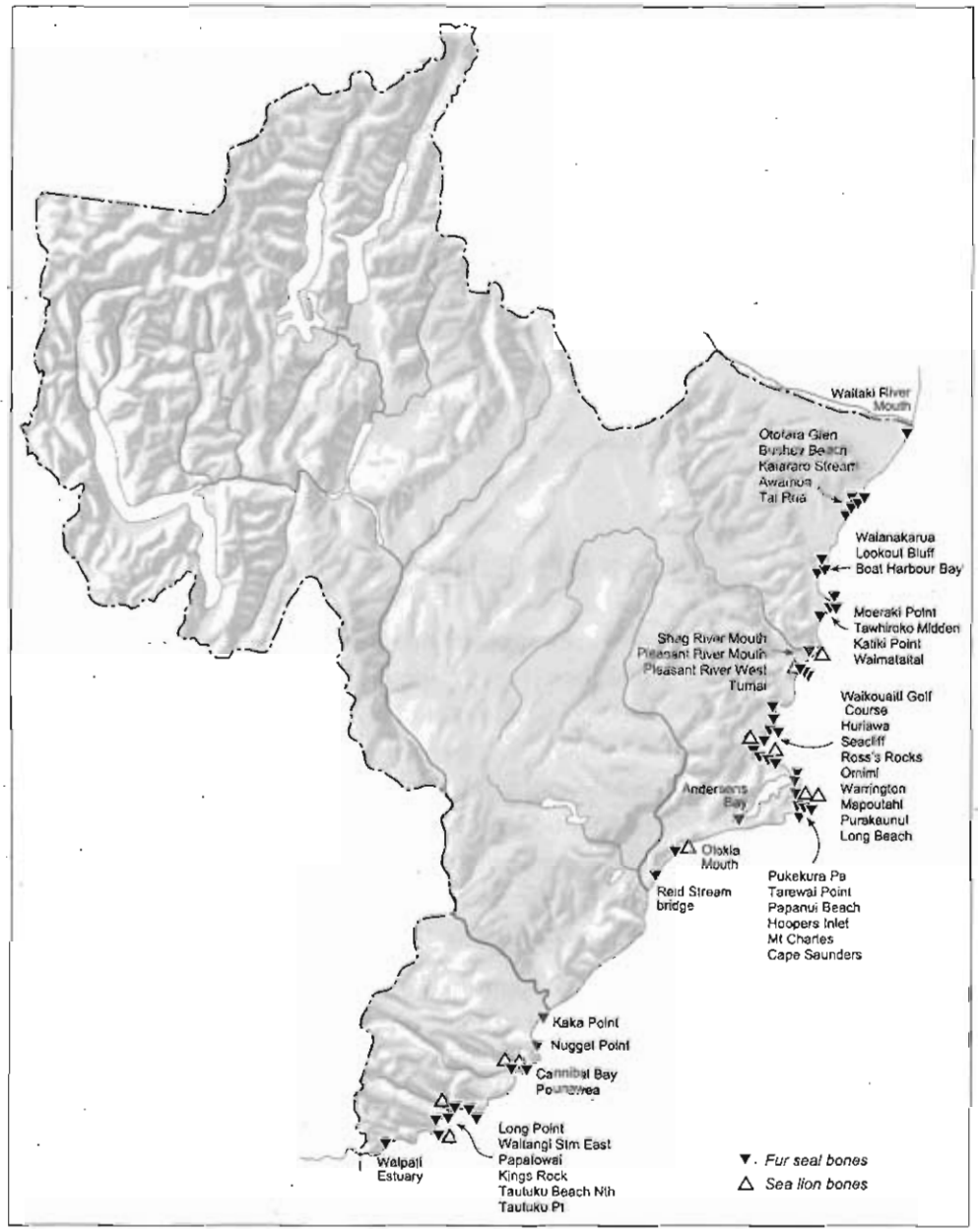
## 2.3 MARINE MAMMALS

A wide range of marine mammals have been recorded from Otago's coastal middens (Fig. 5), including the New Zealand fur seal (*Arctocephalus forsteri*), New Zealand sea lion (*Phocarctos hookeri*), southern elephant seal (*Mirounga leonina*), the leopard seal (*Hydrurga leptonyx*) and several cetaceans (pilot whale, dolphin, and unknown species). Their bones are most common in the older middens which include abundant moa bone as well, fur seals being the commonest of all. On a national scale, sites with seal bones are most common along the east and south-east coasts of Otago, the Coromandel coast, and two sections of the coast of Northland (Smith 1989: fig. 1).

In Otago identified bones have been recorded from at least 36 sites (Appendix 5). Only 8 of these sites have seal bone associated with Classic Maori artefacts and 28 with moa bones and/or Archaic artefacts, indicating that seal hunting was more important in the early than in the later stages of Otago's prehistoric period. They are so abundant in sites such as Papatowai and Pounawea, that relative meat weights derived from the two groups show that overall about 55% was derived from seals (Anderson & Smith 1992). Not every early site was dominated by seal bone. At the specialist fishing site of Purakaunui, seals contributed only 1.4% to the meat weights.

Unlike birds and lizards, no marine mammals became extinct during the prehistoric period. There was a reduction of breeding range in fur seals and possibly in sea lions. The existence of breeding colonies of fur seals can be deduced archaeologically from the presence in sites of bones of pups and adult females, whose bones are quite distinctive. Analyses of bones from Papatowai (G47/50), Pounawea (H47/1), Papanui Beach (J44/117), Long Beach (I44/23) (Smith 1989: table 5), and Shag River Mouth (J43/2) (Smith 1996) indicated that there were breeding colonies of fur seals in the vicinity. There is no evidence for the presence of breeding colonies in the Catlins and near the Otago Peninsula at the time of European sealing, and it is assumed that persistent culling of the juvenile and sub adult seals led to the demise of the local breeding colonies around the 16th and 17th centuries (Smith 1989). The predominance of juvenile and subadult seal bone in the archaeological sites indicates that most hunting occurred at the haul-out places of non-breeding seals. These sites

Figure 5. Distribution of archaeological sites from which sea mammal bones have been identified.




tended to spread out in a halo around breeding colonies, and such animals would have been easier to catch, compared to large bulls or the females defended by bulls (Smith 1996).

Evidence of other sea mammals is much more sparse. Where present in sites, sea lions are in far smaller numbers than fur seals. This is hardly surprising considering the New Zealand sea lion is one of the rarer species in the wild, and now breeds mainly on the Auckland Islands. In east Otago sites, they occur at Shag River Mouth, Pleasant River Mouth (J43/1), Long Beach, Papanui Beach (J44/117), Hoopers Inlet (I44/13), and Otokia Mouth (I44/5). In south Otago, sea lion bones have been identified from Cannibal Bay (H46/28), Pounawea, Papatowai, and Tautuku Point (G47/64) (Smith 1989). The presence of relatively small adult bones at Pounawea and Papatowai suggests there may have been breeding colonies of sea lions on the Catlins shorelines in the 13th and 14th centuries (Hamel 1977a: 245; Hamel 1980: 61).

Elephant seals and leopard seals are even less common in sites, and although individual elephant seals occasionally pup on Otago coasts, leopard seals never do. All dated sites with elephant seals proved to be older than 500 years BP, and include Waitaki Mouth (J41/56), Shag River Mouth, Pleasant River Mouth, Long Beach, Pounawea, and Papatowai. Most sites included only one or two individuals, but Pleasant River Mouth site was unusual in containing six. Long Beach is the only site at which elephant seal pup bones were found, and most other bones are of sub adult males, the age-sex group which wanders most widely (Smith 1989). Leopard seals are lone hunters, but their distinctive three cusped and hooked teeth and/or some bones occur in at least four Otago sites: Lookout Bluff (J42/29), Omimi (I44/1), Long Beach, and Papatowai.

The remains of cetaceans are difficult to interpret, since a single stranding produces a very large quantity of whale bone and many massive teeth, which might be traded considerable distances. Broken sections of bone are very difficult to identify to species. Pilot whales are found in North Island sites, generally associated with known stranding sites. Dolphins have been identified in six Otago sites: Pleasant River, Ross's Rocks, Andersons Bay (I44/172), Little Papanui, Otokia Mouth, and Papatowai. The layers in which they were found cover a wide range of ages. Pleasant River, Otokia, Andersons Bay, and Papatowai are early sites, but the bone found at Ross's Rocks and Little Papanui are in post 16th century layers (Smith 1989). Dolphins are seldom stranded, and their presence in middens is generally associated with harpoon points, indicating that they were harpooned at sea. This rare practice seems to have been most common on the east coast of the South Island. Unidentified whale bone has been found in seven other Otago sites from North Otago to the Catlins (Smith 1989).

The actual amount of cetacean bone found in sites is very small, suggesting that even the relatively small dolphins were not brought back whole to the cooking area. The relative amounts of whale brought back were even lower, which must raise doubts if cetaceans were ever deliberately hunted for food. On the other hand there is no doubt of the value of cetacean teeth and some bone for artefacts. Stratigraphically provenanced material from Long Beach (I44/23) included a 26 cm long slab of whale bone lying at the top of a layer dated to the 13th-15th centuries (Leach & Hamel 1981: 118). At Kings Rock, Lockerbie found fish hooks made from whale bone in both early and later layers, as well as larger pieces in the upper layer (Lockerbie 1940: 416).

Whale bone and ivory were important for high-status artefacts. All the chevron amulets described by Skinner (1974) were made of 'whale ivory', including the six from Otago found at Hoopers Inlet, Outram, Waikouaiti, Little Papanui, Cargill's Cliffs, and Wickliffe Beach. The amulet from Hoopers Beach was associated with a fine whale-bone comb (Skinner 1974: 78). The tongue-shaped amulets known as rei puta are also generally carved from whale teeth, such as the one from the mouth of the Clutha River (Otago Museum, L72.2). The beautifully shaped hei-matau, in stylised fish hook shapes, were usually made of nephrite, but three large hooks from Papanui Inlet, all very alike, and a fourth from St Clair sandhills (Skinner 1974: 73) were made from whale bone. Reel-shaped amulets for stringing into necklaces were sometimes made from whale ivory, and dentalium was more commonly used to make a smaller tube bead. A

cut tooth (Otago Museum, D53:775) found at Pounawea may have been intended for a reel and presumably another large reel, described as 'ivory', was cetacean (Lockerbie 1959: 102). A cetacean tooth simply hung as an amulet must have been a popular ornament, since imitations were made from moa bone. An amulet (Otago Museum, D52.463) in the process of being carved was found at Pounawea, made from whale ivory (Lockerbie 1959: 102).

In general whale bone and teeth were not used for mundane objects, but a needle (D36:179) of whale bone was found at Papatowai, as well as a lure (D40.304) from Pounawea (Lockerbie 1959), a massive harpoon head (D59.470), and possibly other harpoon heads of unidentified bone. Other less familiar forms made in whale ivory or bone include a seal-shaped amulet from Diamond Lake (D45.110), a humanised lizard amulet from Tomahawk Beach (D27.685), a spiral amulet and a partially carved one from Little Papanui (D32.1373, D26.317), and a snake amulet also from Little Papanui (D46.633) (Skinner 1974).

Patu paraoa were, as the name implies, a special type of long patu made from whale bone. There are relatively few whole patu recorded from Otago, but Skinner lists one from Warrington (D27.856) and a very broken specimen excavated from the Classic site of Karitane (Skinner 1974). Waha-ika, an asymmetrical type of patu, seems to have been made usually from wood or whale bone, and there is one provenanced to Little Papanui (D26.1332). Skinner's Type V patu is represented by examples made mostly from whale bone, found in Otago at Kaikais Beach (D34.49), Puketeraki (D65.920), and Pounawea (D24.1193). The butt ends of broken whale bone patu have been recorded from Whareakeake (D27.857), Warrington (D27.856) and Little Papanui (D29.358) (Skinner 1974). This compilation, taken from only Skinner's work, indicates the importance of whale bone and teeth to Otago Maori, and it is likely that the industrial use of whale bone had a long history in Otago.

## 2.4 FISHING

Throughout the prehistoric period and well into the protohistoric, fish were a major food source. Virtually every coastal midden site in Otago contains fish bone, but identification of the species present has been carried out for only about a dozen sites (Leach & Boocock 1993). Methods for assessment of numbers and difficulties in identification are discussed in Leach & Boocock (1993) and Anderson & Smith (1996c: 237-240). In general fish bones in sandy coastal sites are well-preserved and easily retrieved. This has led to a sense of confidence in numbers derived from analyses of the distinctive cranial bones.

Recent work on the retrieval of the smaller, but more durable otoliths has damaged this confidence, by showing that otolith analysis at the coastal site of Cat's Eye Point, Kakanui, yielded species lists and frequency counts that were very different from those derived from the cranial bones (Weisler et al. 1999). There are still some problems to be sorted out regarding the origins of otoliths, since at a site like Cat's Eye Point a proportion of the otoliths may have come from seal gut contents, or even from a seal colony that pre-dated the occupation site. On the other hand, analyses of otoliths and cranial bones of fish at some

Nelson sites have resulted in comparable species and numbers (I. Barber pers. comm.). Most of the information in this section is derived from analyses of cranial bones.

Large assemblages of fish bone have been analysed from Long Beach (5770 individuals), Purakaunui (2745) and Shag River Mouth (1447); medium numbers from Huriawa (414), Pounawea (430), Ross's Rocks (585), and Pleasant River (168)[4], and small numbers from Omimi (25), Otokia Mouth (3), Papatowai (27), Taiaroa Head (40), Mapoutahi (13), Waianakarua Mouth (4) (Leach & Boocock 1993). The figures in brackets are the minimum number of individuals counted, and vary according to the midden units chosen as significantly separate entities, but the order of magnitude is comparable for all methods.

About 430 prehistoric sites have been recorded along the Otago coastline from Waitaki Mouth to the Southland boundary near Chaslands Mistake. Coastal surveys recording the presence of fish bone and species of shells seen in exposures of midden were carried out between 1976 and 1978 (Croad & Huffadine 1976; Teal 1977; Hamel 1977c; Anderson et al. 1978). The only part of the coastline not covered was from Warrington to Blackhead, where the data on site record forms, though abundant, is uneven. About 300 of the 430 sites recorded are small lenses of shell and fish bone. Of these only 60 have been recorded as containing moa bone which marks them as early.

The most common species caught along the Otago coast was barracouta (*Thyrsites atun*), a schooling fish, taken offshore. The other commonly caught fish were red cod (*Pseudophycis bacchus*), ling (*Genypterus blacodes*), wrasses (*Pseudolabrus* spp.), hapuku or groper (*Polyprion oxygeneious*), blue cod (*Parapercias coleus*), and black cods (*Notothenia* spp.). All these latter species would have been taken in moderately shallow inshore water, mostly over reefs and rocky outcrops, and red cod over sandy bottoms at some times of the year (Fyfe 1982). There is still good rock fishing for many of these species, especially wrasse, along coastal Otago today (Anderson & Smith 1996c: 241). Along the Catlins coast, where bones from several beach middens were spot-sampled, species from the above group were found at Tautuku Point, Picnic Point, Waitangi Stream East, and Long Point South (Hamel 1977a: table 4:9). The most remarkable thing about these fish catches was the concentration on relatively few species, using only hook and line fishing, mostly from canoes, and not using nets or traps. Further north around Cook Strait a much wider range of fish were taken, and nets were in common use. Even as close as Banks Peninsula nets, sinkers and floats have been found in cave deposits (Challis 1995). In the northern half of the North Island there is more concentration on a limited number of species, in particular snapper (*Chrysophrys auratus* ) (Leach & Boocock 1993).

Barracouta were caught on a lure, made by driving a bone point through one end of simple wooden shank. (The bone point was replaced by an iron nail, once iron became available to the Maori in the protohistoric period.) A 4 m pole with a short length of cord (known as a matere) was used to lash the hook about in the water, and the barracouta being voracious feeders struck readily. To be

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[4] These are figures for the pre-1991 excavations at Pleasant River.

successful, the boat had to lie still in reasonably calm water. Anderson has shown that there is good correlation between the percentages of barracouta in assemblages from around New Zealand, with climate data on the frequency of calm periods. The east coast of the South Island, especially in less-exposed areas around Kaikoura, Banks Peninsula and Otago Peninsula, have sites with high percentages of barracouta (Anderson 1981c). Along windier coasts, such as Cook Strait, Foveaux Strait, and Fiordland, higher proportions of *Pseudolabrus* species occur in middens. These can be taken directly from a rocky shore by bait hook or trap (Anderson 1981b). The availability of barracouta in calm weather still does not explain why nets were not used for other species, nor why other fish that are easily taken with a baited hook such as kahawai (*Arripis trutta*), leatherjacket (*Parika scaber*), and greenbone (*Odax pullus*) were not included in the catch. These are all popular fish with recreational fishermen in Otago's waters today (Fyfe 1982).

Where quantitative evidence is available, the only changes over time were an intensification of fishing effort and the taking of fewer barracouta compared to the inshore species. In one area of the Shag River Mouth site, 'the contribution of fish rises from 2% of meat weight in the lowest layers through 14% in the middle layers to 54% in the upper layers' (Anderson & Smith 1996b: 284). Also the inshore species made up 62% of the catch in the early layers and only about one-third in the later layers. This change took place over a short period of time (about 40 years), around AD 1300. At Purakaunui (I44/21)—a short-lived fishing camp of the early 15th century—large numbers of red cod from bait hook fishing and barracouta from trolling had been taken in equal numbers. They made up 93% of the meat weight represented by the bones analysed. Given that the midden material represents approximately 400,000 kg of flesh at this campsite, the fish were probably caught for preserving (Anderson 1981b). At Long Beach nearby, there had been a similar emphasis on barracouta and red cod among the fish taken, but the change in focus over time was slightly away from barracouta in the early period (13th–15th centuries) to more bait hook fishing in the later period (17th century). In terms of numbers of individuals, in the lower layers barracouta made up 81% of the fish catch and in the upper layers 70%. The proportion of red cod changed from 13% to 18%, with ling, wrasse, and groper making up most of the rest of the catch (Fyfe 1982: table 1).

As fish became a more important part of the economy, settlement patterns changed. People moved away from the early sites to be found at the mouth of nearly every main river, to the main peninsulas and headlands. Here they were likely to find patches of calmer water to fish, even on moderately windy days (Anderson 1981c). This is a factor which should be examined on the stretch of coast between Brighton and the Clutha River which has numerous undated shell middens, but no moa hunter sites.

A change in economy to a greater emphasis on fishing has long been noted as a difference between Archaic moa hunting people and the later peoples with a Classic material culture (Lockerbie 1959). At Shag River Mouth around AD 1300, this change was visible even over the short period of 50 years, as the local supplies of big game were depleted (Anderson & Smith 1996b). After the demise of big-game hunting as a way of life, fishing not only increased in importance, but the preservation of large quantities of fish was worked into the new and

more logistically mobile economy of the 17th and 18th centuries. Future work should not only focus on resolving the 'otolith versus cranial bones' problems, but also explore the presence and degree of preservation of fish in both specialist and restricted-function sites of all periods.

## 2.5 SHELLFISH GATHERING AND SEASONALITY

Shell mounds along the Otago coast vary from enormous to only a thin layer running for about a metre in an eroding bank. One of the largest is on the south Catlins coast at Waipati estuary. Here wind-deflated mounds, mostly of pipi shells, run for over 180 m along a swale in the dunes, the mounds being up to 1 m high and 8 m wide (S183/66-68). The only sections of the Otago coast with hardly any recorded shell middens are the low cliffs of the exposed shore south of the Waitaki River Mouth, and a short section of south-facing coast between Quoin Point and the Tokomairiro River mouth. Shells have been identified and counted from the same number of sites as fish bone, i.e. about a dozen. (See list of sites above.) The presence of particular species has been noted from about 175 of the 250 sites systematically surveyed in the 1970s and from 89 of the 150 sites around Dunedin, which have been surveyed off and on since the 1950s. Table 4 shows the distribution of the commonest species along the coastlines, bays, and estuaries of Otago.

Cockles and pipi were collected from sandy shores; blue and green mussels, paua, and catseye from rocky shores; and mud snail from muddy estuaries. Cook's turban shell, rock oysters, tuatua and limpets (*Cellana* spp.) occur occasionally, but often enough to suggest deliberate collecting. At one site on rocky Katiki Point they dominated (42% of numbers) in some midden excavated

TABLE 4. COMMONEST SHELLFISH IN COASTAL MIDDENS.
(Frequency recorded between Waitaki Mouth and Waipati Estuary.)

| NAME | NORTH OTAGO | | DUNEDIN | | SOUTH OF DUNEDIN | | CATLINS | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n |
| Cockle *Austrovenus stutchburyii* | 24 | 41% | 72 | 81% | 16 | 30% | 44 | 50% | 156 |
| Blue mussel *Mytilus edulis* | 27 | 46% | 29 | 33% | 41 | 76% | 39 | 44% | 136 |
| Pipi *Paphies australis* | 14 | 24% | 58 | 65% | 21 | 39% | 38 | 43% | 131 |
| Mud snail *Amphibola crenata* | 14 | 24% | 31 | 35% | 16 | 29% | 32 | 36% | 93 |
| Paua *Haliotis* spp. | 28 | 47% | 9 | 10% | 6 | 11% | 10 | 11% | 53 |
| Green mussel *Perna canaliculus* | 18 | 31% | 16 | 18% | 12 | 22% | 3 | 3% | 49 |
| Catseye *Lunella smaragda* | 21 | 36% | 3 | 3% | 3 | 6% | 7 | 8% | 34 |
| Oyster *Ostraea* spp. | 7 | 4% | 7 | 8% | 2 | 4% | 6 | 7% | 22 |
| Cooks turban *Cookia sulcata* | 14 | 24% | 1 | 1% | 1 | 2% | 2 | 2% | 18 |
| Tuatua *Paphies subtriangulata* | 7 | 12% | 4 | 4% | 0 | - | 3 | 3% | 14 |
| Total sites with shells | 59 | | 89 | | 54 | | 88 | | 290 |
| Total sites recorded | 98 | | 150 | | 61 | | 118 | | 427 |

% The percentages represent the shellfish middens in a region which contain a given species

around house terraces (Trotter 1967a). Other species seem to have been 'by-catches'.

Though most shellfish were consumed at a site close to the collection point, some were carried considerable distances. Of the 57 sites from Blackhead to Clutha River mouth, where each site was assigned to one of three habitats, 87% of estuary sites contained pipi, but so did 66% of the rocky shore sites and 18% of the sandy shore sites. (Along the Otago coasts pipi are available only below mean low water in favoured estuaries.) Likewise blue mussels occurred in 54% of the sandy shore sites, having been carried there from nearby rocks. Cockles were not transported as much, occurring in only 10% of the rocky shore sites (Teal 1977).

Many of the large moa-hunter sites of coastal Otago lie at river mouths where estuarine resources are readily available. Analysis of bird bone and shellfish at Shag River Mouth show some increased reliance on estuarine species of both birds and shellfish in the upper layers. In the stratified sequence from Area C: Dune, the relative abundance of estuarine shellfish increased consistently from 72.8% of total shellfish in the lower layers to 92.5% in the upper layers (Higham 1996: 247). Cockles make up the bulk of the shellfish gathered at many river mouth sites—70% at Shag River Mouth and 50-69% at Pounawea (Hamel 1980). At other sites, such as Papatowai (59%) and in the shell mounds of Waipati estuary, pipi predominate; at Long Beach blue mussel predominates in the lower layers (61%) and mud snail in the upper layers (79%), reflecting an interesting change in the local shoreline (Hamel unpublished data). Occasionally small middens revealed in cross section in eroding banks will consist of one species only, such as in the mud-snail middens at S184/54-56 and S184/69, 71-72 in the upper reaches of the Catlins estuary (Hamel 1977c).

In terms of meat weights, shellfish made a minor contribution at such sites as Shag Mouth or Papatowai where, though abundant, they comprised only 1-4% of the meat weight represented by the remains in the sites (Anderson & Smith 1996b: 284; Anderson & Smith 1992). Nevertheless shellfish were an important part of the diet, judging by the sheer numbers collected—nearly 10 million by estimate at Shag Mouth. The precise location of even the large moa-hunter villages show some signs of being influenced by the location of the best shellfish beds in the local estuary. This was tested at Papatowai, where the rock bar in the entrance of the Tahakopa River suggested that the final meander of the river had been reasonably close to its present position throughout prehistory. The section of the main river channel closest to the site carried the largest cockles and the only bed of pipi in the estuary—a result of the density of the food supply (plankton) delivered by the current to the shellfish beds (Hamel 1977a). At Pounawea and Shag River Mouth, pipi beds were also adjacent to the sites.

Testing for seasonality by analysis of midden materials has been researched for the past 30 years. Attempts to use the presence or absence of particular species of animals has largely failed, because most are available all year round, even if they were likely to have been harvested at only one season. Also the preserved bodies of birds and fish, eaten months after their capture, would have contained some bones, creating problems about the proportions of each body part present in the midden material. This type of data does contain information on

seasonality, but is difficult to interpret. Analyses of the season of death of individual animals, particularly shellfish, offers more certainty (Coutts 1970; Higham 1990; Sansom 1995).

At Ross's Rocks, for instance, black cod species made up an unusually high proportion of the fish bone. Unlike many other fish, black cod species are available the whole year round in rocky ground from the intertidal out into shallow water offshore. By implication they could be the species which were taken in winter when other fish were not available. The Ross's Rocks site was at first considered anomalous, and interpreted as an inshore version of the normal fishing strategy rather than a winter site (Fyfe 1982). Work on oxygen isotopes in the annual shell increment of cockles, however, indicated that the shells in the same layers as the fish bone had indeed died in winter (Till 1984).

Similar analyses at Shag River Mouth did not confirm fishing for black cod as a winter strategy. Oxygen isotope analysis of blue mussel shells from the base of the upper layers at Shag Mouth (Layer 4, Area C: Dune) showed that of the 13 shells analysed, 8 had been taken in winter or as temperatures were dropping, but the fish bone from this layer has the normal pattern of a predominance of barracouta and red cod, with black cod species making up a relatively minor part of the catch (Higham 1996: 250). This variation between Ross's Rocks and Shag River Mouth confirms the importance of such tests as oxygen isotope and other chemical analyses for examining seasonality. Shells, being abundant and well-buffered from chemical deterioration by the heaps within which they lie, are particularly valuable for these sorts of tests.

Sansom (1995) returned to an old idea, that of thin-sectioning cockle shells to look at the stage of growth when death occurred. Using Pleasant River as his test site, Sansom analysed both natural populations and the midden populations, looking at rates of growth, visible in thin cross sections of the shells, for every month of the year. Natural populations were sampled from below and above mean low water, in order to examine local variation. Occupation material at Pleasant River is scattered across low dunes, and covers a broad time span. Radiocarbon dating suggested repeated occupation of temporary campsites, some as early as the late 12th or 13th century, with a peak of activity contemporary with Shag River Mouth in the 14th and early 15th centuries, and persisting into the 15th or 16th centuries (Smith 1999). Sansom sampled four of the campsites, and considered that the shells from the main period of occupation showed evidence for all year round collecting and certainly spring and autumn. Two layers dated to the 15th or 16th centuries were summer collections. The method is still relatively cumbersome to use, in that growth rates vary between estuaries and the 'signature' for each would probably have to be determined from samples of up to 200 shells.

Freshwater mussel, *Hyridella menziesii*, was the only freshwater mollusc utilised by Maori. It was widely available throughout Otago, with large populations in shallow lakes such as Tuakitoto and Waihola-Waipori. It is found in a wide range of inland sites (Fig. 6; Appendix 6), and is specifically mentioned as present in Diamond Lake and possibly Frankton Arm, Lake Wakatipu (Ritchie 1980a), Lake Onslow, and the Minzionburn. Midden deposits with freshwater mussels have been recorded mostly from rock shelters (14 of the 19 sites recorded), especially those recorded by Michael Trotter. Other

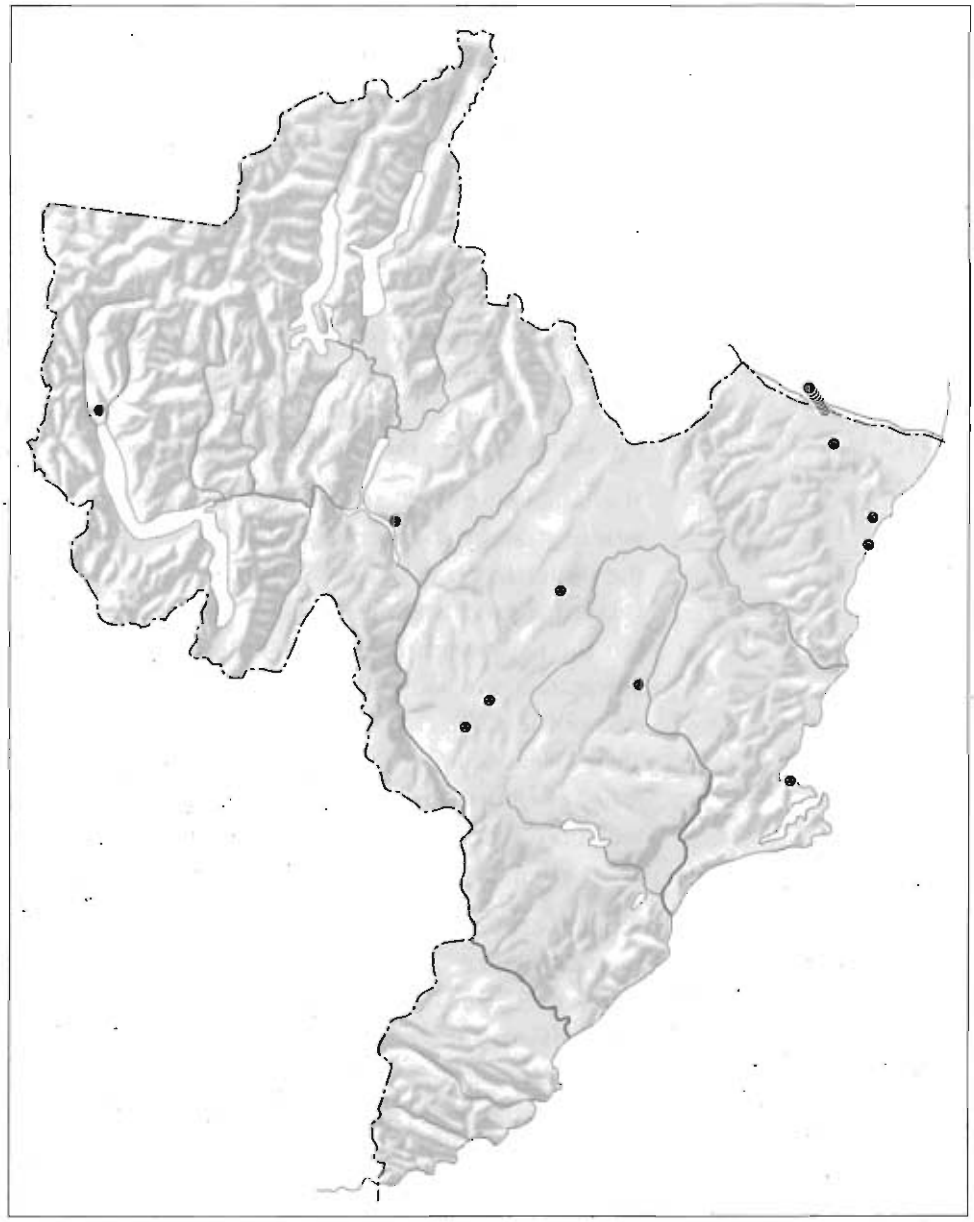


Figure 6. Distribution of archaeological sites from which freshwater mussel shells (*Hyridella menziesi*) have been identified (for site names, see Appendix 6).

recorders seem to have missed these inconspicuous shells. Its occurrence at Mapoutahi on the coast is unexpected (Anderson & Sutton 1973). Like most shellfish, it would have been only a minor component of the diet in terms of meat weights.

Shellfish analyses are important for what they tell us about settlement pattern/environment interactions, dates, and seasonality. They provide an abundant, chemically stable resource for the development of new techniques, and it is likely that future work will be technological, such as easier laboratory methods of testing for season of collection and the refining of radiocarbon dating on shell.

## 2.6 INTRODUCED ANIMALS—KURI AND KIORE

Dog (kuri, *Canis familiaris*) and rat (kiore, *Rattus exulans*) bones have been analysed from the same dozen sites listed above for fish and shellfish, and have also been noted on site record forms from many more sites (Appendix 6). Only some recorders were able to recognise dog bone in the field, and since bones of dogs are relatively uncommon in middens, compared to fish bone, they will not have been recorded for all the midden sites in which they in fact occur. The information about general distribution is, therefore, very uneven.

Dog bones (Fig. 7; Appendix 7) occur in middens of all ages from the early sites of Pounawea and Shag River Mouth to the 17th century levels of Little Papanui and at Tarewai Point, which was probably occupied in the 1830s. Two major analyses have been carried out at a national level by Allo (1970) and Clark (1995). The Otago sites analysed by Clark (1995) include Shag River Mouth (J43/2), Pleasant River (J41/1), Purakaunui (I44/21), Long Beach (I44/23), Whareakeake (I44/20), Kaikais Beach (I44/127), Tarewai Point (J44/103),

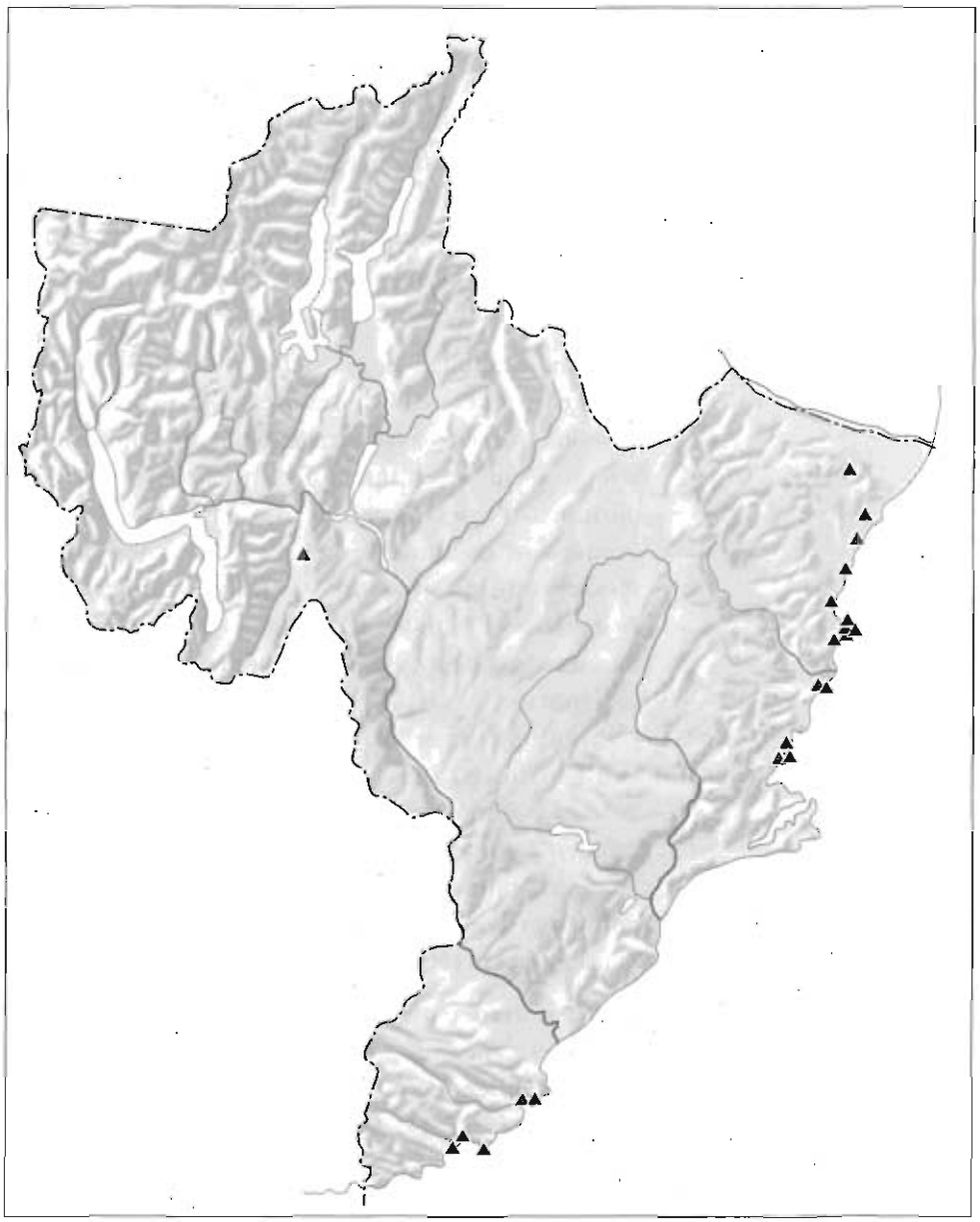


Figure 7. Distribution of archaeological sites from which dog (kuri) bones have been identified (for site names, see Appendix 7).

Pipikaretu (J44/2), Hoopers Inlet (I44/13), Little Papanui (J44/1), Akatore (I45/56-58), False Island (H47/6), Pounawea (H47/1), and Papatowai (G47/5). Clark's osteometric work should provide a valuable standard for archaeological analysis of dog bones. He found the population as a whole relatively homogeneous and definable as a breed. There were some interesting temporal and spatial differences in the dimensions of the limb bones. Dogs at Archaic sites in Otago had stouter radii, humeri, and tibiae (mid-shaft dimensions) than dogs at sites with Archaic artefacts in the North Island, but the opposite applied to more recent sites. Dogs from Otago Peninsula sites with Classic artefacts had slimmer limb bones than dogs from similar sites in the North Island. Clark considered that nutrition was the main factor involved, since tooth wear correlated well with the more slender boned dogs. A young dog from the Classic site at Whareakeake had particularly worn teeth. The wear on dog teeth correlated with that found by Houghton on human teeth, suggesting that the same diet for man and dog may have been a major factor in tooth wear. At the Archaic site of Shag Mouth, the frequency of gnawing marks on seal bone suggested a diet for the dogs of meaty bones, but at Classic sites on the Peninsula this was more likely to have been the remains of dried fish, full of scales, sand, and hard bones (Clark 1995).

There is little evidence for dogs in inland sites where it would have been difficult to feed them, especially after the demise of the moa. There are bones of only four dogs in the mass of moa bone from Hawksburn (Anderson 1989). Sites from which bones have been thoroughly analysed include Owens Ferry, Dart Bridge, Minzion Burn, and Coal Creek, and although full information on the bone material is not available for all sites, there have been no reports in the literature of dog bone from them.

Clark has included in his analyses material lodged in the Otago Museum from some early excavations. Among this early material is an important skeleton from Cannibal Bay (excavated from beneath a midden dated to about 500 years ago), which is the most intact and best preserved dog skeleton which Clark saw during his work. Some of the early excavations provided reasonably large samples of dog bone, such as 107 bones from Whareakeake and 103 from Pleasant River. Other sites with large to medium assemblages of dog bone are Pounawea (17 individuals, Hamel 1980), Long Beach (17 individuals, Hamel unpublished data), Purakaunui (11 individuals, Anderson 1981b), Karitane (13 individuals, Leach 1969), and Shag River Mouth (76 individuals, Smith 1996). Considering the relatively small areas excavated at the early sites of Pounawea and Papatowai, they carry high densities of dog bone (8 from approximately 7 $m^3$ of midden excavated at Papatowai, and 17 from about 8 $m^3$ of undisturbed midden at Pounawea). Though these samples are small, they compare well with Shag River Mouth (0.67 dogs per cubic metre) and Long Beach (1.02 dogs per cubic metre in the early layers, and 2.6 dogs per cubic metre in the upper 17th century layer) (Hamel unpublished data).

The importance of dogs as a source of meat is indicated by the high proportion that died as juveniles or subadults. At Shag River Mouth, 44% of the bones were from juveniles less than 6 months old and 23% from sub adults of 6-18 months (Smith 1996: 191). At Pounawea the respective figures were 29% and 47% (Hamel 1980) and at Long Beach 6% and 53% (Hamel unpublished data). At all

three sites about two-thirds of the dogs had been killed before reaching maturity at about 18 months. At Shag River Mouth, cut marks on the dog bones, consistent with flensing for meat and skins, were relatively common (Smith 1996: 193). The relative amount of meat obtained from dogs was not great, and at Shag River Mouth it was of a similar order to that obtained from shellfish or small birds (Anderson & Smith 1996b: 284). Anderson's estimate of the number of dogs kept at Shag River Mouth is, however, startling. If the occupation lasted about 50 years and if the estimate of about 10,000 dogs for the whole site is fairly valid, a population of more than 200 dogs at a time was associated with the village of about 150–200 people at the river mouth.

There is ample traditional evidence of the importance of dog meat as a desirable food in the protohistoric. Early writers described it as 'a dainty', a 'great delicacy', and 'highly esteemed' as a dish to present to a distinguished visitor. The skins were highly prized for cutting up into tags which were carefully sewn

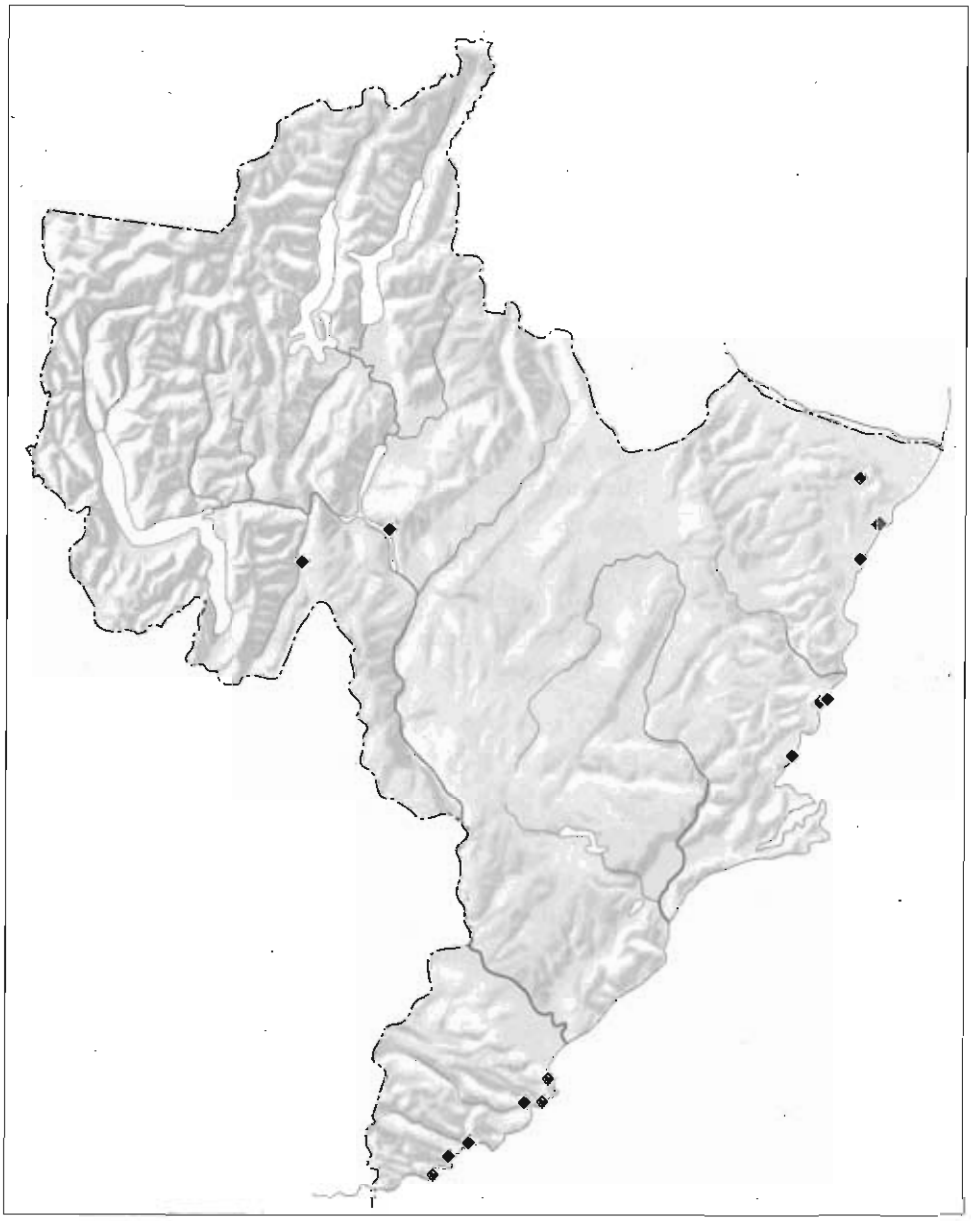


Figure 8. Distribution of archaeological sites from which rat (kiore, *Rattus exulans*) bones have been identified (for site names, see Appendix 7).

with a fine bone needle and thread on to cloaks. Such cloaks were a indicator of social rank and only worn by chiefs (Allo Bay-Peterson 1979). In Otago dried dog skin has been found in four caches at Puketoi and near Middlemarch (Anderson 1981d). Fine needles, suitable for sewing such a fine material as dog skin, occur in many Otago sites—four from Shag River Mouth (McGovern-Wilson et al. 1996a: 162) and many from all layers at Pipikaretu (Teviotdale 1932: 99).

Stylised figures interpreted as dogs are relatively frequent at Maori rock art sites throughout New Zealand. Those of North Otago tend to be drawn in outline and some have prominent genitals (Trotter & McCulloch 1971). Many are fairly naturalistic with a wide open mouth (possibly howling), but they often lack ears. Anderson (1981d) has included an analysis of these drawings in his consideration of kuri as hunting dogs, assembling evidence that the South Island dogs might have been bred with heavier shoulders, necks, and jaws for moa hunting.

Rat bones are ubiquitous in all well-preserved and well-sieved midden material. Distribution of sites in which they are found suggests a coastal pattern (Fig. 8; Appendix 6), but those middens with ample shells provide the best conditions for preservation of such small bones. Inland sites with good preservation, such as rock shelters, also tend to have rat bones, e.g. those in the Waitaki Gorge (outside of the Otago Conservancy). At Shag River Mouth rat bones were abundant through all levels—55 individuals in all (Smith 1996: 189). At smaller excavations, such as Pounawea, Papatowai, and Purakaunui, there was a similar pattern of scattered rat bone in all layers. Whether these were the remains of rats that had been eaten or had died naturally was not determined. This would be difficult to determine because of differential preservation of the smaller bones, the loss of the smallest bones during sieving of midden material, and the ease with which the bones could be disarticulated by weathering of the midden.

The distributions of kuri and kiore have as much importance to understanding the history of the New Zealand biota as to archaeology. As predators and hunters they filled different niches from man, and their effects require careful assessment in the studies of biota extinction. Bones from middens, particularly of kuri, provide evidence that biologists cannot obtain elsewhere, and they could be the focus for rewarding inter-disciplinary work.

## 2.7 PLANT FOODS AND OVENS

The New Zealand flora is not rich in large fruited trees or plants with 'starchy' stems and roots, especially compared to the tropical floras of the Pacific. In Otago the only abundant food plants for the Maori were bracken (*Pteridium esculentum*) rhizomes, referred to as fern root, and cabbage trees (*Cordyline australis*) whose stems and rhizomes could be steamed to produce kauru. Pithy material in the trunks of some tree ferns, pollen from raupo (*Typha australis*), greens from native sowthistle (*Sonchus* spp.), young ferns and New Zealand spinach (*Tetragonia* spp.), and small berries from tree fuchsia (*Fuchsia excorticata*), coprosmas, and snow berries (*Gaultheria*) provided supplementary food (Hamel 1974). It was bracken and cabbage tree which were the major

Natural erosion has uncovered these oven stones on a Maori occupation site at Taieri Mouth.

carbohydrate sources in Otago throughout the prehistoric period. Other important plants were flax (*Phormium tenax*) for fibre production, various tussock and reeds for thatch, and podocarps for canoe and house timbers. Over 40 species of trees, shrubs, climbers and herbs can be identified in the Catlins forests, for instance, as being of importance to the Maori occupants (Hamel 1977a).

The only archaeological sites where processing plant foods has been investigated are umu-ti. After excavation of four ovens on the Otago Peninsula and a consideration of other evidence, Knight (1966) distinguished umu-ti as ovens for cooking cabbage tree stems and roots. They could be distinguished from ovens used to cook other foods, because they had:

- Almost perfectly circular raised rims
- A rim 50–80 cm high above the interior pit
- A deep oven pit with almost vertical walls baked by high heat (only visible after excavation), and various other characteristics of stratigraphy common to large ovens
- A complete absence of faunal remains

The ovens which Knight (1966) described on the Otago Peninsula (thought to be I44/62, 63, 64, 67, J44/11, 15, 33, 70) lay on a north-facing slope of McArthurs Hill, Lower Portobello, at about 220 m a.s.l. and on a ridge running north towards Taiaroa Hill at about 100 m a.s.l. They showed on the surface as simple circular raised rims and lacked flake material and other stone tools. They ranged in diameter at the top of the rim from 4.0 to 7.0 m. The height of the rim from the centre of the oven before excavation varied according to the amount of infilling from erosion and human agencies, but when excavated proved to be about 1.7 m deep with flat bases 1.5–2.0 m across. The oven stones were reddened and pitted and showed selection for a limited size range, weighing 4–16 kg. Nearby vegetation was considered to have comprised cabbage trees and broadleaf/kowhai (*Griselinia littoralis/Sophora microphylla*) forest with stony outcrops. Knight (1966) associated a high frequency of ovens with broadleaf forest on the outer end of the Otago Peninsula and a lower frequency with forests containing totara (*Podocarpus hallii*) on the more southern parts of the Peninsula. The association may be with a more open forest type rather than with a given species, since cabbage trees are not shade-tolerant. From aerial reconnaissance, Knight (1966) considered that ovens were correlated with stony outcrops or were close to stony creek beds, the latter providing both stones and water. The Peninsula has a highly dissected topography with creeks which vary greatly in their flow rate, many drying out in summer. Knight (1966) considered that there were traces of prehistoric dams across these creeks and that these traces occurred more often than expected near umu-ti, but he did not provide any figures. He also noted the presence of borrow pits adjacent to umu-

ti and excavations left after removing the deep tap root of nearby cabbage trees, associated with a dimpling effect.

Sites described as ovens and umu-ti have been widely recorded throughout Otago since Knight's work, with some of the highest densities being in his area of interest on the outer part of Otago Peninsula east of Hoopers Inlet and Lower Portobello Bay (48 sites). When recorded sites are assessed by map sheets, the rest of the area around Dunedin on Map 144 contains 66 sites, the Moeraki/Kakanui area has 40 (Map J42), and the Teviot/Lake Onslow area has 61 (Maps G43 and G44). The latter area has a density of ovens about as high as that on the outer part of the Otago Peninsula.

The field evidence recorded as 'ovens' varies greatly. Small ovens, which recorders assumed were not umu-ti, only become visible after ploughing (as scatters of oven stone and charcoal) or in eroding banks (road edges and beaches) or in sand dunes. Intact umu-ti are unusual in that they are visible on the undisturbed ground surface, unlike most Maori sites. Usually they appear as raised rims with a well-defined central hollow, though after ploughing they are indistinguishable from small ovens which never had clear rims.

The large cluster of ovens around the Millers Flat and Lake Onslow area includes 37 which are recorded as having raised rims and another 19 which had been destroyed before they were recorded. Some of the latter were reported to have been associated with moa bones and flakes. They include the large moa hunter sites at Millers Flat (G44/10) and Coal Creek (G43/51), as well as smaller scatters with flakes and sometimes moa bones at Lake Onslow and in the Minzion Burn, Tima Burn, Oven Hill Creek, and the Benger Burn, lying between the Clutha River edge and hillsides at 700 m (G43/2, 9, 115, 120, 132; G44/17). Those described as umu-ti are all large, being mostly between 2.2 m and 4.0 m in diameter, with one 5.0 m across. They lie on all sorts of slopes, but the general lie of the land is to the south. It is likely that about 45 of the sites were classifiable as umu-ti, and except for their association with a higher than usual density of sites containing moa bone and flakes typical of moa-hunter sites they cannot be given any sort of date. They cover an area of land about 11 × 18 km and tend to form loose clusters.

The other large group of ovens lies in North Otago, particularly along the hill slopes about 5 km back from the coast. On the Map J42 which covers the coast from Moeraki to north of Kakanui, about 40 sites have been recorded as ovens, but 18 of these are eroding middens with charcoal, ploughed scatters of oven stones, or eroding charcoal and midden layers along river and beach edges, the latter occasionally showing the pit of an oven in section. The other 23 ovens were visible on the undisturbed ground surface at the time of recording. They are not as strongly clustered as at Millers Flat, though this may be because they are the remnants of clusters. The largest group is within the old Herbert Forestry area (10 sites with about 15 ovens) where many have been disturbed and some may still suffer damage from logging. They are clustered within about 2 $km^2$ on ground sloping south-east from 200 m a.s.l. up to a knob at 450 m a.s.l. They range in size from 1.5 to 6.0 m and are mostly in ones and twos. Associated sites range from scatters of artefacts to a rock art site. There are two distinctive clusters of three sites in each at Trotters Gorge and on top of Moeraki Hill (close to the coast), both at about 150 m a.s.l. There are two looser clusters west and

Preparation of a building site uncovered these oven stones and a blackened shelly sand on the edge of a large Maori site at Warrington which was occupied throughout prehistory.

south of Trotters Gorge and some isolated ovens in the southern Herbert Forests. Bishop Selwyn described part of the Waitaki River delta in 1844 as covered with cabbage trees (Stevenson 1947: 111), but any associated ovens on flat ground would have been destroyed by cultivation.[5]

There are two other clusters of large ovens with raised rims at Hummocky Runs Road near Middlemarch and at Basalt Hill, Maerewhenua. The Middlemarch group includes nine sites with about 12 ovens, scattered over about 2 km² of north-facing hillsides at about 550 m a.s.l. with gentle gullies (I43/39-48). According to the local farmer this is a true cluster, and the surrounding hillsides lack ovens (author's field book). The Basalt Hill group contains eight sites with about 12 ovens, again in an area of about 2 km² on north-east facing slopes at 400 m a.s.l. It is tempting to see these tighter clusters within 2 km² blocks as the consecutive efforts of the same group of people, but the cabbage trees may have been clustered in the first place because of an environmental effect. Rogers (1922) describes ovens as common along the north-facing slopes of the Kahiku Range south of Balclutha, but few of these have been relocated.

The only ovens in New Zealand which can be firmly identified as umu-ti are those tested by Fankhauser for plant residues from cabbage trees (Fankhauser 1986a). His study area was limited to South Canterbury, but the 55 ovens described were of similar size and shape to those described by Knight and others as likely to be umu-ti. As well as testing the ovens for plant residues, Fankhauser (1992) dated 25 ovens using radiocarbon dates on charcoal and six using thermoluminescence analysis of rocks. Much of the charcoal came from podocarps and other relatively long-lived trees. When the sites dated on short-lived species are examined, they fall into two fairly discrete groups (see Appendix 9), suggesting that umu-ti were mostly used in the 14th and 15th centuries and from the 18th century up until about 1860, the latter date derived from historic accounts (Challis 1995). Fankhauser defines the characteristics of umu-ti for field surveyors as hollows with raised rims, 2-6.8 m across, with evidence of burnt stone and charcoal if the turf is lifted or probed in the hollow, lacking faunal remains or stone tools, and usually near water (Fankhauser 1987). Dry baking burns the cabbage trees before the unpalatable polysaccharides (glucofructans) can be converted to fructose, and so water was necessary for an umu-ti. Not all ovens are circular. Some are oval and some rectangular, three of the latter in South Canterbury having been dated to less than 300 years ago. Rectangular umu-ti, in fact trenches, were described by Tikao, a 20th century

[5] Kauru Hill, 20 km west of Oamaru, is a basalt outcrop and typical of sites where cabbage trees commonly occur today. Though no ovens have been recorded around the hill, the name suggests it was a place where kauru was produced.

informant for Best (1976: 269), and may have been introduced by the Ngai Tahu and Ngati Mamoe (Fankhauser 1992).

Fankhauser (1986a, 1989) also investigated the nutritive properties of kauru, the fructose-rich meal derived from long baking of cabbage trees, and used ethnographic material from South Canterbury to work out input-output energy values of ti harvesting (Fankhauser 1986b). The result was a ratio of one to five (input/output), which included a 20 km walk between the living and harvesting sites. Kauru has carbohydrate values similar to other 'starchy' foods such as sweet potato, taro, yam, and potatoes, but it is relatively low in proteins and high in fats. A kilogram of cooked dry root and stem would supply an adult with sufficient energy and fat for daily needs, but not sufficient protein (Fankhauser 1989: 217). Kauru production in South Canterbury can be viewed as a distinct industrial process, carried out at a considerable distance from major settlements, with the product carried back to the village for consumption—an ethnographically confirmed pattern which appears to fit the prehistoric archaeological evidence as well.

Other sites in Otago with large ovens identified as umu-ti have been excavated. The most interesting one was the Dart Bridge site (E40/2) at the head of Lake Wakatipu (Anderson & Ritchie 1986). Before excavation two or three large raised-rim pits were visible, as well as 15 depressions or pits and a complex of mounds and stony areas. Excavation showed these pits to comprise five groups of ovens and open fires, sometimes cut into one another. Three of the pits had raised rims, 3–5 m across, about 1 m deep, with straight sides and slightly curved bases. Three other pits were less than 2 m across, shallower and cut in bowl shapes. Each of the six contained a dense layer of charcoal overlain by stone free of charcoal, making them physically similar to Fankhauser's umu-ti in South Canterbury. A seventh pit was only 1 m across and filled with mixed charcoal, shattered oven stones and burnt moa-bone fragments, and was similar to ovens excavated at the moa-hunter site of Hawksburn (see below). Unlike other umu-ti sites, there were numerous artefacts and flake material (2221 pieces of modified stone), mostly made from porcellanite, silcrete, nephrite, and argillite, particularly around Complex D which included one of the umu-ti-like ovens (Anderson & Ritchie 1986). The stratigraphy and acceptable radiocarbon dates suggest at least two periods of occupation around AD 1250–1350 and AD 1500–1650. Occupation and kauru production at Dart Bridge is quite different from South Canterbury. Production was carried out within a settlement where moa were processed and tools used and re-worked, rather than in a purely 'industrial' site. The significance of this site within the Otago settlement patterns will be discussed below.

An isolated oven at Tahakopa had a perfect raised-rim (2.4 m diameter and 80 cm deep), and when excavated proved to have a rounded base, full of charcoal topped with stones, and had been reused at least twice (Hamel 1977a). The position of such a large oven on the frosty flats of the Tahakopa Valley suggests, that though the nearby hillsides are still heavily forested, the flats may have been sufficiently open to carry cabbage trees, at least in the 17th and 18th centuries (Hamel 1977a). Though the pattern of thick charcoal in the base with oven stones on top fits the pattern for Fankhauser's umu-ti, two shallow ovens of mixed charcoal and stone formed in the top of the deeper one suggest that

the oven was later re-used for other purposes. A large oven was partially excavated at the Lagoon site (S123/7), Glenorchy, by Simmons in 1967. It lay within an oval raised-rim about 3 m across, with four post holes forming a rectangle around it, possibly for a shelter over the oven, which was further sheltered by its position at the foot of a steep bank (author's field book).

Excavations in Otago of other types of ovens include the large moa hunter sites at Pleasant River on the coast and at Hawksburn, Coal Creek and Owens Ferry inland, but they have not been as fully reported as Dart Bridge. At Pleasant River, shallow scoop ovens were found at scattered campsites on the estuary flats. They were mostly about 1 m in diameter with burnt stone and charcoal mixed with burnt and unburnt moa bone. Some were up to 3 m across (Smith 1999). At Hawksburn a complex band of 18 ovens was excavated, associated with moa bone (much of which had been burnt) and stone tools and flakes (Anderson 1979a, 1989). The 18 ovens excavated were small: 0.6–1.0 m in diameter and 30–60 cm deep. Many had been reused several times. Most of the bone midden lay in a separate patch to the north, with a butchery area lying to the east of the band of ovens. At Coal Creek the ovens lay on a lower terrace among drifts of heavily burnt and broken bone. At Owens Ferry there were two ovens associated with scoop hearths and a small butchery area and midden of moa bone (Anderson 1989).

At Shag River Mouth, ovens and open fires formed a broad swathe across the north-facing slopes of the site. About 80 were excavated in the high dune area at the south end of the site. The ovens were relatively broad shallow scoops in the sandy substrate, varying greatly in size, from 1–4 m. All contained mixed charcoal and burnt stone and many had burnt and unburnt moa bones and other midden material. The large ones had been re-used 5–10 times (Anderson & Allingham 1996: 48).

It is possible to divide ovens into those associated with other activities, such as preparation of animal foods (bone and shell middens), tool making and dwellings, and umu-ti where only kauru has been prepared. In Canterbury umu-ti are also distant from other types of sites, especially villages. In Otago umu-ti clusters, such as those near Middlemarch and Basalt Hill, fit the Canterbury pattern, but those near Millers Flat have moa hunting sites with bones and flakes scattered throughout the same area. It is not known whether the Minzionburn, Tima Burn, and Oven Hill Creek moa hunting sites ever had large raised-rim ovens within the sites as was the case at Dart Bridge. The Tahakopa and Lagoon Site ovens are similar to the Millers Flat group in having sites of other types within a kilometre or so.

The correlation of the modern distribution of cabbage trees in Otago with the distribution of umu-ti is poor. Since they are a tree of open ground and very palatable to stock, it is not surprising that their present strongholds are basalt outcrops and coastal wetlands. Few, if any, cabbage trees are visible today around some of the large clusters of umu-ti in schist country, such as those near Millers Flat and Middlemarch.

At present the analysis of plant residues from ovens is our main source of archaeological information about plant foods. Ovens are important to our understanding of prehistoric economy and settlement pattern. Their form, function, and distribution relate closely to several facets of settlement patterns

and to the use of both plant and animal foods. Umu-ti in particular require considerable effort from a group of people, and the known dating to the 14-15th centuries and the 18th-19th centuries suggests correlation with the presence of organised villages.

## 2.8 STONE RESOURCES

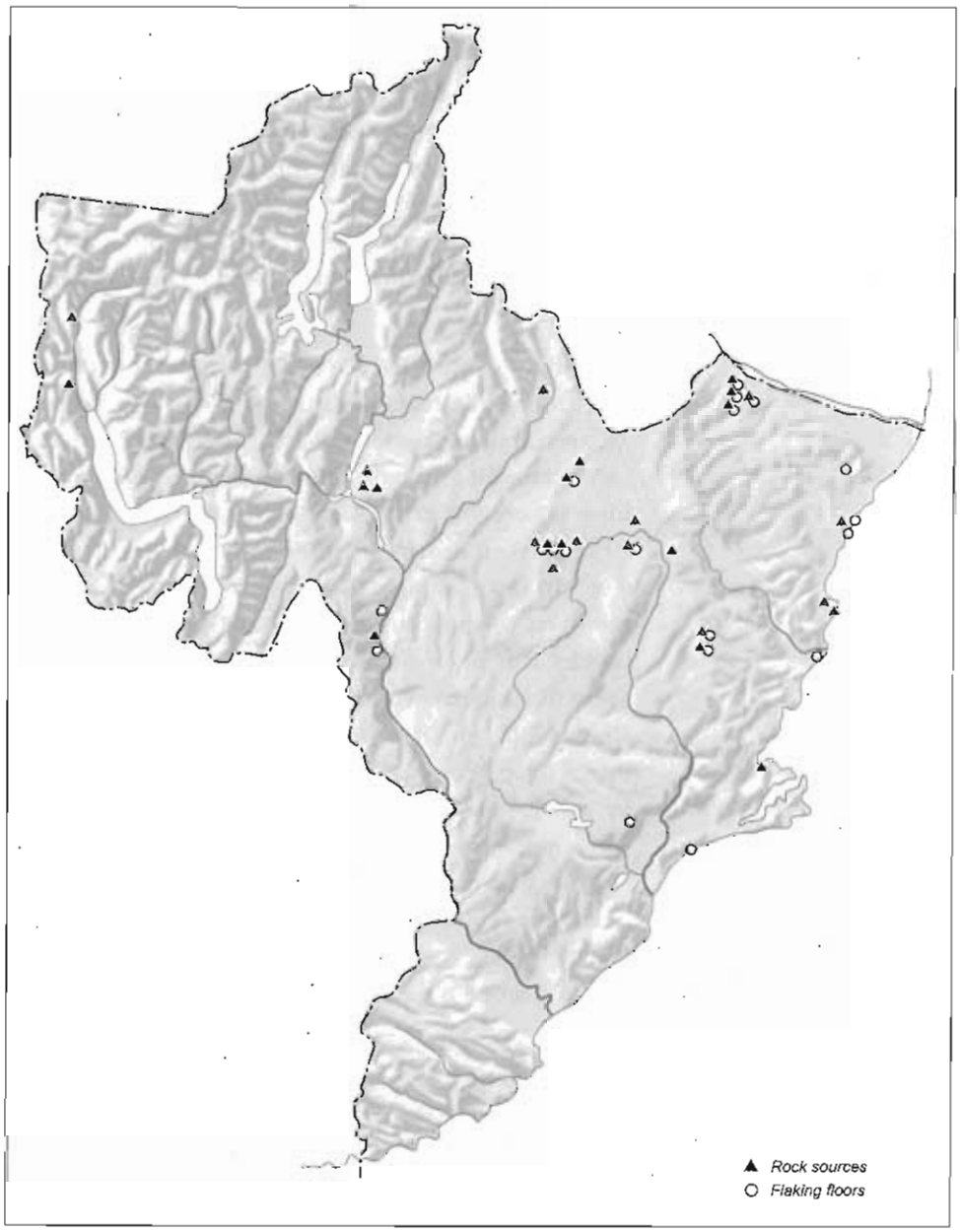
Rock types that are suitable for flaking into sharp-edged tools generally occur in small, hard-to-find outcrops. Prehistoric Otago was relatively rich in flakeable stone sources (Fig. 9), especially porcellanite, silcrete, basalt, chalcedony, chert, and argillites (or meta-argillites). More widespread rocks, such as schist, sandstone, siltstone, basalt, and greywacke, were made into files, saws, grindstones, ulu (D-shaped scrapers), and hammer stones. Rock types which were used less frequently included haematite, pitchstone, fossilised wood, grossular garnet, quartz, phonolite and opaline jasper (McGovern-Wilson et al. 1996a; Hamel 1980; Leach & Hamel 1981). The only types imported in 'industrial' quantities were obsidian from the northern half of the North Island, argillites from Southland, and nephrite from the West Coast to supplement the material from the Dart Valley. Some rock types, such as Nelson argillite, seem to have come in only as finished artefacts. Obsidian was brought to Otago in blocks weighing many kilograms, such as an example from Long Beach, now in the Otago Museum.

### Silcrete and porcellanite

Silcrete and porcellanites were particularly important to moa-hunters, making up the bulk of their cutting tools. Geologically, silcrete was 'formed as a hard duricrust (Measure of hardness 6.5-7.0) of siliceously cemented quartz sands and gravels of freshwater origin' (Anderson 1989: 160). Porcellanite is a natural ceramic (Measure of hardness 6.5-7.0), formed by high pressures and temperatures, and is usually found where natural fires in Taratu coal measures have baked overlying mudstones. A minor and inferior source of white porcellanite is found near Moeraki township, where mudstone has been baked by volcanic flows. Even the best quality porcellanite does not flake as evenly as a fine-grained silcrete. Attempts to source silcretes and porcellanites, other than the white Moeraki porcellanite, to particular quarries have not been successful. For porcellanite in particular, there tends to be a high degree of variation in colour and chemical composition within a single quarry (Anderson 1989: 160).

Over 300 exposures of silcrete and porcellanite have been mapped in the south-eastern districts of the South Island (Anderson 1989: fig. 12.4), the greatest concentration occurring in a broad band from Nenthorn to Manuherikia Valley. Anderson (1989: 160) reports on records of 30 silcrete quarries and 15 porcellanite quarries for Otago, Southland, and South Canterbury, but the site record file for Otago shows only 18 for silcrete and 2 for porcellanite (Appendix 9), and Anderson's own map plots only 23. Some of Anderson's sites are not separate quarries, e.g. S125/3 is a find spot, Courthill is a moa hunter site and flaking floor, and S152/4 is part of Coal Creek S152/3.

Figure 9. Distribution of flaking floors and rock source sites showing traces of prehistoric working (for site names, see Appendix 9).




The Bremner Quarry (S125/1) is the largest porcellanite quarry in Otago, with two patches of rock about 700 m apart, each covering about 0.6 ha. They form bare pink areas in the tussocks on the edge of a terrace at the head of the Manuherikia Valley, a remote location lying at 760 m a.s.l. The workings consist of quarry pits and layers of flakes up to 30 cm deep scattered over the surface of the bed rock. The Coal Creek porcellanite quarry (S152/3,4) has been badly disturbed by coal mining and road making from the 1870s onwards. The porcellanite outcrops as pink and purple patches in the cuttings for State Highway 8 north of the Roxburgh Hydro Dam. Judging by the occurrences of flakes and outcrops, there may have been several workings scattered over about 1.5 km of hillside parallel to the road.

Porcellanite was carried to a moa hunter site at Courthill (G42/2) about 13 km due north at Fruitlands in such large quantities that a farmer there filled several large sacks when the site was first ploughed (J. Reid, Arrowtown pers. comm. 1995). At the moa hunter site at the mouth of Coal Creek close to the source,

96% of the stone materials were porcellanite (Anderson 1989: 160). At the Pounawea moa hunter site (H47/1), on the distant Catlins coast, of the 1203 stone artefacts excavated 42% were porcellanite (Hamel 1980). Further north up the coast porcellanite's popularity declined. Chalcedonies outcrop adjacent to the local volcanics and appear to take the place of porcellanite at the Long Beach site (I44/23), where overall porcellanite made up only 10% of the stone artefacts and chalcedonies 52%. At the Shag River Mouth moa-hunter site (J43/2), where silcrete dominated the flake assemblages, only 2% of the flakes were porcellanite.

The silcrete quarries have been better documented (Appendix 9). The best known one at Oturehua (Leach 1984) covers about 20 ha, with discrete areas of quarry pits and associated working floors. In one area of only 60 × 60 m, 49 subrectangular pits, usually 2–3 m across and about 25 cm deep, marked where unweathered silcrete had been quarried. Piles of good fine-grained material were stacked nearby, with cores and flakes strewn down a sunny slope. An area 6 × 10 m of flaking floor was excavated, and over 14,000 flakes and cores removed for analysis and 'jig-saw' reconstruction. Analysis showed that large blocks had been quartered beside the quarry hole, elongated pieces carried away to a nearby working floor, where the cortex was flaked off and a platform shaped. Rough flakes and blades were removed to form a fluted core which might have been carried away or else further worked so that sets of blades could be struck off (Fig. 10). Reconstruction of the cores showed the reiterative sequence of preparation and blade production (Leach 1984). On the basis of the flake technology present, the site was worked during the 13th and 14th centuries, since similar tools appear in coastal sites, such as the well-dated layers at Shag River Mouth (H. Leach, Anthropology Department, University of Otago, Dunedin pers. comm.)

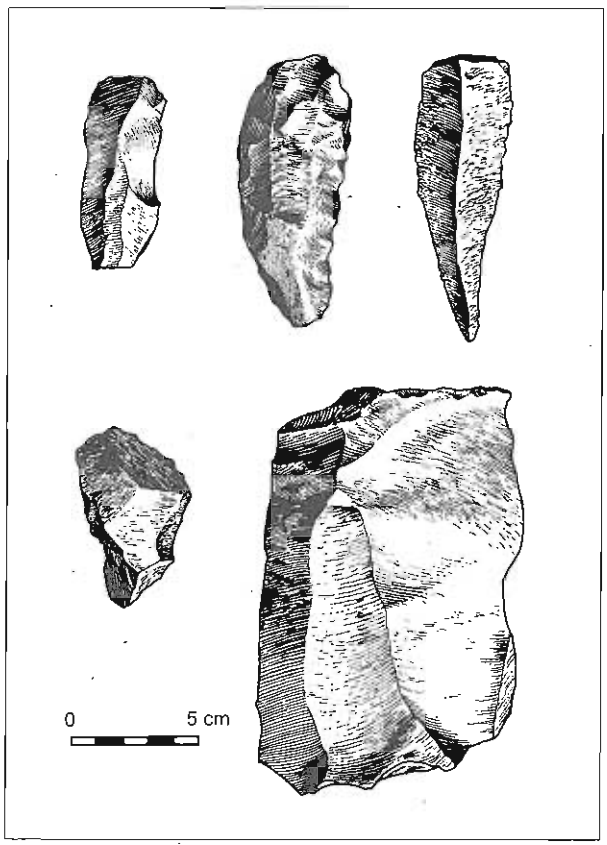



Figure 10. Silcrete tools from Pounawea. The silcrete core (lower right) is typical of those from Oturehua, 150 km to the north. The long flakes were probably struck on site at Pounawea. (Reproduced from Hamel 1980: fig. 17.)

The sequence of flaking elucidated in blade production at Oturehua was applied to the study of adze making at a Riverton argillite quarry, and answered a previously unexplained mystery about Archaic tools. Blades were made and used as specialised tools by East Polynesians soon after their arrival in New Zealand, even though such use is not apparent in the southern Cooks, where the New Zealand population is thought to have come from. The procedures for creating triangular adzes at Riverton showed that striking of blades for preforms involved the same skills as those used for striking blades at Oturehua. The southern blade industry seems to have developed as a useful off-shoot of a particular adze-making technique, now known to have been used in at least Pitcairn and Marquesas Islands, as well as early New Zealand (Jones 1984). The Oturehua and Riverton excavations were unusual, in that they explored specialist camps for extracting and preparing raw materials, and showed that the knowledge of the basic principles of flaking was widespread throughout the southern South Island (Leach 1984).

## Nephrite

Nephrite is reasonably common in early sites from the 14th century at least, e.g. Dart Bridge and Shag River Mouth. Sources of the rock were discovered relatively early, and some very fine large Archaic adzes were made in nephrite, such as the pair found at Lower Portobello (Wilson 1987: 48 ff.). Many of the early nephrite tools show signs of having been flaked and may have rough unpolished areas. At Classic Maori sites, basalt, silcrete, porcellanite, chalcedony and chert were important for utilitarian stone tools, but nephrite was of particular importance, both for making tools of great mana and for tools that would retain a cutting edge better than those in any other rock type.

New Zealand nephrite consists of twisted and tangled microcrystals of the minerals tremolite-actinolite with a measure of hardness 6.5 (Beck 1984). Though not as hard as silcrete and porcellanite, it is very much tougher and less likely to shatter because of its structure. This makes it very difficult to flake by standard methods, and adzes from early sites indicate that a smash-and-bash method was used at first on cobbles of suitable shapes. In Classic sites, sawing of nephrite was developed to a highly skilled level, using a spall of greywacke or a slab of sandstone or schist with quartz grit, to rub grooves into the nephrite to outline the desired object. Grinding, polishing and drilling reduced the object to its final shape.

Nephrite in Otago occurs at the heads of Lakes Wakatipu and Wanaka. The Wanaka sources are boulders of semi-nephrite in the Makarora River and its tributary, Muddy Creek. Relatively few artefacts have been identified as coming from this source. The Wakatipu field is derived from a line of ultramafic rocks high in the Humbolt and Ailsa Mountains. Boulders of nephrite are found in the beds of streams whose headwaters cut across this line of rocks. The material in the Caples is semi-nephrite, as are most of the boulders in the Routeburn. The worked boulders in the Routeburn are a historic site (E40/5) within the Mount Aspiring National Park (Beck 1984). The Routeburn nephrite is relatively soft, and a surprising number of artefacts which appear in hand specimen to have been made from it are yellow, brownish or chalky white, an effect that can be produced by long weathering or by heating. Beck found that heating the stone to about 650°C for a short period of time changed the colour and increased its hardness. Maori could have achieved this effect in a fire of native timbers, and appear to have used the technique deliberately, judging by the number of nephrite artefacts which show evidence of heating (Beck 1984: 97).

One of the most important Otago sites is north of the Routeburn in Slip Stream, another tributary of the Dart Valley. The Dart and South Westland nephrite fields are second in importance only to the major Westland field around Hokitika. The Slip Stream site is a Specially Protected Area under the National Parks Act 1980 and has been specially recognised in the Ngai Tahu Deed of Settlement as a Topuni area. The site includes a large boulder which appears to have had large pieces broken off it by Maori, and is the largest undamaged[6] boulder of nephrite known (Beck 1984: 54). Partly finished artefacts with the distinctive characteristics of this source tend to occur more along Foveaux Strait than in Otago. It is the Routeburn nephrite which is more common as

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6 Undamaged is used here in the sense of undamaged by Europeans.

partly finished objects in Otago and Canterbury (R. Beck, Southland Museum, Invercargill pers. comm. 1997).

Sourcing greenstone artefacts by means other than the appearance of hand specimens has proved difficult, due to variability of element composition within sources being as great as between sources. Many small sources may have been completely removed, and Maori often used cobbles from river beds, making sourcing even more difficult. Ritchie attempted to derive signatures of minor elements using Tube Excited Fluorescence Analysis and obtained only inconclusive results (Ritchie 1976). He concluded that about 80% of artefacts could be sourced from appearance by persons very familiar with the sources, but this needs to be tested against element composition analyses.

Nephrite objects are widely distributed in occupation sites throughout Otago, and it is likely that there was at least one important working area close to the Dart River field. Charles Haines, who collected Maori 'curios' early in the 20th century, described the site of a Maori building with a hearth and associated moa middens near the Dart Bridge (Anderson & Ritchie 1986). In 1919 Haines presented the Otago Museum with a collection of 50 items, most of which are thought to have come from the vicinity of the Dart Bridge site. They comprised mostly nephrite adzes, adze preforms or blanks, and nephrite flakes. The nephrite blanks had been shaped by a smash and bash method. Anderson & Ritchie (1986) consider that the area excavated near the Dart Bridge (E40/2) was not necessarily Haines' site.

The major known working sites of nephrite in Otago are on the coast north of Dunedin at Tarewai Point, Whareakeake, Long Beach, Purakaunui, and Warrington. In the early 19th century, they may have functioned as manufacturing centres for nephrite objects to be traded to Europeans throughout New Zealand. In the late 19th century, Whareakeake was literally mined by fossickers for its greenstone artefacts, the diggers speaking of claims and tailings, though they did not bring in water to sluice as Teviotdale did at Little Papanui (Teviotdale n.d.; Thomson 1944; Simmons 1967: 8). Large collections were amassed, which were estimated to have included up to 3.5 hundredweight (about 180 kg) of worked nephrite and semi-nephrite. Two principal buyers from the diggers were Murray Aston, who sold to tourists, and John White, a Dunedin barrister and solicitor and private collector. Of White's 600 nephrite objects, 400 came from Whareakeake (Skinner 1959). Much of White's collection was deposited in the Otago Museum. Skinner considered that Whareakeake had held by far the largest concentration of worked nephrite and semi-nephrite in Otago. Since there are both a moa hunter site and a Classic Period village at Whareakeake, these collections cannot be securely provenanced as early or late (see below).

Besides the 19th century trade, nephrite working may have had a long tradition at Long Beach, Purakaunui, and Warrington sites as well, since Chapman knew of particular areas in all three bays where there were concentrations of 'innumerable', very small nephrite chips, some of them with polish on them (Chapman 1891a: 501). On the other hand this evidence may indicate that flaking could have been combined with sawing well into the Classic period, a supposition supported by the nephrite artefacts at Katiki (dated by traditions and radiocarbon to the 18th century) where flaking and sawing were used together, sometimes on the same object (Trotter 1967a; Brailsford 1981: 227).

The Otago Museum collections hold more than a dozen pieces of nephrite from Whareakeake, which are either flakes or objects made from flakes. Flaking techniques were not observed by Europeans. In 1842 at Waikouaiti, Shortland saw chief Koroko and another old man grinding greenstone, using traditional methods in Koroko's house which was set up as a stone-working shop (Shortland 1851: 115).[7] In Otago, Beattie and Cowan were told that there was pounamu under Te Koroka, a bold peak at the head of Lake Wakatipu, in a place known of old as Puketai after a chief of note who died there. Nearby was a kaika called Puia, where the people lived when getting greenstone (Skinner 1935).

## Other rock types

Basalt quarries are very poorly documented in Otago, but basalt use was widespread. There was a small phonolite quarry (I44/171) on the edge of Blueskin Bay and a flaking floor (I44/198) in the Waitati township only 1.2 km away. Waste flakes from making adzes out of a light green, fine-grained phonolite—probably from Doctors Point—have been found at Mapoutahi, the 14th century site at Purakaunui, and in the 13th to 15th century layers at Long Beach (Anderson n.d.). A black basalt is relatively common in sites around Dunedin, and a flaking floor on Brighton Island (I44/5) was full of black basalt flakes before it was eroded away. The quarry for the material was probably on Scroggs Hill nearby (Helen Leach pers. comm. 1999). Basalt in a flaking floor (J42/4) on the north side of the Kakanui River came from outcrops all along the adjacent shore line (Weisler & Somerville-Ryan 1996). These are the only basalt quarries identified, but there are numerous outcrops of basalt among the Tertiary volcanics of eastern Otago, as well as beach boulder sources.

Among minor rock types, chalcedonies and cherts are the most important in coastal Otago sites. Both comprise cryptocrystalline quartz. In Otago, chert outcrops widely as a siliceous sediment, the purest forms originating from diatoms or other highly siliceous organisms, originally formed without great heat or pressure, e.g. on the sea floor (C. Landis pers. comm. 1997). Elsewhere in the world chert is synonymous with flint and includes nodules in limestone and dolomite as well as bedded chert (Bates & Jackson 1984). Moore (1977: 53) has recommended that flint as a term should be dropped. Chalcedony has precipitated out of fluids in volcanic rocks and occurs as a deposit filling or lining cavities and is more translucent than chert. Agate is a banded chalcedony, and in Otago the best known occurrence is on the south side of Katiki Point (J42/43). A green chalcedony outcrops near Moeraki township. Both chert and chalcedony are harder, denser and more vitreous than porcellanite (Bates & Jackson 1984). Chert and chalcedony are found in four localities between Oamaru and Moeraki, on the Otago Peninsula, doubtfully near Lake Waihola and in a broad band of detrital gravels in the central Clutha Valley around Alexandra and Cromwell (Moore 1977: 63).

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[7] About 1870, Judge Chapman saw more than a hundred of the 'political prisoners from Taranaki' cutting greenstone in a systematic way, using a remarkable invention. Two men worked either side of a slab of greenstone, drawing a framework holding about 10 bars of No.8 fencing wire to and fro across the slab while a third man dribbled water and sand on to the cuts. The narrow strips were then ground down and drilled for ear pendants. The government supplied the raw material, and when the men were freed they had the 'manufactured goods to sell' (Chapman 1891a).

Nearly every large site which has been excavated contains a few rounded pebbles of haematite (ochre), or traces of where it has been ground with a mortar in a large shell. Early sites with haematite include Hawksburn, Schoolhouse Creek in the Lower Nevis, Shag River Mouth, Pounawea, Purakaunui, Dart Bridge, and late sites include Whareakeake, the upper levels of Little Papanui, Katiki, Karitane, Mapoutahi, Taiaroa Head, Kings Rock, and Kaka Point (Holdaway 1984). At Little Papanui, Skinner (1960) linked an oven full of powdered haematite with a report by Dieffenbach that Taranaki Maori roasted the ore in the preparation of ochre. At Shag River Mouth some of the haematite was derived from a yellow iron oxide (geothite or limonite), which had to be heated to convert it to haematite (McGovern-Wilson et al. 1996a). Haematite occurs widely in Otago in sedimentaries that are iron-rich and have been heated by the action of volcanic flows, e.g. on Huriawa Peninsula at Karitane.

Cobbles in river beds and along the coast were also a useful source of some rock types. Having survived much tumbling, a cobble was likely to be tougher than average for its rock type, which may or may not have been a desirable attribute for flaking. At Shag River Mouth (J43/2) some silcrete and basalt artefacts had cortex with chatter marks, indicating that cobbles in the Shag River or on the nearby coastline had been the source, but other material came from quarried rock.

## The patterns of rock types in sites

At the Archaic site of Shag River Mouth, where silcrete made up about 75% of the flaked materials, chalcedony was the second most important rock type. The relatively high frequency of local chalcedony and water-rolled basalt in the site indicated a strong reliance on local materials. Porcellanite, mostly in small flakes, and eight nephrite artefacts must have been obtained from inland Otago or even the West Coast. Obsidian from the North Island and meta-argillites from Southland and Nelson indicate an even wider trading network (Smith et al. 1996).

The Shag River Mouth excavations produced an assemblage of 99 complete or fragmentary adzes which were analysed along with 432 from the Otago Museum Shag River Mouth collections. Adzes were both manufactured at the site and extensively reworked. Local basalts, mostly of relatively poor quality, were used to make roughly finished utilitarian adzes. Many of these were made from cobbles which were already near enough in shape so that a little trimming could make a useful article. These opportunistic shapes were not those of 'standard' adzes made by definable techniques. Among the 121 primary adzes which had not been reworked 40% were basalt, 34% nephrite and 19% meta-argillites. The high proportion of nephrite, mostly made into narrow, chisel-shaped adzes, is surprising in an Archaic site. They and the other chisels in the assemblage comprise a set of fine wood working tools, suitable for carving complex patterns. The heaviest adzes from the site have appropriate weight to cutting edge ratios for adzing the main planks for canoes, and the adze assemblage in general indicates a wide diversity of wood-working on the site (Smith & Leach 1996).

Since this book is about the sites themselves, a dissertation on artefacts and the technology of their manufacture is not appropriate, except in one respect. A rock source in the ground or cobbles in the river bed were important as primary sources, but adzes within a site itself were a secondary source of material, which

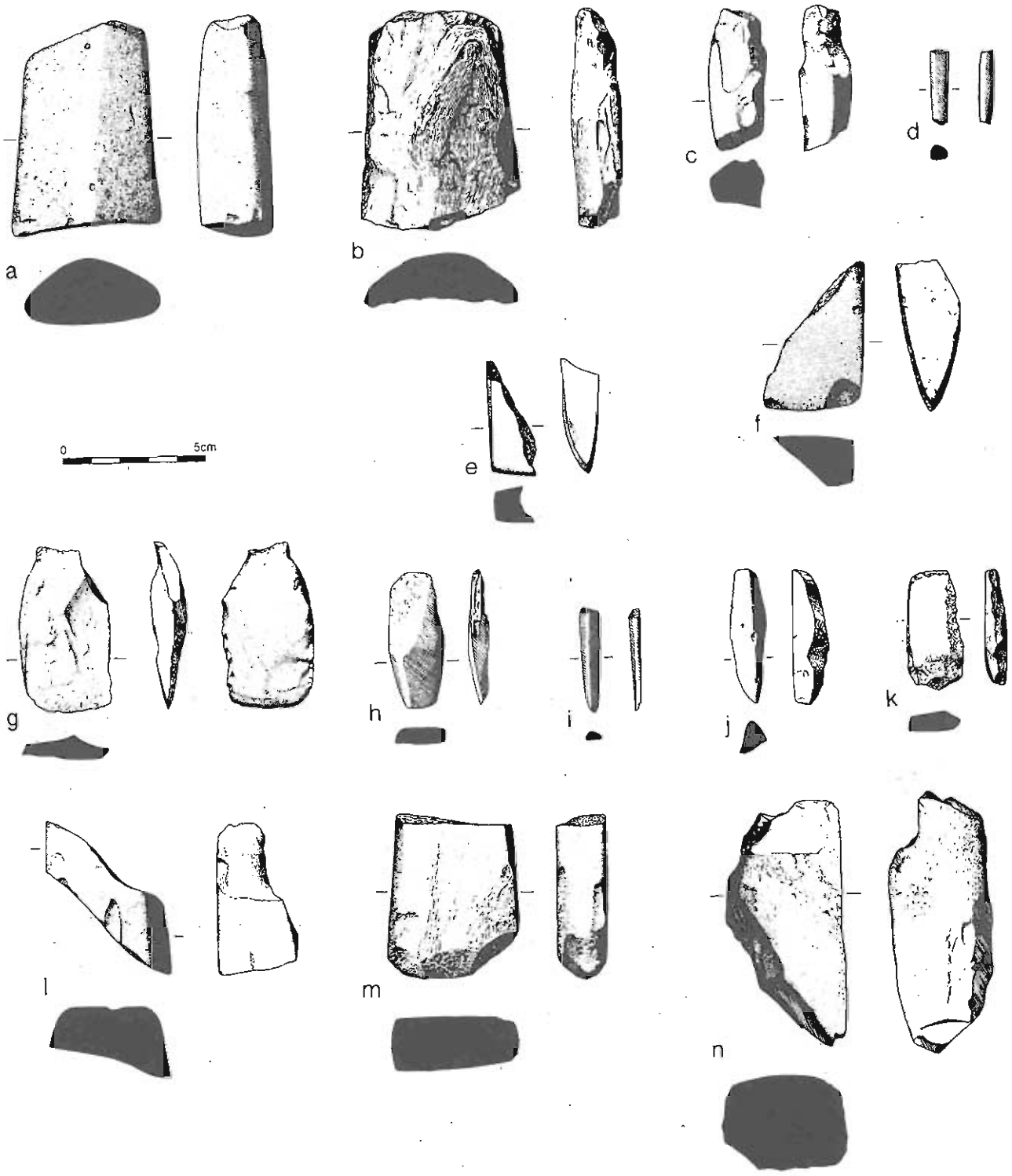



Figure 11. Recycling of adzes at Shag River mouth Archaic site. Adzes a–f have been broken and discarded, but adzes g–n have been reworked for further use. (Reproduced with the permission of ANH Publications, ANU, from Anderson et al. 1996: fig. 10.2.)

could be worked using a variety of refurbishment and recycling techniques. The Shag River Mouth collection (Fig. 11) contains 62 refurbished adzes, excluding the nephrite adzes on which it is not possible to perceive reworking. Three objectives were discerned—rejuvenation of the bevel, a narrowing or thinning of the body of the adze, and grip creation—either alone or in combination. Recycled adzes (106 of them) had been treated more drastically and the result might be a

different type of adze or another sort of tool. There was a definite preference for the finer-grained rock types for refurbishing or recycling. The fine-grained meta-argillites from Cook Strait and Foveaux Strait were both well represented in the re-worked adzes. The range of tools made from recycled adzes was very wide, including scrapers, planes, hammers, awls, burnishers, saws, and cutters. To make a new adze, the bevel might be reversed, or a flake struck off the body to make into a small flake adze. The platform for flaking could be provided by a transverse fracture across the body of the primary adze. There were 117 other broken adzes in the Shag Mouth collection, which had not been reworked and possibly represented a potential resource (Smith & Leach 1996).

It has been suggested that the amount of effort put into using the poor-quality local basalts for primary adzes and the reworking of the good-quality imported materials meant the people at Shag River Mouth did not have trading networks to replenish supplies of good quality stone (Anderson et al. 1996a: 143). There is a similar pattern in the Papatowai collection of adzes. Of 70 adzes collected by Teviotdale from Papatowai Point (G47/50) and deposited in the Otago Museum, all, but two were reworked, either on the primary adze itself or on a flake struck from it. Much of the reworking was on Bluff and Riverton meta-argillites, mostly using simple bilateral flaking, but 26 were flake adzes made on skilfully struck flakes (Hamel 1977a: 316). The Bluff source of stone was only two or three days' canoe journey to the west.

It seems more likely that a good-quality adze could be viewed as having a 'life history' of preform, finished adze, refurbished adze, recycled adze and, when it could not even be used as a hammer, finally discarded. This process has some consequences for adze typology. Some adze types, such as Duff's 1B, tend to be the result of reworking. Adzes can change their type by reworking. The incidence of spade-shouldered adzes in eastern and south Otago may be due to refurbishment of other adze types, rather than being a distinctive cultural marker (Smith & Leach 1996: 144).

At Long Beach, the flake assemblages from both the Archaic and Classic layers were dominated by chalcedonies, silcrete, and a local green volcanic, with porcellanite and chert much more important in the Classic layer (Table 5). As at the Shag River Mouth site, there had been some working of the local, poor-quality basalt, but on a very minor scale and only in the Archaic layers. Silcrete blades were found only in the Archaic layers, but a silcrete drill and many flakes lay among the Classic material in the upper layer. Unlike Shag River Mouth, there was no nephrite in the Archaic layers, and the 22 nephrite items found in the Classic layers had been mostly flaked. There were several flakes and slivers of nephrite, indicating that the pieces had been worked on site. One of the flaked nephrite objects in the upper layer was a skewed adze-shaped amulet, found typically in Classic sites, indicating continuity of nephrite flaking into the early Classic (Leach & Hamel 1981).

Other Archaic sites where small lithic assemblages have been analysed include Pounawea and Papatowai in the Catlins. At Papatowai, the popular rock types were Southland argillite (41% of 66 pieces), porcellanite (32%), and silcrete (18%), with all other types less than 3% each (Anderson & Smith 1992). In his 'selective collecting' at Papatowai, Teviotdale found at least four nephrite adzes, a thin adze or scraper and a small polished triangle of nephrite, but does

TABLE 5. STONE MATERIALS FROM LONG BEACH (LEACH & HAMEL 1981).

| ROCK TYPE | NUMBERS OF ITEMS | | | PERCENTAGES | | |
|---|---|---|---|---|---|---|
| | LAYER 4 | LAYER 3 | LAYER 2 | LAYER 4 | LAYER 3 | LAYER 2 |
| Chalcedony | 17 | 15 | 222 | 16.8 | 22.1 | 36.0 |
| Green chalcedony | 4 | 3 | 85 | 4.0 | 4.4 | 13.8 |
| Crazed chalcedony | 7 | 2 | 34 | 6.9 | 2.9 | 5.5 |
| Silcrete | 19 | 4 | 74 | 18.8 | 5.9 | 12.0 |
| Volcanic | | | | | | |
| green | 27 | 17 | 15 | 26.7 | 25.0 | 2.4 |
| grey-brown | 4 | 8 | 3 | 4.0 | 11.8 | 0.5 |
| black | 1 | | | 1.0 | | |
| Non-lustrous porcellanite | | | | | | |
| pale green | 1 | | | 1.0 | | |
| black | 2 | | | 2.0 | | |
| grey | | 1 | | | 1.5 | |
| white | | 6 | 21 | | 8.8 | 3.4 |
| other colours | | | 19 | | | 3.1 |
| Lustrous porcellanite | | | | | | |
| red-brown | | 2 | 20 | | 2.9 | 3.2 |
| purple grey | | | 13 | | | 2.1 |
| Obsidian—grey | 2 | | 12 | 2.0 | | 1.9 |
| Obsidian—green | 2 | 6 | 20 | 2.0 | 8.8 | 3.2 |
| Chert | | | | | | |
| yellow | 2 | 1 | 13 | 2.0 | 1.5 | 2.1 |
| grey | 4 | 1 | 22 | 4.0 | 1.5 | 3.6 |
| white | | 1 | | | 1.5 | |
| Schist | 6 | 1 | | 5.9 | 1.5 | |
| Opaline jasper | 1 | | 2 | 1.0 | | 0.3 |
| Argillite ? Southland | 2 | | | 2.0 | | |
| Argillite? D'Urville Is. | | | 1 | | | 0.2 |
| Pitchstone | | | 2 | | | 0.3 |
| Other siliceous rocks | | | 4 | | | 0.6 |
| Nephrite—grey green | | | 15 | | | 2.4 |
| Nephrite—dark green | | | 7 | | | 1.1 |
| Grinders and cutters | | | 13 | | | 2.1 |
| Totals | 101 | 68 | 617 | | | |

not describe whether they showed traces of flaking or sawing (Hamel 1977a: 211). Pounawea (1203 pieces of rock material) showed the same pattern as Papatowai—porcellanite 42%, Southland argillite 35%, silcrete 19% and other types less than 1% each (Table 6). There was only a single piece of nephrite in the Pounawea material. Both sites contained hammer stones of grossular garnet from Southland, and the flake collections included many pieces from polished adzes. As noted above, the Otago Museum collection of Papatowai adzes includes a high proportion of reworked adzes, especially those of Bluff and Riverton argillite. They could be said to take the place of utilitarian tools made of local poor quality volcanics at Shag River Mouth, since the Catlins coast lacks volcanics, or indeed any flakeable rock types (Hamel 1980).

The full analysis of the tools from the inland moa-hunter site of Owens Ferry is not yet available. An analysis of microchipping of porcellanite tools from the site was made by Kooyman (1984). He found that of the tools which could be

TABLE 6. STONE MATERIALS FROM PAPATOWAI AND POUNAWEA (ANDERSON & SMITH 1992; HAMEL 1977A).

| | PAPATOWAI | | POUNAWEA | |
|---|---|---|---|---|
| ROCK TYPE | n | % | n | % |
| Chalcedony | 1 | 1.5 | 5 | 0.4 |
| Silcrete | 12 | 18.2 | 231 | 19.2 |
| Volcanic green | | | 1 | 0.1 |
| Lustrous porcellanite | 21 | 31.8 | 505 | 42.0 |
| Obsidian—grey | | | 1 | 0.1 |
| Obsidian—green | | | 9 | 0.7 |
| Chert | 1 | 1.5 | 2 | 0.2 |
| Argillite ? Southland | 27 | 40.9 | 419 | 34.8 |
| Argillite? D'Urville Is. | | | 2 | 0.2 |
| Other siliceous rocks | 1 | 1.5 | 12 | 1.0 |
| Nephrite dark green | 2 | 3.0 | 1 | 0.1 |
| Grinders and cutters | | | 12 | 1.0 |
| Grossular garnet | 1 | 1.5 | 3 | 0.2 |
| Total | 66 | 100 | 1203 | 100 |

n = Numbers of artefacts made from each roek type

% = The percentage of eaeh rock type for the site

classified, most had been used for working wood, some for cutting meat, and only a few for cutting bone.

Nephrite is the only rock source which has continued to be of spiritual and commercial importance to Maori, and has traditions associated with its origins and location. When Maori acquired metal tools from the first European ships, the collection of rock types other than nephrite and the skills associated with creating the wide range of tools found in archaeological sites ceased abruptly. Unlike mahinga kai for food, stone sources were rarely discussed with the Europeans who collected traditions, or in the Maori Land Court hearings. No European described watching a Maori making an adze, a nice indication of how effective Maori were as traders. With the exception of nephrite, archaeologists are on their own when it comes to tracing and understanding the place of stone resources and stone tools in the prehistoric economy.

## 2.9 ROCK SHELTERS AND ROCK ART

Rock shelters in Otago are divided both culturally and geologically into two quite different groups. The rock shelters of North Otago have been formed in limestone and were used extensively for rock art. The rock shelters of Central Otago have been formed in schist, they were very rarely used by the Maori for rock art, and more traces have been found in them of non-Maori occupation (gold miners and rabbiters) than of Maori occupation. Within the Cromwell Gorge, Ritchie (1982a) recorded 40 rock shelters occupied during the 19th century gold rush. Only three shelters had traces of Polynesian occupation, and some others were interpreted as moa nesting and roosting sites, some half filled with moa droppings (author's field books). Many of the Cromwell Gorge rock shelters have been inundated by the Clyde Dam power project.

The three Polynesian sites (Italian Creek G42/183 and Rockfall 1 G41/389 and Rockfall II G41/453) were excavated by Ritchie (1982a). All three contained evidence of moa bone or egg shell and though the radiocarbon dates on charcoal from short-lived plants were somewhat erratic, they all indicated early occupation. Rock shelters further up the Clutha River in the Kawarau Gorge were considered by Ritchie to be mostly occupied by Europeans, and he did not identify any with prehistoric remains (Ritchie 1983b).

In schist rock, shelters may contain or merge into clefts which were used for burials and for caches of such objects as wooden bowls, kits of fibres and work materials and even a feather box with huia feathers from the North Island. Clefts with caches have been widely recorded throughout Otago, but there seems to be a special concentration around the Maniototo. Given the perishable nature of many of the cache materials, most of these are thought to be relatively recent (see section 4.2 Other sites).

The North Otago rock art sites were the earliest to be reported. Mantell sketched the drawings at the Takiroa site in 1852 (Mantell 1852) and reported on them in an address to the New Zealand Institute in 1868 (Mantell 1868). Some of his drawings are available in Trotter & McCulloch (1971), who provide a useful set of annotated photographs and drawings of rock art throughout New Zealand. Hundreds of rock art sites are known, containing thousands of drawings (Davidson 1984: 214), but the two main concentrations in New Zealand are in the limestone areas of North Otago and South Canterbury. Other significant investigations of North Otago rock art sites have included those by Hamilton (1896) of the main sites in the Waitaki Valley, Stevenson (1947), J.L. Elmore (a visiting American antiquarian who cut out blocks of limestone with drawings), Theo Schoon (1962) who also damaged the paintings by overdrawing, general surveys by the North Otago Historical Society (Peterson 1962), and Trotter & McCulloch (1969) who carried out the first-large scale surveys of North Otago sites. The most recent work has been that of the South Island Maori Rock Art Project, which is a long-term intensive survey carried out by Brian Allingham under the auspices of the Te Runanga o Ngai Tahu (Allingham 1991a-c, Allingham n.d. a-d).

Locations in which rock art is found in North Otago include simple cliff faces, the back walls and roofs of overhangs (which may be very shallow or deep enough to be called caves), narrow crevices almost too small to enter, and boulders out in the open. Only a few of the rock shelters have signs of Polynesian occupation. The drawings are made with naturally occurring pigments of charcoal (90%), haematite, and white clay, and a few are incised (petroglyphs). The area with the highest frequency of rock art sites in Otago runs from the Waianakarua River to the Waitaki River and inland to Lake Benmore. Subjects include abstract designs, indecipherable figures (taniwha?), dogs, humans, fish, birds, canoes, sailing ships, people in European clothing and on horse back and Maori words in Roman serif typeface. Since the birds clearly include moa, the drawings are considered to have been added to steadily throughout prehistory and into the protohistoric. Human figures, shown full face or in profile, are the most common of the recognisable drawings.

Some drawings have been assigned to early or late periods on the basis of subject matter, superimposition or from excavations of cave floors (Fomison

n.d.). Three stylistic periods—Early Polynesian, Classic, and European Contact—were distinguished by Fomison (n.d.). The early style includes many living subjects linked into compositions and drawn with internal blanks, and the Classic drawings tend to be more stylised, with more mythical subjects, using lines and infilling. Fomison saw similarities to Classic Maori art and artefacts. Drawings assigned to the latest period tend to be more casually drawn with European subjects and writing (Fomison n.d.). It should be possible to eventually test Fomison's classification, as it is technically possible to directly radiocarbon date rock art by taking microsamples from the natural varnish overlying the drawings. This contains algae which have grown on the surface of the drawing and then been killed by water-deposited compounds. Using AMS (accelerator mass spectrometry), the radiocarbon in the algal remains can be measured, but there are still difficulties with the sampling process (Dayton 1997).

Bain used a statistical discriminant analysis to explore differences between North Otago and South Canterbury drawings. When drawings of dogs, humans, fish, and birds were grouped according to Fomison's classifications, the Early and Classic groups proved to be significantly different, both within and between the regions (Bain 1985). Given the mobility of people at all stages during the prehistoric, the regional differences could reflect the preferences and skills of the artists, rather than the mores of local cultures. Gifted and widely respected artists in different localities may have made innovations copied by later artists, and effectively created artistic traditions associated with each region (Davidson 1984: 217).

The South Island Maori Rock Art Project, begun in 1988 under the guidance of the New Zealand Historic Places Trust, is increasing the number of recorded sites by up to 400% in some areas. With increased funding from the Ngai Tahu Development Corporation, this survey is producing unusually detailed descriptions of each site. Besides plotting the sites on topographical maps and aerial photographs, each site is photographed to show the art, its relationship to the site and the setting of the site in the wider environment. Detailed drawings and measurements are made of each site and the art work. Many of the drawings are very faint or damaged, and dot-for-dot drawiugs are also made as guides to the photographs.

The first seven volumes of the project have concentrated on known clusters of rock art, including the well-known site at Takiroa south of Duntroon (Allingham 1991a–c, Allingham n.d. a–d). The majority of sites described in the coastal area north of the mouth of the Kakanui River contain a few linear human figures drawn in black, with the notable exception of a large composition near Totara. The latter contains bands of small figures crammed ou to about 2 $m^2$ of rock face. The whole composition has later been deliberately scratched with fine horizontal and vertical lines. Moa eggshell and freshwater mussel shells were commonly found on the rock shelter floors.

The works at Takiroa and in the Upper and Lower Waipati Creek include long bands of figures, created as deliberate compositions, with naturalistic representations of people, birds, dogs, and fish, as well as abstract shapes. The Takiroa sites include figures of horses, sailing ships, and people in European dress, but it is also notable for the wide range of techniques and styles used. The

more remote sites in Waipati Creek lack Contact period work. Incised figures occur sporadically, but are particularly common in the Waipati Creek sites where finely scratched or incised designs overlay black figures. The lower Waipati Creek group contains the well-known depiction of a moa 100 cm high. Curvilinear and rectilinear designs occur together, with no indication that one is earlier than the other. The use of red ochre is widespread, but more common at Takiroa than elsewhere, and is found both under and superimposed on black figures.

The object of this survey has been to record for posterity a permanent photographic record. The compiled volumes so far are disappointing in one respect, in that many of the drawings are so faint that it is impossible to see them clearly in the photographic reproductions. The point-for-point drawings are a great deal more satisfactory for analyses of the art work itself. Records of major groups of sites, such as those at Maerewhenua, have yet to be compiled, and it is early days yet for analyses of this new material. Though some styles are considered to be 'Early', Allingham frequently comments on the need for excavation and dating of the sites. Until radiocarbon dating has been carried out on a selected group of sites, styles ascribed to periods, and sites ascribed to the times of their creation, it will be difficult to place these sites in the context of other cultural evidence.

# 3. Settlements

## 3.1 DEFENDED PA

Otago has only four sites which can be archaeologically described as defended headland pa with traces of trenches and palisades—Katiki (J42/20), Huriawa (I43/1), Mapoutahi (J44/17), and Pukekura (Taiaroa Head, J44/3, 4). The dates of occupation of these pa have been derived from excavated material which includes Classic artefacts, along with a few radiocarbon dates centred on the 18th century. Traditional evidence has also been interpreted to indicate that various incidents at the pa sites occurred in the late 17th to late 18th centuries and that there were close links between chiefs associated with each pa. There is also evidence of a palisaded settlement at Whareakeake (Lockerbie 1959: 92; Skinner 1959), which was in a bay and not on a headland.

At Katiki, a long peninsula surrounded by low cliffs is joined to the mainland by a very narrow and easily defended neck of land. The traditional name of the pa was Te Raka-a-hineatua. Confused accounts of the battle at Katiki are provided by White (1889) and Beattie (1916). Feuding at Kaikoura between Taoka and Tawhakiterangi induced Taoka to move south by stages, constructing pa near the Ashburton River, near Timaru and at Katiki. Soon after the Katiki pa was completed, a war party under Tawhakiterangi arrived from the north. Accounts describe an ambush of four people from the pa, a set fight between a few warriors and then a general battle. Traditions of feuding between Taoka and other chiefs involved the other three pa at Huriawa, Mapoutahi, and Pukekura. Only two sieges (at Huriawa and Mapoutahi) are described in the traditions, and many of the insults and killings took place away from the pa sites in short fights rather than during prepared battles (Anderson 1998: 48ff). It is, therefore, not surprising that defensive structures on Otago pa are less massive than those of North Island pa. Using Shortland's and Stack's genealogies, Anderson places these feuds in the late 17th to late 18th centuries, the sieges of the coastal pa coinciding with other raids by Ngai Tahu in the interior (Anderson 1982b).

Archaeological evidence shows the main features of the pa sites to have been terraces for houses, traces of ditch-and-bank defences and midden material with Classic style artefacts. Katiki has the largest set of terraces which lie on *both* sides of the narrow neck (Brailsford 1981: 226). Excavations have indicated the presence of rectangular houses built of heavy wooden slabs with square stone fireplaces inside them (Trotter 1967a) and associated with midden containing Classic style artefacts. Radiocarbon dating, both here and at Pukekura Pa (Leach & Hamel 1978), agrees with the 18th century occupation of these two pa sites. At the time of European contact, the main settlement in North Otago was to the north of Katiki at the Moeraki kaika, close to the Moeraki whaling station. The population here fluctuated (Durward 1929), as people continued the prehistoric pattern of moving readily between Kaikoura and Otago.

Te-Pa-a-Te-Wera is on Huriawa Peninsula and has clear ditch-and-bank defences across a steep approach to the main peninsula (Mackay 1961). There is an account of an unsuccessful siege at this pa, carried out by Taoka against his

nephew, Te Wera (Cowan 1906). After six months, lack of food forced Taoka to abandon the siege (Anderson 1998: 50). There are two main areas of small terraces on the peninsula. Excavations revealed complex patterns of post holes, possibly for drying racks and rectangular houses (Brailsford 1981: 224). The defence system took advantage of a complex system of natural slumps, and seems to have consisted of over-steepened banks and paths along ditches (Easdale & Jacomb 1984). A few European items showed that occupation persisted into the contact period (Leach & Hamel 1978). A whaling station was established at the northern side of the peninsula, and when Shortland visited in 1843 he found the local Maori living on an open beach inland of the whaling station and away from the pa (Shortland 1851: 139).

Mapoutahi Pa is on a smaller peninsula than the other three pa, and has a very clear ditch across the neck. A long trench is marked on a 1929 survey plan (SO 6053) as running along the south-western cliff edge. In 1983 a slip on these cliffs revealed that there had been a double-row palisade along the western edge, but no trace of a ditch was seen during an archaeological investigation. Instead, mounds of oven rake-out seemed to have been mistaken for a deliberate bank. Shell and spiky fish bones appeared to have been deliberately thrown into the base of the palisade, though they may also represent earlier occupation (Anderson n.d.). Excavations on the level ground of the peninsula showed that the site had been scraped clean of debris and, except for a square stone fireplace, there were no indications of house sites. Around the edges, midden material from the 1983 slip revealed fish-hook types similar to those in the lower layers at Long Beach, dated to the 13th–15th centuries. The pa was successfully besieged by Taoka in the mid 18th century and the inhabitants killed (Anderson & Sutton 1973). There could have been terraces on the nearby slopes, but the site was badly disturbed in the 1870s when the main trunk railway was built around the adjacent cliffs. At the time of contact with Europeans, the main Maori settlement was closer to the whaling station in the mouth of Purakaunui inlet (Shortland 1851: 120; Anderson 1981b).

Traditions linked to Pukekura Pa include senior chiefs and heroes such as Waitai (the second?), Taikawa, Taoka, and Tarewai, who have been estimated as mostly belonging to the 18th century (Beattie 1916). The well-known tradition of Tarewai is difficult to place chronologically, but lies around the time of major feuding between Ngai Tahu and Ngati Mamoe, with people from both tribes resident in the pa (Anderson 1998: 54). At Taiaroa Head the obvious position for a defensive ditch for Pukekura Pa is now occupied by a European stone wall and trench, but there may have been an earlier ditch and bank defence (Edward Ellison, Otakou Runanga, Otago pers. comm. 1999). Heavy modification of the headland for European defences has obscured other evidence of Maori occupation, but the small terraces, on which the European cottages were sited behind the stone wall, had traces of midden with flake tools in two places (Hamel 1992f). These were on a defensible site facing east. A lens of midden has also been found on the crest of the pa on exposed slopes facing into the west which provide a wide view of the eastern coastline (Leach & Hamel 1978). The cliff face known as Tarewai's Leap lies at the northern end of Pilots Beach, but material excavated by Teviotdale and provenanced as coming from Tarewai Point (J44/3) came from a terrace on a spur running down to the southern end of Pilots Beach. This very rich site, outside the main natural defences of the pa,

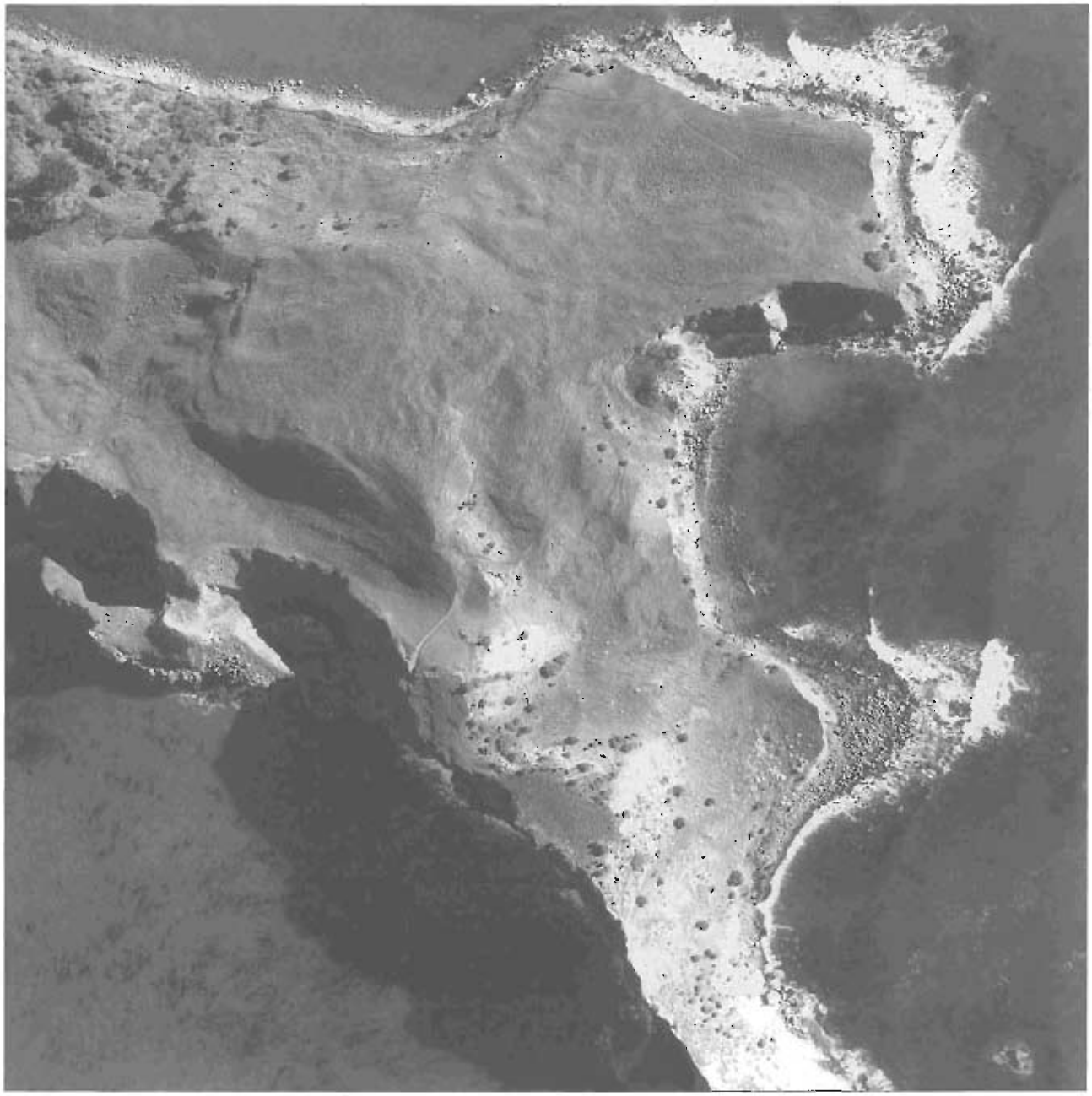
seems to have been a nephrite-working village of 8–10 huts occupied up to the protohistoric, judging by the European artefacts (Teviotdale 1939a). The inclusion of worked bottle glass in an otherwise Maori midden within Pukekura Pa itself (Hamel 1992f) also indicates occupation up to the time of European contact, perhaps until the time of the measles and influenza epidemics of 1835 (Teviotdale 1939a; Olssen 1984). On the other hand, Bishop Selwyn's sketch of the headland in 1844 shows it well-covered with shrubland (Anderson 1998: 55), suggesting abandonment more than 20 years previously.

At the time of his visit in 1840, Dumont d'Urville saw 'two important looking villages ... one consisting of about 20 houses rose on the bluff at the entrance to the harbour; the other was built around the European fishing [whaling] station' (Dumont d'Urville 1955: 17). The village on the bluff may have been the Tarewai Point village or it may have been the site known as Hobart Town on Harington Point (Campbell 1992: fig. 4.17). Kettle's 1846 chart shows a native settlement down on the south end of Te Rauone Beach (Campbell 1992: fig. 18), where later settlers saw it. Other observers recorded villages and huts around the outer harbour, including a 'deserted pa' at Otaheiti (Anderson 1998: 167), but none described a palisaded pa.

Though traditional accounts refer to other places as pa, it cannot be assumed that they were established forts. An analysis of feuding in the interior of Otago shows that references to battles do not include accounts of sieges, and principal traditional figures are said to have occupied various settlements during their adult lives (Anderson 1982b; Anderson 1998: 43 ff.). Some sites of battles on the coast, such as Henley Hill (145/25), Pa a tupare taniwha (144/11) on the Taieri River north of Henley, and Ram Island (H45/5), Lake Waipori, are described as pa, and although they are defensible sites there are no accounts of sieges or physical signs of defences. A third possibility is that some sites were fortified against the *possibility* of attack, in particular from Te Rauparaha (E. Palmer, Dunedin pers. comm. 1999).

There are some sites known only from archaeological evidence and with no attached traditions which lie on partially defensible ridges along the coastline between Dunedin and Oamaru. The best known is Omimi (I44/1), comprising living floors with moa bone and other midden material, lying in the small natural-looking slumps on the end of a spur which drops steeply to the beach 20 m below (Hamel 1977b). A similar defensible site lies on the outer corner of Matanaka headland, facing east and comprising six terraces with natural-looking slumps and sheep hollows running away on steep ground below (Site Record Form J43/42). No midden has yet been found associated with this site which lies in full view of Huriawa, Mapoutahi, and Pukekura. The Classic site of Tarewai Point (J44/3), high above Pilots Beach, is in a rather similar position (Teviotdale 1939a), but there are steep slopes above it as well as below. Others are historic villages on Acheron Head (I44/137–141) and Pulling Point (I44/75) in Otago Harbour, Brinns Point (I43/38), and Cape Wanbrow (J41/75).

The Classic site at Whareakeake is in a different position, lying on swampy flats with steep surrounding hills. The foundations of adzed posts, marking a palisade along a swampy edge of a creek, were uncovered during an excavation in 1956 (Bell 1956; Skinner 1959: 224; Lockerbie 1959: 92). Though only about 30 m of palisade was uncovered, its position relative to a small interior fence and an area



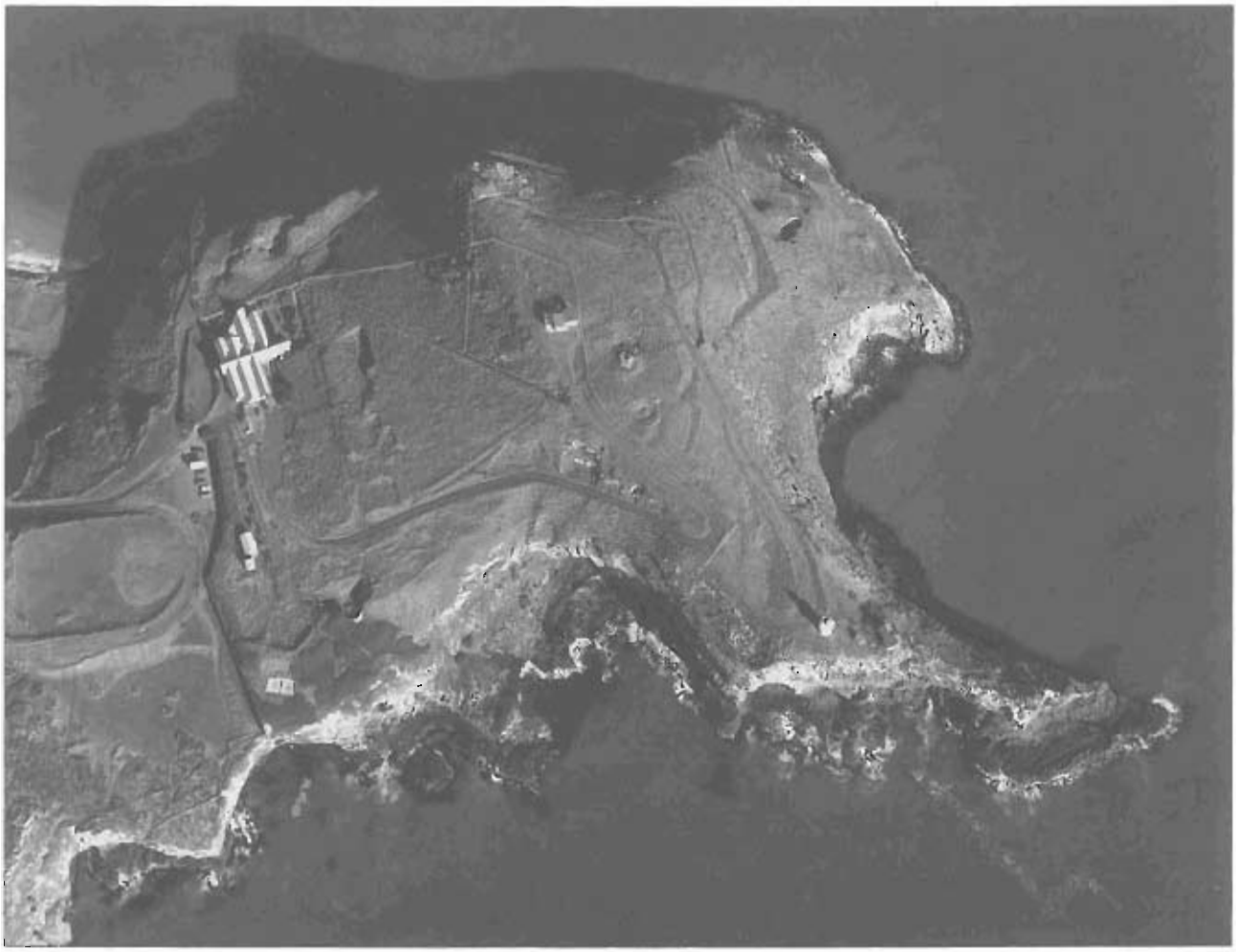
Huriawa Peninsula from the south. Terraces spread down the main spur to the right of the trig, and there is a large kokowai source in the adjacent bay. The platform (lower centre left) above the blowhole, has terraces cut into its side. (For a more general view of the peninsula, see page 95.) *Photograph: Kevin Jones, DOC*

of post holes forming no clear patterns, indicated that the palisade may have enclosed an area 60–100 m in diameter. Judging by the modern topography, the movement of sand from the prograding beach could have created quite sufficient swamp for this late village to have been a small swamp pa (author's field book).

The prograding nature of the coast from Kaikais Beach to Purakaunui has been demonstrated by the northward movement of the beach at Purakaunui since the 1860s (Anderson 1981b) and by the stratigraphy of the Long Beach site (Leach & Hamel 1981). The relative positions of the moa hunter and late Classic sites at both Whareakeake and Long Beach are similar. The early sites are on old boulder beaches at the back of the flats against the hill slope. The Classic site at

Mapoutahi Pa from the sea. A single ditch across the landward end of the peninsula and steep cliffs all round the pa created a naturally defensible site. *Photograph: Kevin Jones, DOC*

Whareakeake (described below) extended all along sand flats behind a foredune which may be relatively recent, with the palisaded village in the swampiest section (Bell 1956). At Long Beach, there is a local account of the remains of huts being seen by the early settlers in a patch of manuka close to the outlet of the creek (B. Waller, Long Beach, Otago pers. comm. 1995). If this was the site of an early 19th century settlement, the topography was suitable for a small, palisaded, swamp pa (author's field book). A palaeogeographic study of this section of coastline since AD 1000 would provide useful evidence about sand transport along the east coast of Otago and the effect on Maori settlement patterns as beaches have been built and destroyed.



Pukekura Pa. Taiaroa Head lighthouse is at the far right and Pilots Beach and Tarewai's Leap are high left. The large white building is the visitors' centre. On the landward side of it, zigzagging down to the sea, is a stone wall built on the line of an old ditch and bank defence. The terraces to the right of the visitors' centre were the sites of small cottages for the lighthouse and signal station staff. The circle to the right of centre is the cover over the Armstrong Disappearing coastal gun.

*Photograph: Kevin Jones, DOC*

## 3.2 TERRACES

In Otago, terraces for habitations are strongly associated with the Ngai Tahu pa sites. They are best developed at Katiki Point, where a series of 12 terraces run round a steep slope on the *mainland* side of the narrow neck that defends the actual pa (Brailsford 1981: 226). These terraces tend to be 2.5–3.5 m wide and vary in length from 80 m to shorter 4.5–8.0 m terraces suitable for single houses, and cover an area of about 80 × 100 m. Excavation of one of these outer terraces revealed only deep layers of midden and a square stone fireplace. This is notably different from the two terraces excavated on the main knoll of the pa beyond the narrow neck, where there are four series of terraces, up to 4.25 m wide and covering an area 100 × 160 m. There was evidence of two rectangular houses here, marked by the burnt stubs of strong totara slabs, with square stone fireplaces inside them (Trotter 1967a). The terraces on the outer knoll cover a greater area than those on the mainland slope, but the position of the latter are distinctly anomalous. They may have been used only when there were no threats to safety. They could also have been palisaded in such a way that people could move quickly down slope to the main pa when threatened.

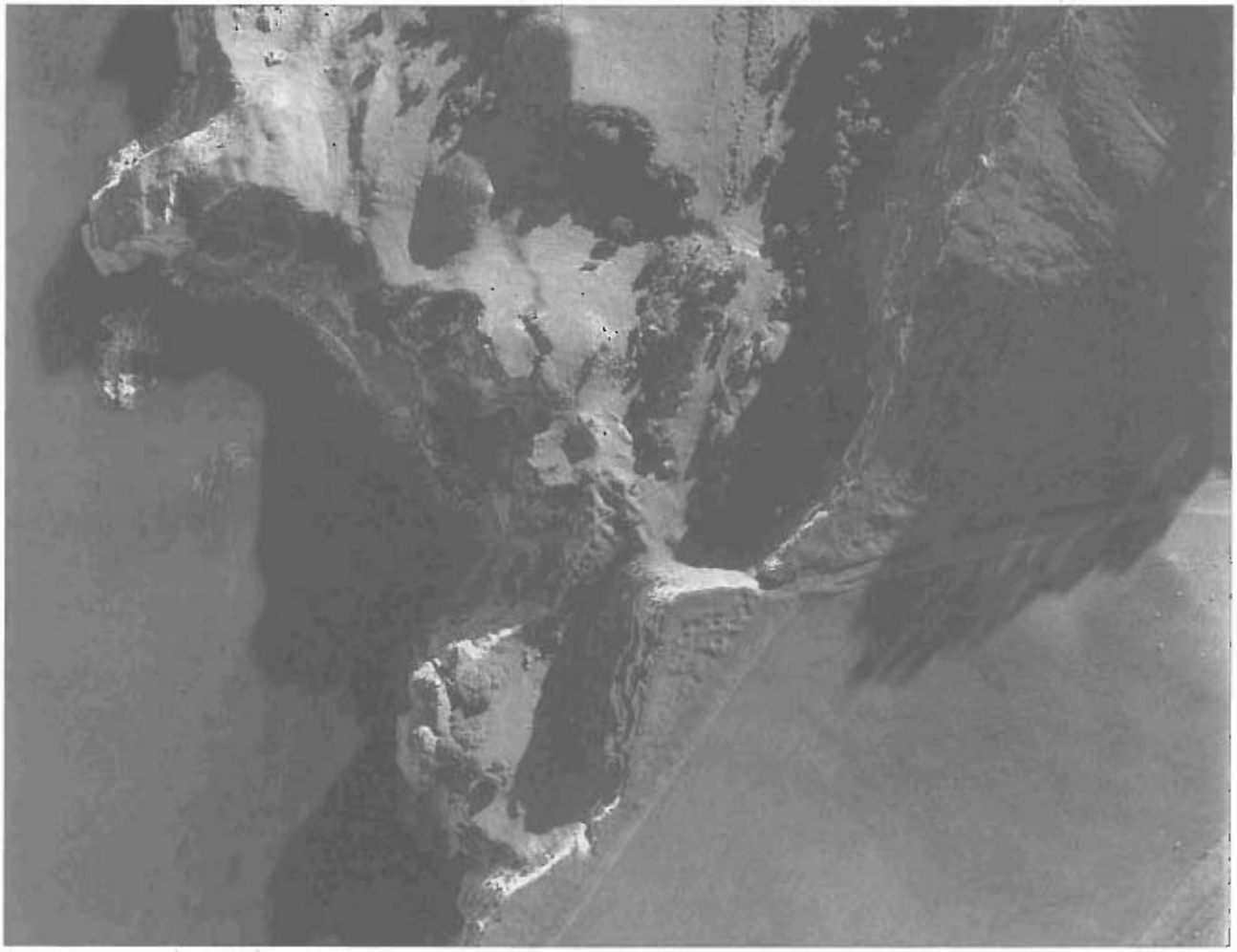
Teviotdale recorded terraces at the undefended site of Little Papanui J44/1 (Teviotdale n.d.; Simmons 1967). This artefact-rich site (nearly 4000 items according to Teviotdale (1932)), with two or three layers of occupation, is tucked into a sheltered north-facing hollow at the southern end of Papanui Beach. The excavated materials were somewhat similar to those from Long Beach (I44/23), in that the lower layers of both sites contained some moa bone and appeared to be late Archaic in style, whereas the upper layers contained Classic artefacts. Most other coastal occupation sites (with the exception of those discussed above) lie on relatively level ground, though Little Papanui was established in a confined space at the mouth of a creek. Three terraces on the south side of the creek were described by Teviotdale as 10 × 4 paces, 35 × 11 paces, and 30 × 6 paces. (His pace is likely to have been close to a metre in length.) He considered that these were natural slumps which had been further modified, and described one or two hut sites on each terrace, but did not provide details of the size or shapes of the huts (Simmons 1967).

Though Teviotdale does not say so explicitly, the cluster of huts at Tarewai Point seem to have been on a terrace, about 50 m long, high on a spur above Pilots Beach. The road to the Signal Station took advantage of the terrace and ran across the site, partly covering the main area of huts (Teviotdale 1939a: 109).

## 3.3 HOUSES AND HUTS

Dwellings are not just for shelter, but can be a means of expressing status and artistic skills. There has been a general perception that under circumstances of high mobility and the scattered resources typical of most hunter-gatherer lifestyles, permanent houses made of solid slabs of hardwoods would be unlikely. In Otago, this would particularly be the case after the 15th century. Anderson (1986) discusses in detail the implications of the simpler and easily built round huts which were described by early European observers in New Zealand. The Murison brothers, when crossing the Maniototo Plain in 1858, came upon 'scrub whares', dome shaped and thatched with tussock which had been used by Maori eeling parties (Anderson 1986). An informant, Rakiraki, told Beattie that in the 19th century, there were several round huts at a Maori settlement at Waitaki Mouth where potatoes were being grown. Of low status and quickly built, such huts were usually free standing and would have left no post hole marks in the ground. Such temporary structures are typical of hunter-gatherer economies throughout the world.

Archaeological evidence for temporary huts may be circular depressions (which could be confused with pits for other purposes), fireplaces (which need not be built *inside* a hut), and collections of artefacts (which may represent an outdoors working floor). Anderson (1986) was dissatisfied for obvious reasons with these separate criteria as archaeological evidence of a hut, unless they could be combined into a pattern. At moa hunting sites at Hawksburn and Glenaray, Anderson *was* satisfied that a combination of a fireplace, artefact concentration, midden patches and stone slabs in repeated groupings represented the sites of round huts (Anderson 1986). Teviotdale assumed the



Terraces on Cornish Head, Matanaka. The group of five rectangular features just below the centre have been hollowed-out by sheep and look like pits. The white face above them is a cliff from which the ground slopes sharply left to the sea, making the site quite defensible. *Photograph: Kevin Jones, DOC*

presence of numerous huts from the presence of round and rectangular depressions at Waitaki Mouth (Teviotdale 1932: 95, 1939b) and from the relative positions of fireplaces and artefacts at Shag River Mouth (Teviotdale 1924, Anderson & Smith 1996b: 277).

None of the assumptions made so far about huts in Otago are surprising in the context of a relatively mobile hunter-gatherer way of life of its inhabitants. There is, however, one matter which does not fit. If the first settlements along the Otago coasts were relatively sedentary villages of 20-40 years duration (Anderson & Smith 1996a), there should have been time and energy to build permanent rectangular houses with separate walls and a gable roof, similar to that found in the 12th century settlement at Moikau, Palliser Bay (Prickett 1979). Instead, in Otago the only archaeological evidence for rectangular houses appears in the Classic settlements of Katiki Point (Trotter 1967a; Prickett 1987: 100), Tarewai Point (Teviotdale 1939a) and the upper layer of Long Beach, considered to be early Classic (Leach & Hamel 1981). The only hint of earlier rectangular houses is Teviotdale's note of the presence of rectangular depressions, as well as round ones, at Waitaki Mouth.

The evidence at Katiki Point comprises the burnt stubs of slabs outlining two houses (2.4 × 3.6 m and 3.0 × 3.6 m respectively). The first is divided into two nearly equal sections by a centre post with a square stone fireplace in each section. The second house was not so well preserved and had only a scoop of ash marking a fireplace. At Tarewai Point, Teviotdale shows two lines of posts at right angles to one another in his diary, but he could not determine the size of the house (Teviotdale 1933: 26 December). Only one wall of the house at Long Beach was excavated, and consisted of a line of five slabs and a post hole with no slab, extending for 4.3 m, fairly equally spaced except for a small post at one end. In the sandy substrate the post butts were jammed upright with stones (Leach & Hamel 1981: 134). The house floor had been completely dug over by fossickers. Renata (1892b) describes fossicking a house at Long Beach considered to be 10 × 20 feet (3 × 6 m), which yielded a wide range of artefacts, including hoop iron, nephrite adzes, a bone flute, silcrete flakes, and moa bones, suggesting a site of repeated occupations over many centuries up to the protohistoric.

There is reasonable evidence for rectangular houses at Whareakeake, in that one of the fossickers describes the hut floors as comprising beaten brown sand with the burnt ends of upright stakes of kowhai, matai or totara, varying in size from 6–20 feet square (Renata 1892a). Simmons infers a house or a terrace, 10–12 feet long, dug out by Teviotdale in a lower layer at Little Papanui (Simmons 1967: 10).

The best ethnographic account of rectangular houses in Otago is that of Morrell (1832), an American sealer who landed near Kaka Point in 1830 and described a village that he called Tavaimoo as consisting of 28 barn-shaped houses, the largest '10 feet high, 30 long and 12 broad', i.e. 9.0 × 3.0 m in plan. Others were half the size and only four or five feet high, i.e. less than 1.5 m, framed up with small trees and thatched with long grass. The interiors were described as 'strongly constructed and fastened with supple vines ... painted red and black'. The door and only window were very small. Louis Le Breton's paintings of the Otakou settlements in 1840 show rectangular houses varying in size and gable pitch and associated with food whata (Anderson 1998: 170). These buildings seem to have been typically Polynesian in design, with no obvious influence from the European structures which might have been built by sealers along the coasts for nearly 40 years.

Settlements of the 1820s south of Otago had similar buildings. Pahi's village, seen by Boultbee in 1826 (Begg & Begg 1979: 170, plate 111), had rectangular houses 30 feet long. Boultbee's drawing also shows the standard North Island pataka or storehouse, built on high posts to keep rats and dogs out, and presumably used at Pahi in the 1820s to store potatoes.

There have been very few excavations large enough to show how houses, ovens, and other structures were arranged within settlements. At Hawksburn there was a band of ovens along the edge of the creek and suggestions of a rough semi-circle of round huts on the river flat to the west (Anderson 1989: 145). The huts were placed where the prevailing wind would have blown the smoke of the cooking fires away from them. At Shag River Mouth, hearths were spread in clusters, sinuous lines, and singly along the western face of the main dune, with a large central butchery and cooking area. Midden dumps tended to

be peripheral to the cooking area, with shell dumped to the east and north and seal and moa bone to the south and west, perhaps where the dogs were kept. There were dwellings with clusters of bone and stone working tools around the central area. Though the pattern is not very orderly, it is sufficiently coherent to suggest a single integrated village (Anderson & Smith 1996: 278).

Hawksburn and Shag River Mouth were early villages. There have been no comparable excavations of classic villages. The small excavation at Long Beach opened up the edge of only one rectangular house, but the distribution of flakes and tools showed that in the 17th century at this site, there were definable activity areas clustered around open fires close to the house (Leach & Hamel 1981: 135).

# 4. Change

## 4.1 FROM EARLY VILLAGES TO CLASSIC VILLAGES IN OTAGO

Early sites in Otago have received a great deal of attention from archaeologists. The middens of Papatowai, Pounawea, Pleasant River, and Shag Mouth, with their abundant moa and seal bones, wide range of adze types, graceful and distinctive fish hooks, and their deep occupation layers, have provided a wealth of material for further analysis. The attentive reader will have noticed that most of chapter 2 described the environment and resources of those first people who hunted moa and lived well at transient villages established close to the fur seal colonies. They had found an Otago which had more forest and shrublands than grasslands, but in 400 years the dense shrublands and drier forests of silver beech, Halls totara, and celery pine had been converted by recurrent fires to bracken, fescue tussock, and open shrublands.

A brief resume of the resources and settlement patterns of these early people is needed so as to understand how things were before the changes of the 15th century. These people found—especially in the drier forests and shrublands—at least eight species of moa, the medium-sized species being the most abundant. Moa bones and egg shells have been described from about 100 sites in Otago, and at some of those sites (Waitaki Mouth, Shag Mouth, and Hawksburn) estimates of numbers of birds represented are in the thousands. Moa hunting was most intense on the coast, possibly because that was where most people lived for most of the year. Moa bone made solid and durable fish hooks and awls. The smaller bird species seem to have always been a minor part of the diet of these people, and the wide range of species represented by only one or two individuals in each site suggests opportunistic hunting for variety or possibly more for feathers than meat. The particular species taken provide much 'food for thought' about local environments.

Seal hunting by these village people could contribute over 55% by weight of the meat in their diets, even in sites were moa bones are abundant. The presence of pup bones indicate that there were fur seal breeding colonies close to their villages, from Papatowai to Shag River Mouth, but the predominant age classes of fur seals hunted were the more easily caught and meaty juveniles and sub-adults.

Though the land-based moa and seal were major food resources, these people retained their maritime skills, and fish were always an important component in the diet. The most distinctive aspect of their fishing was the concentration on relatively few species, especially barracouta and red cod, and the lack of evidence for using nets or traps. Even in the early villages such as Shag River Mouth, increased reliance on fish as seal and moa numbers declined shows up before the site was abandoned, and the early 15th century site at Purakaunui seems to have been a specialised fishing camp. At Purakaunui, a trend to taking larger numbers of red cod is a precursor of a change visible in later sites.

Everyone ate shellfish, the meat making a small, but valued, addition to the diet, judging by the vast numbers collected. The species taken depended mostly on what was available nearby. Shellfish and dog and rat bones appear in sites of all ages. Analyses of interesting differences between early and late sites for these three ubiquitous resources are still to come. The processing of cabbage tree in umu-ti, though one would expect it to be an on-going activity, may have been more important in the early and late periods, when village life provided a base for co-operative effort.

Stone resources of the early sites have shown up the speed with which Otago was explored. The early sites at Papatowai and Pounawea contain abundant silcrete and porcellanite which occur in suitable quality only at hard-to-find inland sites. 'Foreign' rock types, such as North Island obsidian, and argillites from Southland and Nelson, were brought in. Flaking technology expanded to cope with the strange materials, such as silcrete and porcellanite, and even more crucially to develop a whole new range of adze types. Nephrite baffled the early tool makers to begin with. They tried flaking it quite persistently (even in the 17th century at Long Beach) before settling to sawing this tough new material. Frequent refurbishing of old adzes, at sites such as Pounawea, Papatowai and Shag River Mouth, may be an index of how sedentary these early people were.

The coastal emphasis of the settlement pattern of the early people and the degree of inland occupation is clearly shown by mapping sites containing moa bone. The possibility of other early inland sites lacking moa bone and hence not shown here is indicated by the fact that the silcrete flaking site of Oturehua and all umu-ti lack moa bones as markers of their age. There could have been other inland sites other than those shown in Fig. 2. The coastal sites included simple undefended villages and camps at the mouths of rivers, on the crests of boulder beaches, on sand flats and dunes and near creeks running into open bays. The known inland sites lay mostly along rivers and creeks, though a notable few were at high altitude. The inland lakes were not a focus of known occupation, and there were no terraced or obviously defensible sites, other than possibly Omimi.

What did the early villages and houses look like? The information discussed in chapter 3 indicates how little is known about them. There is some evidence for round dwellings associated with square hearths and for both round and rectangular depressions at Waitaki and Shag River mouths. Most of the discussion in chapter 3 was about settlements and house sites belonging to the post-16th century period.

The Classic pa and open bay sites had attracted the attention of 'curio hunters' all through the first half of the 20th century. Archaeologists assumed that in general these sites would be badly disturbed with thinner layers of occupation which would yield less valuable assemblages for analysis. The sites in between, post moa-hunting, but lacking large numbers of Classic artefacts, were and remain almost invisible to amateur and professional alike. In fact there seem to be only a few sites containing deep occupation layers which may belong to the 16th and 17th centuries. Yet given some interesting continuities of subsistence strategies and artefact styles between early and late sites, it is highly likely that the people of the early villages were still here in Otago. After the demise of the

large moa populations and reduction of fur seal breeding colonies, a whole new strategy of life had to be devised. The large villages, typified by Shag River Mouth, could no longer be maintained. It is time now to look at those few sites which contain some evidence of those changes.

## 4.2 FOUR SITES SHOWING CHANGE

Three open-bay sites, rich in Classic artefacts, have produced archaeological evidence for the change from early villages to the way of life of the Maori witnessed by the first Europeans in Otago. A fourth site, Shag Point, is also likely to produce useful evidence, but has only recently been investigated. Much of the material derived from its excavations has still to be analysed (Weisler 1998, 2000). The material from these sites will be considered in the context of each site itself before seeking generalisations about change.

### Little Papanui

Between 1929 and 1932, Skinner regularly took the Otago Branch of the New Zealand Institute out to Little Papanui (J44/1) to dig for artefacts with Teviotdale, and in 1965 Simmons conducted a more systematic excavation of the Classic site in the centre of the beach (J44/117). Some of the Little Papanui material that was catalogued, e.g. D29.5462 to 5910, was assigned to upper, middle and lower layers from excavation notes (Otago Museum archive), but most were not provenanced (Otago Museum Registers, especially those for 1929 to 1934; Teviotdale and Steele collections). Simmons (1967) analysed the collections and the available information, including a report and diagrammatic map by Teviotdale (n.d.). Simmons was able to assign features found by Teviotdale, such as ovens, fireplaces and burials, to layers and to terraces, but could not plot them relative to each other. Some bone was identified to genus, but most only to a major group, e.g. moa, *Diomedea*, fish, bird, seal, porpoise, and human, and only nephrite was distinguished among the rock types. The lower layers (on each side of a creek which ran through the site) had ovens and a rectangular stone fireplace, along with moa, seal, and fish bones. The intermediate layer had ovens, caches of artefacts, seal bones and industrial moa bone, along with about seven fireplaces, mostly on the interface with the top layer. Material within the upper layer included about five fireplaces, several ovens, and seal, albatross, bird, dog, porpoise, and human bones, along with much kokowai. Worked and burnt human bones, including the burnt skulls of two children, were present, and there were several burials in clean sand below the top layer. Traces of hut floors and posts were found in both upper and lower layers.

Most of Simmons' (1967) analysis of Little Papanui concentrated on the spectacular artefact collections, which were typified by such figures as:

- Adzes—92 from the bottom layers, 21 from the middle layers, and 108 from the top layers
- Fish hooks—134 from the bottom layers, 8 from the middle layers, and 197 from the top layers

- Bird spear points—21 from the bottom layers, 2 from the middle layers, and 33 from the top layers
- Flake tools—500 from the bottom layer, 177 from the middle layers, and 250 from the top layers

Considering the excavation methods, many of the smaller items would have been washed away. The diagnostic features which have been ascribed to Archaic and Classic and which are present at Little Papanui are:

- In the lower layers—a greater range of adze types, higher proportions of silcrete blades, higher percentages of one-piece bait hooks
- In the upper layers—an increase in the percentage of nephrite objects, higher proportions of ungripped rectangular adzes, increased use of local chalcedonies in the upper layers, and the presence of notched, multi-barbed 'baroque' points, and of serrated and dog-legged barracouta points (Simmons 1967)

Among diagnostic ornaments and other materials, Simmons notes the lack of *early* Archaic ornaments, such as whale-tooth units and reels in the bottom layers, where the only ornaments were two bone toggles and a dentalium tube bead, a set of traits shared with the Shag River Mouth site (Anderson et al. 1996a). Ornaments from the top layers were more numerous and such items as perforated human teeth, curved cloak pins, 'kinky' (sic) pendants, bone flutes, and 'whakapapa' are considered to be Classic style ornaments elsewhere (Leach & Hamel 1981). These, along with the well-developed baroque fish-hook points and use of human bone for artefacts, suggest occupation into the late Classic (Simmons 1967).

## Long Beach

At Long Beach (I44/23), a site excavated on an old boulder ridge revealed a lower layer comprising ovens, midden rich in fish bone, but with few moa bones, and a burial of a 15-month-old child in the boulders below the ovens. An intermediate sandy layer with sparse material may have represented a period of abandonment. The thick upper layer contained dense fish midden, thick with articulated bones of barracouta heads, with ovens and ash heaps beside post butts of the house described above. Single radiocarbon dates from each of three layers gave estimates of 13th–15th centuries for the two lower layers and the 17th century for the upper layer (Hamel & Leach 1977, 1979). Distribution of flakes suggested that in the 17th century the boulder ridge was used as a flaking floor for working silcrete, porcellanites and nephrite. The upper layer did not contain large quantities of nephrite, but the 22 pieces found were associated with cutters, grinders and burnishers and suggested a small nephrite working area. Many of the pieces had been flaked (Leach & Hamel 1981: 131). There was no nephrite in the lower layer which contained some moa bone. The Napier and Dempster collections from Long Beach contained modest numbers of nephrite objects (32 items in the Napier collection, D28.580 ff., 9 in the Dempster collection, D29.5120 ff.), but there were sufficient to be considered characteristic of a Classic site. Other artefacts from the upper layer of the excavated site, such as a comb, cloak pin, kinked pendant and skewed amulet among the ornaments, serrated and double-barbed bait-hook points, serrated

and dog-legged barracouta points, an incised fragment of a bone flute, and worked human bone, all fit well within a Classic assemblage. The presence in the lower layer of the site of both plain barracouta points and one which has a lug worked on the outside curve suggests the local evolution of the dog-legged point (Leach & Hamel 1981). The lack of baroque bait-hook points, sawn nephrite, or early European artefacts suggest that this was not a favoured site within the bay in the late 18th century, which tallies with accounts of hut remains closer to the mouth of the creek in the 19th century. Its artefacts place the lower and upper layers of this site as late Archaic and early Classic respectively, with strong continuity between the layers, but an unknown time span of abandonment between them.

The large sample of midden material from Long Beach is the only Classic midden in Otago that has been analysed to species (Fyfe 1982; Hamel unpublished data; McGovern-Wilson 1986; Smith 1985). Much of the information has been described above under the headings on subsistence. There were only two significant differences between the data from the early and late layers—the presence of fragments of moa bone and tuatara bones in the early layers only, and the changes in proportions of shellfish taken (blue mussels and pipi made up 74% of the shellfish in the lower layers and mud snails made up 79% of the shellfish in the upper layers). This correlates well with other evidence about progradation of the adjacent shoreline. The most striking point about the midden evidence is the continuity of subsistence strategies between layers assumed to belong to 15th and mid 17th centuries respectively, on the basis of radiocarbon dating and artefact types. Throughout the whole period of occupation, the seals taken were mostly juveniles or sub-adult, and about half of the dogs killed were less than 18 months old. Many species of small birds were taken from shoreline, estuary, forest, and open land. The fishing strategy throughout was highly selective—mainly offshore trolling for barracouta and bait-hook fishing for red cod, ling, and groper, with some inshore fishing for labrids. Though there are some changes in artefacts, especially among ornaments, there is continuity in such things as the choice of silcrete and chalcedonies for stone tools and the design of fishing gear. It seems significant that these are tools associated with survival (Leach & Hamel 1981: 139).

### Whareakeake

In this open-bay site, there is a site with moa bones well back from the shoreline, about which little is known, and a large Classic village site on the sand dunes which has been heavily fossicked. The very large numbers of artefacts collected from Whareakeake (see Nephrite under section 2.8) are thought to have been collected over most of the flat lying behind the sand dunes. The village at the eastern end, excavated by Bell and Lockerbie, was once thought to have been the village burnt by the sealer, Kelly, in 1817. It is more likely that Whareakeake was the place where three of Kelly's men were killed, but the village that he actually burnt seems to have been inside the entrance of Otago Harbour (Entwisle 1998). The finding of a 'Captain Cook medal' at Whareakeake in 1863 (Skinner 1959: 221; Hjarno 1967: 7), as well as some other European artefacts, indicate that the upper levels of occupation could have been late 18th to early 19th century. A series of radiocarbon dates, however, obtained for the excavation as a whole had mean values entirely within the 17th

century (Anderson 1982b: 63). Driver, the first European to live in the area in 1838, did not describe hut ruins at Whareakeake, whereas hut ruins were seen at Purakaunui and Long Beach (Skinner 1959), suggesting that the site could have been abandoned after 1817. Fossickers found many stone fireplaces, which they considered marked the sites of houses and around which they found most artefacts, especially close to the walls marked by burnt stubs of posts. A single large post, 34 cm maximum diameter, and standing 1.7 m high, in the excavated site was identified as either a support for a whata or the centre post of a large house. Over most of the flat, there were three dark occupation layers separated by clean sand, with most of the artefacts in the upper layer. The lowest layer was about four feet (1.2 m) below the modern surface (Thomson 1944, Lockerbie 1959, Skinner 1959: 224). The lowest layer contained charcoal, oven stones, fish bone and shell (Skinner 1959: 224), suggesting that this layer was later in time that the lowest layer at Long Beach (I44/23) or the site at Purakaunui (I44/21) which both contained moa bone.

Lockerbie (1959) and Hjarno (1967) used the artefacts from Whareakeake to characterise the Classic and to compare against Archaic sites in the Catlins. Lockerbie selected, as typically Classic Maori, both the quantity of nephrite objects and the quality of their workmanship, the relatively few types of adzes (mostly in nephrite), nephrite amulets (including the relatively high number of hei-tiki), and the presence of patu and mere at Whareakeake (see glossary for explanations of Maori words and technical terms). Hjarno (1967) defined fish hook styles as Classic (Fig. 12B) on the basis of the Whareakeake material collected from the front dune area, noting the presence there of dog-legged and notched barracouta hooks, bait hook points of three types with barbs and notches, and low numbers of one-piece bait hooks and serrated hooks. Skinner estimated that about 12 hei-tiki in collections could have come from Whareakeake (Skinner 1959), 10 of which are illustrated in Thomson (1944). Renata (1892a) describes the finding of 10 hei-tiki by people known to him, which include only some of those listed by Skinner. A wide range of other amulet shapes, especially kinked and anthropomorphic ones, many nephrite chisels, gouges, adzes, and some drills, as well as sandstone and basalt saws from Whareakeake are illustrated by Skinner (1959). Many of the bone pendants are simple curved and needle-like shapes. Other bone artefacts include five large whale-bone combs, five flutes and five toggles of albatross wing bone, drilled human teeth and imitation human teeth in shell Skinner (1959). Many of these traits are similar to the upper layers at Little Papanui (see above). The lack of provenance for much of the material from this site makes it more difficult to use in analysing change.

### Shag Point

Occupation on the low headlands of Shag Point comprise thin layers of midden and artefacts, spread over two discrete areas of about 1600 and 1800 $m^2$ respectively. Radiocarbon dates of early 15th to early 16th century for the southern midden and mid 16th to 18th century for the northern midden provide a useful sequence to compare against the very much larger Shag River Mouth site (from mid 13th to mid 14th century) only a kilometre to the south-east across the river. Weisler (2000) interprets both areas as representing repeated short visits by small groups of people, a pattern appropriate to fishing camps to

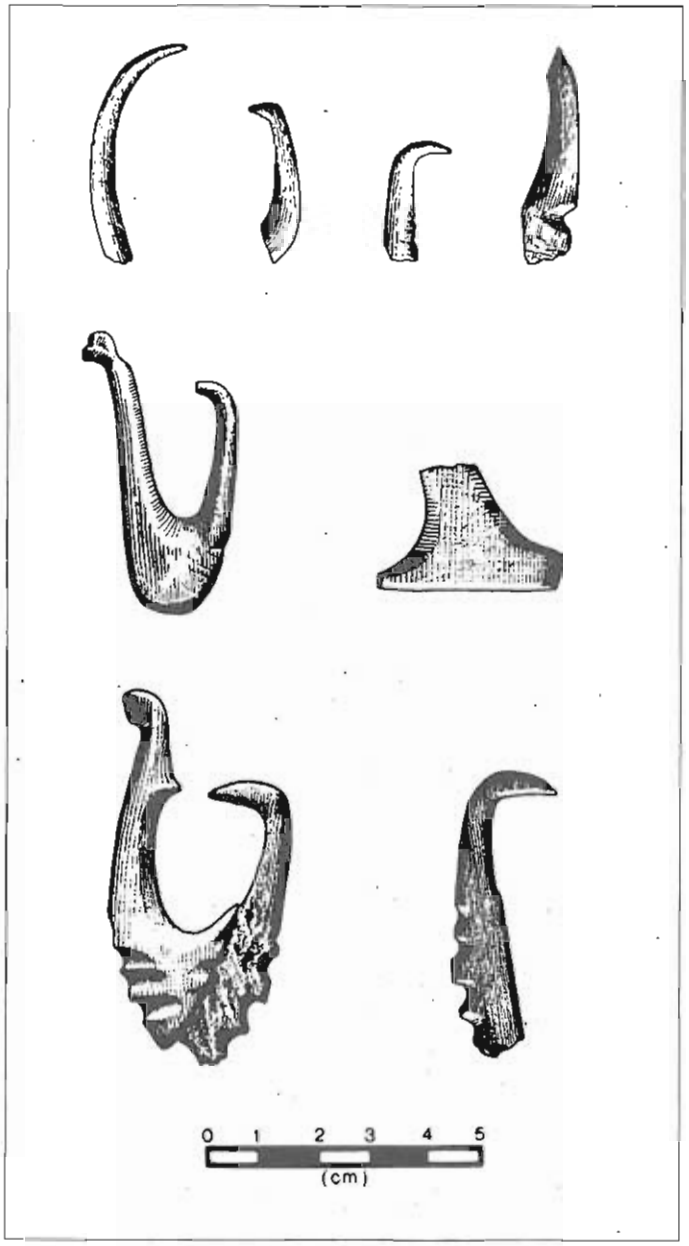



Figure 12. The change from early to late classic is reflected in fish hook styles.

A. *(Left)* Early fish hooks from Pounawea. The fish hooks are made from moa bone, except for the middle left bait hook which is of ivory, probably whale tooth. (Reproduced from Hamel 1980: fig. 10.)

B. *(Right, opposite page)* Classic fish hooks from Murdering Beach, showing baroque points on the right. (Reproduced with the permission of the Otago Museum, from Hjarno 1967.)

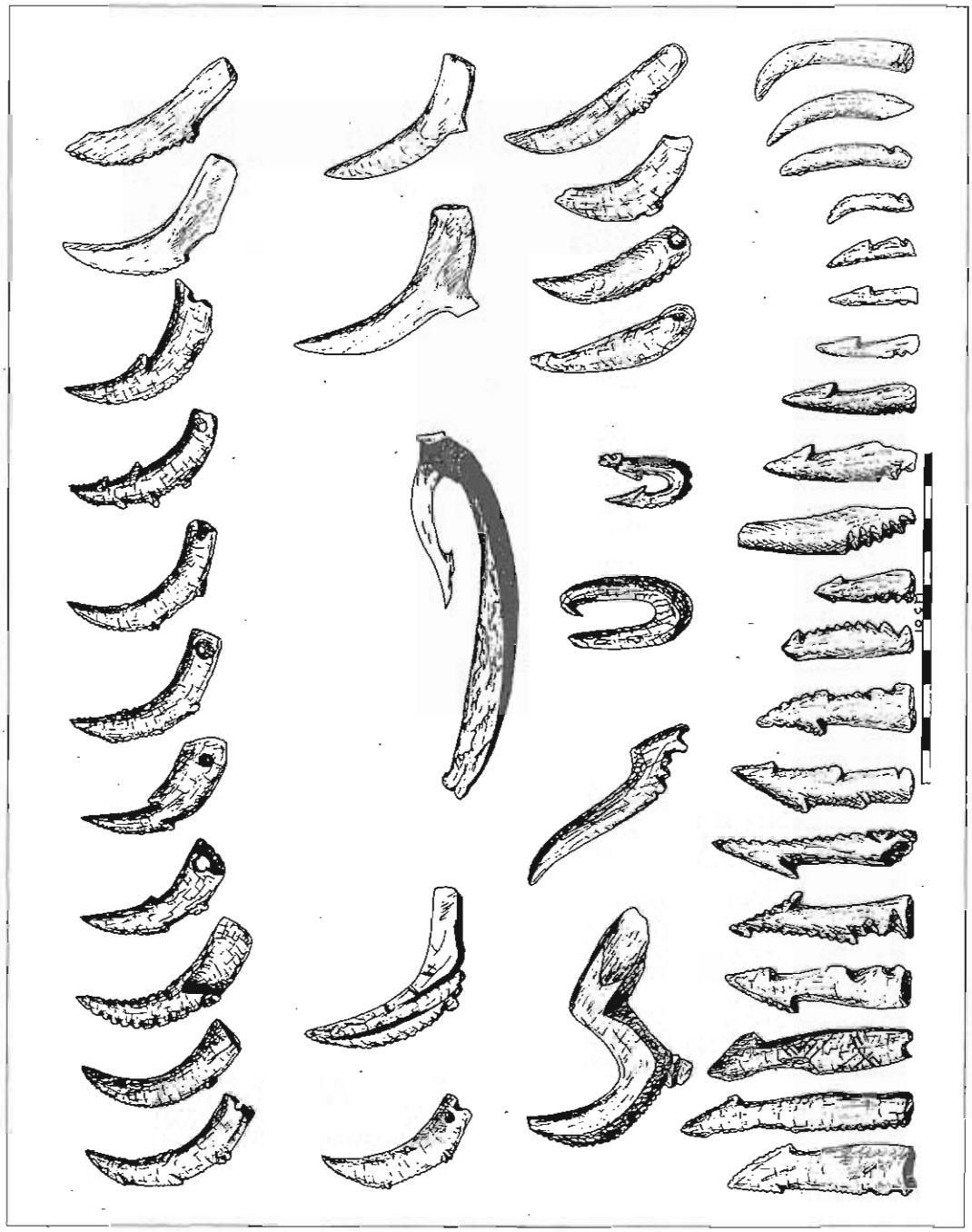
catch barracouta and red cod. Refined methods of sieving and otolith identification appear to be revealing that species other than barracouta were more important at these later sites than previously realised. Though rocky shorelines surround the camps, pipi from the mouth of the Shag River make up 80% of the shellfish samples. Activity at the southern midden was focussed on fishing , but fur seal consumption was the focus of the northern midden. Both adult and juvenile seals were being taken.

The assemblage of artefacts is dominated by two-piece bait-hook points, in forms comparable to those from the upper layer at Long Beach. The second major group of artefacts comprises wood-working tools, including finished and reworked adzes and chisels of nephrite and basalt. Other rock types include the usual range of silcrete, chalcedony, obsidian, basalt, and chert (Weisler 2000).

Closer analysis of the material from this site should provide another view of the change in life style from living in villages dependant on moa and seal meat to living in smaller groups collecting a greater range of food for preserving and storing. In particular it should give us insights into development of two-piece bait hook styles, the place of fur seals in the diet during the 17th-18th centuries and new fishing strategies for catching a wider range of species.

## Other sites

Another site which is known to have lower layers with moa bones and occupation through to the contact period is Warrington. This is a large site of over 2 ha, from which artefacts have been deposited in the Otago Museum, and at which some small 'key-hole' excavations have been carried out (Site Record



File, I44/177). The midden material and artefacts are in the process of analysis at present (Ian Smith, University of Otago, Dunedin pers. comm. 1999).

Other important Classic sites for which there is some evidence about material culture are the four main pa sites, as well as Kaikais Beach, Tarewai Point, False Island, and Kings Rock. Fish hooks in the Otago Museum collections from all these sites, except Pukekura and Mapoutahi, were analysed by Hjarno (1967). Descriptions of artefacts from them are scattered through papers by Skinner (1974), Teviotdale (1932) and Lockerbie (1959). Small samples of midden material have been analysed from Pukekura (Leach & Hamel 1978), Mapoutahi (Anderson & Sutton 1973), and Katiki (Trotter 1967a). The information available fits within the patterns described for Whareakeake and the upper layers of Little Papanui and Long Beach, though there is no reason to believe

that they are all sites of similar activities. The four pa sites, Warrington, Long Beach, Whareakeake, Tarewai Point and Little Papanui show characteristics that suggest they were sites of the new sort of Classic village.

Anderson (1982b) compiled the available archaeological information on late prehistoric inland sites (16th-19th centuries), none of which had a secure chronology. The youngest complex at the Dart Bridge site was dated to the 17th century and comprised two shallow pits separated from the other ovens, with no faunal material and only one flake of porcellanite (Anderson & Ritchie 1986). For inland Otago, Anderson (1982b) listed 26 rock shelters and clefts with material remains and 17 find spots or middens that by their nature appeared to be relatively recent. Their distribution on the landscape showed a concentration in the Strath Taieri and Maniototo, and scattered sites all along the Clutha from Beaumont west to around the western lakes. Undated ovens could also belong to this period or to the 16th and 17th centuries. In stark contrast to the coastal area, the archaeological evidence of settlements is sparse, and rock shelters with remains are concentrated in the Strath Taieri and Maniototo. These remains are mostly domestic articles such as wooden bowls, material for garments, and gear for hunting weka or fishing (Anderson 1982b). Some of this material could belong to the protohistoric period discussed below. Anderson (1982b: 75) suggests that the inland basins could also have been places of retreat from the tensions of coastal living and resource management, where children could be instructed in traditional beliefs and the arts of living.

## 4.3 THE RICHNESS OF THE PROTOHISTORIC PHASE

There are four categories of evidence applicable to protohistoric Otago: traditional accounts, recollections of Maori informants, European observations, and archaeological sites. Each group covers a different time span—traditional accounts of feuds belong mostly to the 1710-1830 period, recollected observations on subsistence to 1800-1880, and European observations to between 1810 and 1850. Archaeological evidence from sites thought to have been occupied between 1750 and 1840 because they include traces of European material in an otherwise Maori matrix would fall into this phase. Since the upper layers of Maori sites are easily contaminated with European materials, very few sites qualify for this phase. All groups of evidence include the period of contact between Maori and European.

These strands have been drawn together by Anderson to describe Maori settlement in the interior of southern New Zealand, with the exception that the archaeological evidence used covers the period AD 1550-1800 (Anderson 1982b). In his more recent ethnohistory of the southern Maori, Anderson (1998) uses genealogies, oral traditions and recollections, and documented observations, but not archaeology, acknowledging the many difficulties in meshing archaeological and historical evidence. This section, therefore, is not about archaeology as such, but about evidence which could be used in future to interpret archaeological sites of the 18th-19th centuries. Compared to the half-dozen traditionally known sites, dated by their early European material to this phase, and the four named coastal pa, there are dozens of historically named sites of this period with no traces of archaeological material (Appendix 10).

Some may have been of very recent establishment, such as the villages at Moeraki, Kakanui, Aramoana, and Henley established by northern people fleeing from Te Rauparaha (Anderson 1998: 90) in the 1830s.

## Settlements

The accounts of conflicts and tribal revenge indicate great mobility within the whole of the South Island, in a pattern of raiding and withdrawals by both attackers and defenders. Anderson (1998) distinguishes between the non-seasonal mobility of migration and the seasonal mobility of resource gathering. In the early 19th century Maori villages in the south were clustered in seven local areas, the two in Otago being from Waikouaiti to Otakou and at the mouth of the Clutha. These areas had seasonal food camps as well as coastal villages and, in the north, defensive sites. Most settlements outside these areas were seasonally occupied mahinga kai, a term which encompasses the gathering of stone resources and flax as well as over fifty different foods (Anderson 1998).

The archaeology of protohistoric and contact period sites is sparse (Fig. 13). Some coastal sites have a few early European artefacts mixed with otherwise typically Maori midden material. These sites are Tawhiroko midden near Moeraki (J42/21, site record form), Ross's Rocks (I43/22, Till 1984), Pukekura (J44/7, Hamel 1992f), Te Umu Kuri (J44/44, Wellers Rock, site record form), and Tarewai Point (J44/3, Teviotdale 1939a). The Cook medal from Whareakeake places parts of the sites in the protohistoric phase. There has been no well-controlled and published excavation of a site that grades into the protohistoric, though it is apparent that Tarewai Point, and parts of Long Beach and Warrington must have been occupied into the protohistoric. This group includes open bay villages, a defended pa, a whaling station, and a nephrite-working village. Rock shelters with drawings of sailing ships, people in European clothing and on horse back, and words in missionary script are likely to fall with this period. These have been recorded at Duntroon and Maerewhenua.[8]

On traditional evidence, there were about 20 settlements around the western lakes. Of these, only one settlement at Queenstown, four at Wanaka/Hawea and one on the Maniototo were dated to the 19th century by Maori and European recollections (Anderson 1982b). Along the coastline 30 sites can be approximately dated to the 18th and early 19th centuries (Appendix 10). Anderson (1982b) was able to assign tribal affiliations to many of the inland sites, most having links to two or all of the three main tribal groupings—Waitaha, Ngati Mamoe, and Ngai Tahu.

Many sites were seasonal camps (Anderson 1982c) for eeling, sea fishing, birding, or kauru manufacture. These seasonal camps depended on the location of specific resources, mostly food, but also specific rock types for tools or flax for fibre. Recollections about specific locations of Otago resources in and around the protohistoric period can be derived from Chapman's late 19th century informants (Chapman 1891b), Beattie's 20th century informants (e.g.

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[8] Some archaeological information for sites of this period is available from Fiordland and Foveaux Strait (Coutts 1972).

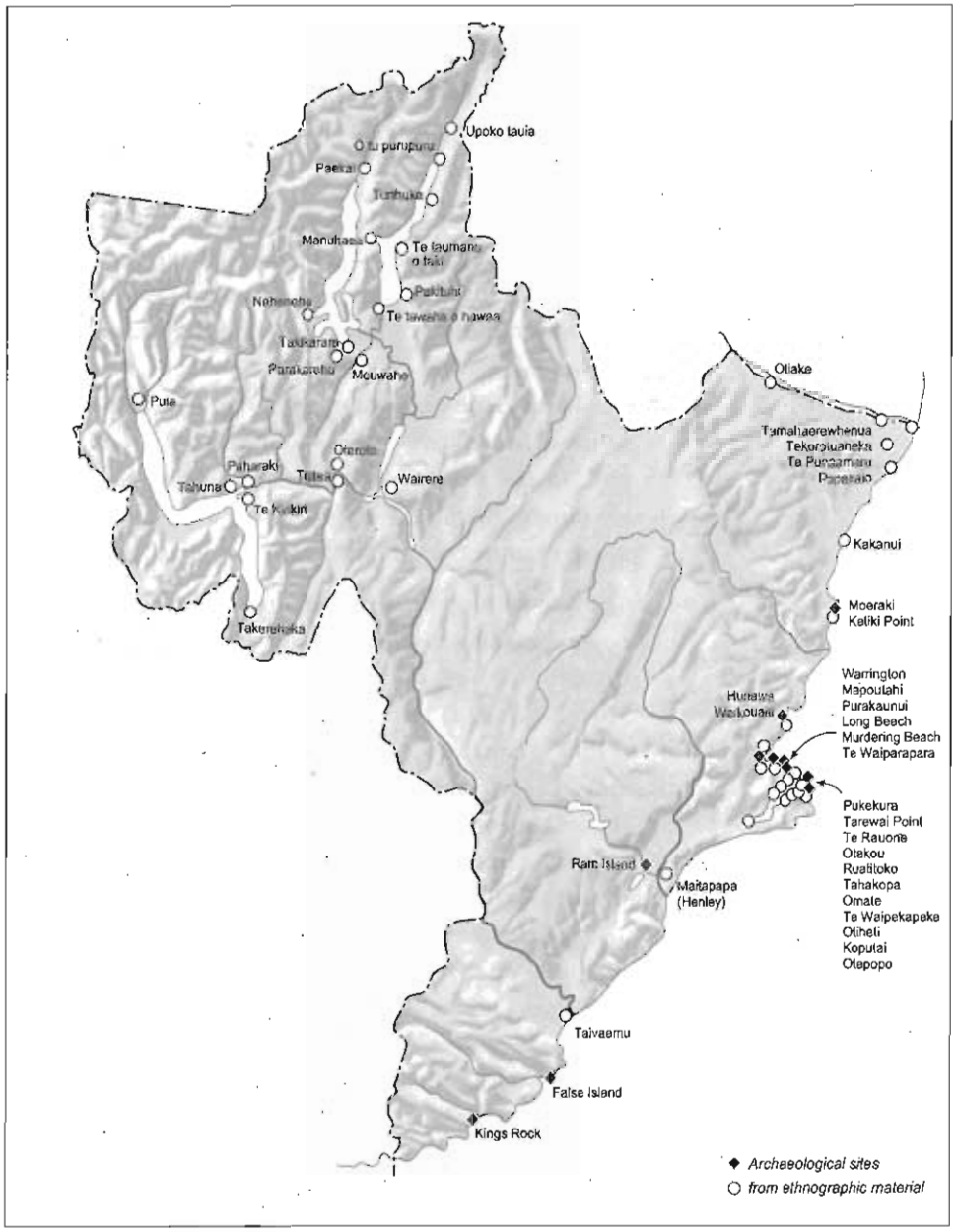



Figure 13. Distribution of classic and protohistoric archaeological sites and villages, some of which have been recorded from ethnographic material only. The locations of the latter are only approximate.

Beattie 1994), and Maori Land Court hearings (Mackay 1873, Appendices to the Journal of the House of Representatives 1891, G-7). Syntheses of this material have been made by Leach (1969) for the east coast north of the Taieri River to Banks Peninsula, by Anderson (1982b) for the interior from the western lakes to the Maniototo, and by Anderson (1998) for the Ngai Tahu rohe. The nature of this material is extremely variable, and locations tend to be whole districts or rivers. For example, people from the coastal settlements are described as going weka hunting on the Maniototo, Old Man Range, the lower Shotover and Arrow Valleys, and at the south end of Lake Wakatipu in late autumn to early winter. People also went to the Old Man Range to quarry flint (Chapman 1891a), an activity which must have ceased when the informant was very young. Lamprey were caught in the Taieri River as far up as about Hyde. Eels were taken at Takikarara on Lake Wanaka. The locations of basic foods, such as fern root, kauru, and European potatoes, were hardly mentioned in the recollections of subsistence in interior Otago, possibly ignored in favour of valuable

commodities such as preserved weka. Recollected information about obtaining greenstone from the head of Lake Wakatipu is also sparse, and considering the lack of Ngai Tahu associations with villages around Lake Wakatipu, the locations of the Dart greenstone may have been lost when the Ngati Mamoe left the area in the 18th century (Anderson 1982b).

## Foods and food sources

An informant, Rawiri Te Maire, speaking to the Maori Land Court hearings in 1881, provided a list of foods taken by the inhabitants of Moeraki, which included eels, minnows (galaxids), mullet, groper, frostfish, flounder, seals, paua, pipi and other shellfish, edible seaweeds, fern root, tutu, kauru, flax honey, shags, pigeons, and tui (Leach 1969: appendix 1). Given the mobility which is also frequently described, it is not possible to determine from this information where these resources were collected.

Much of the information in Beattie's papers is not provenanced specifically to Otago. The foods that were mentioned to Beattie depended partly on him asking the right questions, and he then sorted the information by species. Informants would have been remembering what they did as children and what their parents told them about, which would have applied mostly to the 19th century, after there had been some disruption by the presence of Europeans. The following are examples of the information available, rather than an exhaustive list.

Of plant foods, poroporo berries were collected on the Otago Peninsula, and raupo pollen was collected at Lake Waihola, mixed with water to a paste and baked in ovens. Fern root near Otago Heads was abundant and of good quality, and there were known good stands at Waitaki Mouth and near Port Molyneux (Beattie 1920: 67; 1994: 118, 123, 124). One old informant thought that they ate so much fern root at Otago Heads because cabbage trees were not common on the Otago Peninsula (Beattie 1994: 124), a surprising statement given the high density of umu-ti on the outer peninsula. Fern root is mentioned in at least two traditions linked to Pukekura Pa—Tarewai kept himself alive on fern root while in hiding and Taoka's young son was killed while out with a party gathering fern root (Stack 1898: 85, 87). A small swamp near Port Molyneux was famous for black mud which produced a fast black dye for dyeing flax fibre (Beattie 1920: 74).

Kahawai running into the mouth of the Waitaki River were caught using a small-meshed net, and a good bag contained other fish as well (Beattie 1994: 135), an interesting point to compare against the lack of archaeological evidence in coastal sites for the netting of fish offshore. Three informants mentioned seeing a large net used at the mouth of the Waitaki River for kahawai in the decade around 1880, and another had seen one used for flounder at Puketeraki (Beattie 1994: 135). Barracouta were dried on stages at Otago Heads. At Moeraki the main fish species taken were groper, blue cod and barracouta. Mullet were taken at the foot of falls in the Owaka River close to the township, as this was as far as they could run up the river (Beattie 1920: 60). A galaxid species was commonly taken in the Taieri River and lagoons close to it, and whitebait were plentiful at the mouths of the Waikouaiti and Puerua Rivers (Beattie 1994: 116, 137, 139). Lampreys were known to favour a particular spot in Lake Waihola. Eels were taken by spearing in the Shag River, and Lakes Tuakitoto and

Kaitangata were important eeling places (Beattie 1920: 58). Cutting trenches at the river mouth for spawning eels was described by a Puketeraki informant, and another informant considered that eel weirs were not built on rivers south of Temuka. (Eel weirs were observed around Manapouri in the later 19th century: Anderson 1982b.) Another informant described a weir for lampreys which went right across a river at Kaitangata, which could have been either the Clutha itself or more probably the creek running out of Lakes Kaitangata and Tuakitoto (Beattie 1994: 142, 144, 148). Paradise ducks were driven ashore when moulting at the north end of Lake Waihola, up to 600-700 birds in one day's drive (Beattie 1920: 61, 1994: 165). Such numbers suggest a very different fowling strategy compared to that derived from midden material.

From recollections such as these a pattern of seasonal resource gathering has been defined for the protohistoric. The pattern varied by district and community, and is usually presented in diagrammatic form (e.g. Anderson 1998: 117). Such diagrams are built up from multiple sources and give equal weighting to resources, some of which may have been minor. The Waikouaiti community is shown as collecting weka in winter; eels, ducks, fernroot, and ti in early summer; estuary fish, shellfish, and forest birds from late summer into autumn; and barracouta and red cod offshore from October to May. The plant foods are likely to have been greater in calorific value than the birds which may have had high social values. Fern root and ti are shown as having been collected from both the coastal foothills and the coastal plains and estuaries, but it is likely that the latter sites in Otago yielded far higher returns. Such diagrams are most useful for showing the breadth and complexity of resource gathering and the distances covered, such as to the Foveaux Strait islands for mutton birds (Waitangi Tribunal 1991).

European observations of Maori in the interior of Otago are sparse. A party from Moeraki were seen eeling at Makarora in the 1860s, and there were signs of a recent eeling camp at the head of Lake Wakatipu in 1860 (Anderson 1982b). More reports are available for coastal Otago, and villages or their remains were seen at Kaka Point, at about five sites within Otago Harbour, probably at Whareakeake, at Long Beach, Purakaunui, Warrington, Puketeraki, Waikouaiti, Shag Point (Matakaea), Moeraki, Waianakarua Bluff, Kakanui, and at three or four sites on the lower Waitaki River, e.g. Te Punaamaru, Te Korotuaheke, and Papakaio (Anderson 1998: 71; Barnicoat n.d.; Barnicoat & Davidson 1845: 434; Shortland 1851; Tuckett 1898; McNab 1907; Stevenson 1947; Griffiths & Goodall 1980). Some of the villages were sketched by Europeans, e.g. Te Punaamaru by Mantell (Brailsford 1981: 235), showing useful details such as a palisade and a storage platform.

For this protohistoric period, Anderson & Smith (1996a) used archaeological and archival sources to define a lifestyle and culture as yet unaffected by Europeans. They envisage a settlement pattern of coastal villages of 20-30 houses surrounded by palisades, which were lived in for 20-50 years and then for social reasons, such as the death of a chief, abandoned for a site nearby. The villages were centres for seasonal foraging and for storage of preserved foods, with barracouta fishing being the major industry around Otakou, kauru production in north Otago and south Canterbury, and mutton birding for the southern communities. Strong political control was established by relatively

few Ngai Tahu chiefs. Intermarriages and trading networks facilitated distriburion of resources throughout the tribal rohe, and enabled villages to be relatively sedentary, moving resources from harvesting areas into the villages, and exchanging surpluses with other villages. The advantages of a fixed base were many, including a place for elderly relatives to live, storage of food, equipment and precious objects, and a focus for burial places that helped to establish manawhenua status. The movement of unworked nephrite from distant sources to villages in coastal Otago and trading of nephrite objects into the North Island is one of the clearest indications of the strength of this socio-political system (Anderson & Smith 1996a).

In their short period of occupation in New Zealand, Polynesian peoples had moved through periods of great economic change that profoundly affected their settlement patterns. In the early period, intensive resource gathering allowed for transient coastal villages which required only limited mobility to sustain while at any one place. The village itself probably had to be shifted over 50-100 km when the local resources were depleted. After the extinction of moa and reduction of seal colonies, a poorly defined pattern of smaller hamlets and camps dependent on greater mobility must have been developed, gradually resulting in the growth of the focal villages suggested by Anderson & Smith (1996a). Throughout these changes, there are strong threads of continuity in subsistence strategies and artefact styles, presumably reflecting continuities in social behaviour. At the end of the 18th century, an even more profound economic change was about to affect settlement patterns and the whole pattern of life as more and more Europeans arrived in Otago. The details of change and continuity are worth exploring.

## 4.4 CONTINUITY AND CHANGE

The process of describing Classic sites involved describing changes in settlement pattern (the development of headland pa sites and of permanent villages), changes in some artefacts (ornaments and fish hook points), in the amount and quality of nephrite objects, reduction in use of long silcrete blades, reduction in adze types used, loss of moa from the diet and traditional evidence of increased food preservation. At the same time it was possible to argue for strong continuity in the use of particular quarry sites for silcrete, chalcedonies, and basalts, of particular birding and fishing strategies, and in the styles of many utilitarian tools for which there is a traditional local base of up to 500 years.

Challis (1995) also argues for continuity in material culture in that part of the Ngai Tahu rohe based around the Canterbury plains, hills, and Banks Peninsula. During an intermediate phase, new artefact forms arose and old ones passed out of use. Like Otago this intermediate phase falls in the 16th and 17th centuries. There is a continuity of occupation and cultural development focussed on Horomaka (Banks Peninsula), where a variety of marine resources encouraged continuity of settlement after the extinction of the moa species.

The changes have been linked to the movement south of Ngati Mamoe and Ngai Tahu peoples into land occupied by Waitaha. O'Regan described the Waitaha as the first people in the South Island, but when the Ngati Mamoe were drawn

south in the mid 16th century by the abundant bird, eel, and fish resources they came to dominate Waitaha, more by strategic marriages than by war. Ngai Tahu moved south in the 17th century as a mosaic of tribes from the eastern North Island, bonding into a unitary tribe about a century after moving into Te Waipounamu—'a century of conflict, of peace making and intermarriage, both with the Ngati Mamoe and amongst themselves. It was during that time that 'classic' Maori culture was implanted in the South Island.'(O'Regan in Waitangi Tribunal 1991: 177). The newcomers absorbed the earlier people's knowledge and experience of the land and its resources, a process of fusion that was still continuing when Europeans arrived (Waitangi Tribunal 1991: 175). The social basis for continuity of resource use, associated with some new fashions in ornaments and artefacts, is confirmed by this traditional evidence. The links to the northern people strengthened a trading network that carried nephrite and mutton birds north in return for obsidian and kumara flowing south.

Anderson has defined the developed social pattern of the Ngai Tahu in the protohistoric as relating to the land and its resources in three ways. There was the tribal territory that the tribe would fight to defend against outsiders from the North Island. There were rights of access to resources, inherited through hapu and widely spread throughout the tribal lands. There were customary annual ranges through which members of communities dispersed in the course of the yearly economic activities. Any one community was made up of several hapu at a time, exercising their rights of access. Thus hapu owned land and rights of access, but did not, as hapu, manage them. Communities managed land and property, but ownership remained with the hapu (Anderson 1980b; Waitangi Tribunal 1991: 181). The strength of this political control allowed the development of village life again in the 18th century.

If the early villages ceased to be viable in the 16th century and the new villages based on preservation and transport of dispersed food did not appear until the 18th century (Anderson & Smith 1996a), there would seem to be a gap of 100–200 years. It is unlikely that people left Otago or even that there were any major disruptions of traditional society, given the strong continuities in subsistence strategies and artefact manufacture. The nature of occupation at Long Beach suggests that some of the specialised early fishing sites continued to be occupied by communities who simply went on fishing and birding to support themselves. The political affiliations of the community could have gradually changed over time to take advantage of access to far-flung resources and gain security through marriage links to other hapu.

It is quite possible that people during the early moa-hunter period created some small middens of purely fish bone and shell, and about 60 of the small middens recorded in the site record file for Otago did have moa bone in them. After about AD 1550, if people had to live in smaller groups, the predictable availability of food along the shoreline would have been attractive. Many of the small shoreline middens lacking moa bone may have been created during the period between the early and late villages. These small middens of shell and fish bone may be useful for showing how the new way of life was established in the 17th and 18th centuries.

With further research, after his 1980s paper on social structure, Anderson distinguished a difference between resource management north and south of

Banks Peninsula. Roughly speaking, where kumara could be grown, a hapu held an area with varied resources called a wakawaka, but in the south each hapu had management rights within a given resource area called a mahinga kai. A northern hapu, at any one season, was to be found mostly living within its wakawaka, but some rights such as to weka hunting grounds were outside the wakawaka. The weka hunting grounds were treated as a mahinga kai area, *within* which rights were assigned. In the south most rights to occupation and management of an area hinged on the mahinga kai system, whereby many hapu held rights within a large area. Within high-use areas though, such as the titi islands, rights were again assigned to individual hapu (Anderson 1998: 112). In the south, at any one season, a hapu was widely scattered, but chiefs had places of residence which were associated with them as heads of hapu rather than with a given food resource. Some, but not all of these latter places were defensible pa. Rights of land tenure under either system were multi-layered, blending rights by descent and rights by occupancy.

This flexibility of social structure is the response of a Polynesian culture, whose land-based resource had been some form of horticulture and arboriculture for millennia. In southern New Zealand, the land management system, where each hapu had rights to geographically scattered mahinga kai and no wakawaka with clustered mahinga kai within it, must have been revolutionary. Such a system may not have developed until the demise of the dense moa and seal populations forced a reliance on much more patchy and scattered resources.

## Changes induced by the arrival of Europeans

The arrival of Europeans only gradually changed Maori life in Otago in the first half of the 19th century, particularly through intermarriage. An increase in population which might have resulted from growing potatoes and raising pigs was counteracted by the Maori's lack of immunity to European diseases and the low birth rates of Maori women. There was a movement of people towards the whaling settlements at Tautuku, Taieri Mouth, Otakou, Karitane, and Moeraki. In a study of the development of early Maori-Pakeha families in southern New Zealand, Anderson (1991b) noted assimilation into Pakeha culture through intermarriage, which usually resulted in Maori women moving into their husband's family. The whaling station sites included the first mixed-race households, along with the earliest historic European sites, some of which have been surveyed and excavated (see chapter 6 below).

At first the coastal communities retained their mobility. In 1844 Munro (Hocken 1898: 250) noted that the Maori were great travellers, well-provided with good boats. From March to July significant numbers of people travelled to the titi islands in Foveaux Strait, and at other times of the year into Central Otago for eels, well into the 19th century. Shortland, carrying out census work on coastal communities in the 1840s, was aware of the mobility of their inhabitants and ascribed empty villages to the people having moved away as whaling declined (Anderson 1998: 192). From the first decades of the 19th century, Maori had been growing the white potato at their villages, the storage of which may at first have been worked into the normal storage pattern. Cultivation would have increased sedentism, once the problem of keeping pigs elsewhere had been

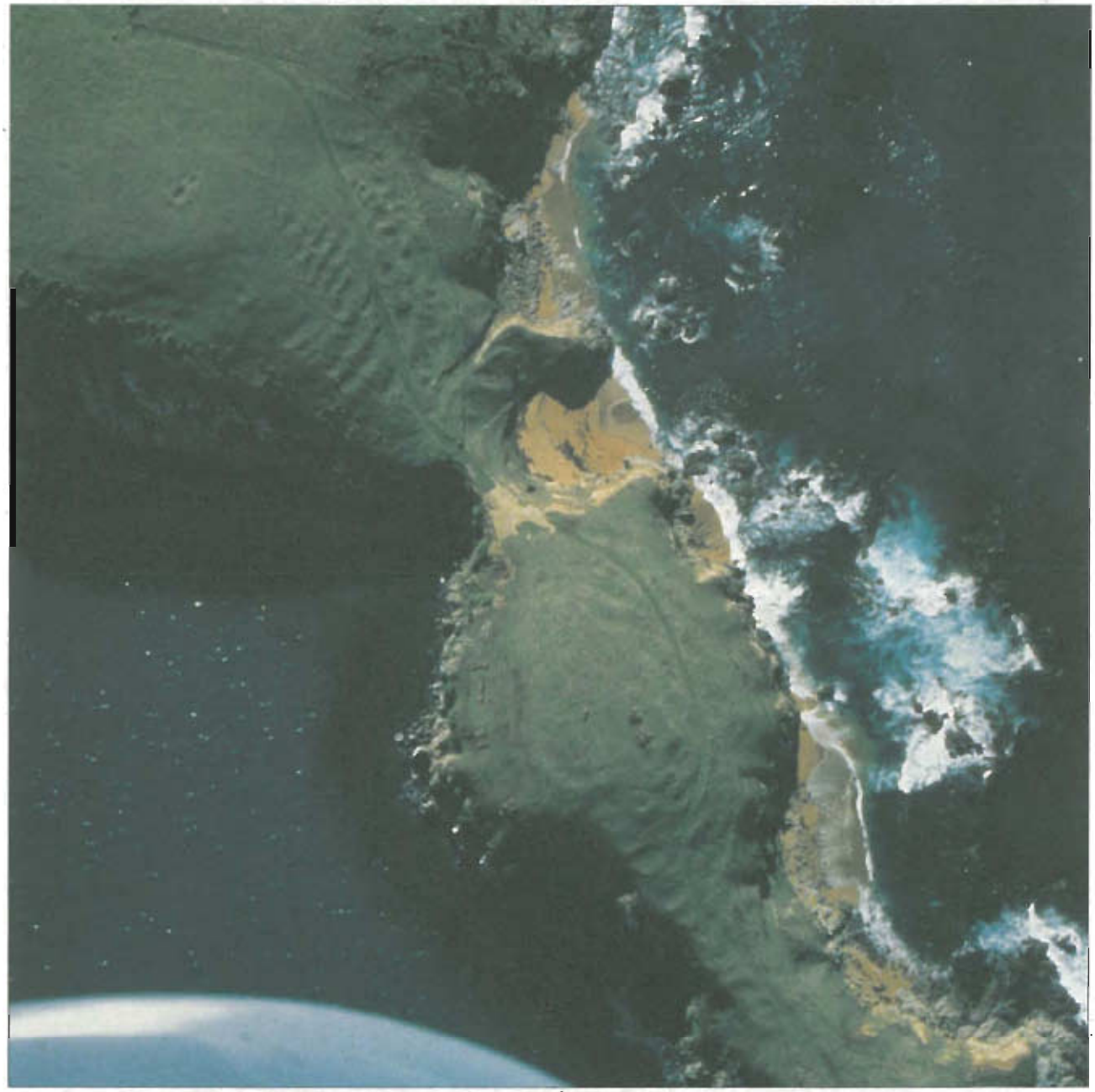
It could be expected that inland sites concentrated on fowling and freshwater fishing and coastal sites on fishing and shell fishing. None of the late inland sites have been confidently dated in Otago, but Lee Island in Lake Te Anau, dated to the 16th century, could be considered typical of the fowling sites. From the late 17th century onwards sites become easier to place in the chronology, such as the village indicated by the upper layers of Long Beach with a rectangular house, and other villages seen in the early 19th century, such as Murikauhaka, Warrington, Whareakeake and Otakou on the coast, as well as numerous, traditionally recorded, small villages around the western lakes. The earliest villages are associated with Waitaha and Ngati Mamoe traditions and the later ones with the Ngai Tahu. If stores of preserved food were essential for village life in the late period and population densities were relatively high, food stores would need to be defended. Headland pa and palisaded villages within swamps, where this food could be stored and defended during late winter and spring, may have become as economically sensible in Murihiku as further north. These sites needed to be in warm sheltered places close to shellfish beds for fresh food. Since they were to be permanently occupied the year round, it was worth adzing heavy timbers for substantial houses and for pataka.

To explore this new pattern of wide-ranging resource collection, preservation of only parts of birds and fish, storage for consumption in seasons other than that of collection, and trading for both subsistence and mana, archaeologists will require new methods of midden analysis. There is a lack of sound archaeological analyses of large faunal and lithic assemblages from Classic and Protohistoric sites comparable to the analyses of Archaic assemblages. The ethnographic material provides information about the position of named settlements and sometimes about the main activity carried out, but does not provide material that can be compared against the Archaic assemblages. The named settlements are likely to be only a subset of all settlements. For instance, none of those named in Otago seem to have been quarry sites for stone resources such as silcrete and porcellanite. Intensive analysis of material from minor sites and establishing tests for contemporaneity will be needed to fill in the settlement patterns and to understand how the pattern of gathering scattered resources was developed.

The most challenging tasks for the future in Otago archaeology will be to assemble data from late sites comparable to those from the early sites, to fill in the cultural gap between early and late villages, and investigate the settlement pattern along the coastline between Brighton and the Clutha River. There should be systematic surveys for undisturbed late sites from which midden material could be acquired for analyses similar to those made for the early sites. Even if the samples are much smaller, new techniques may enable us to draw far more information from midden samples than in the past. Such procedures could require re-sampling old sites and locating many more sites of short duration.

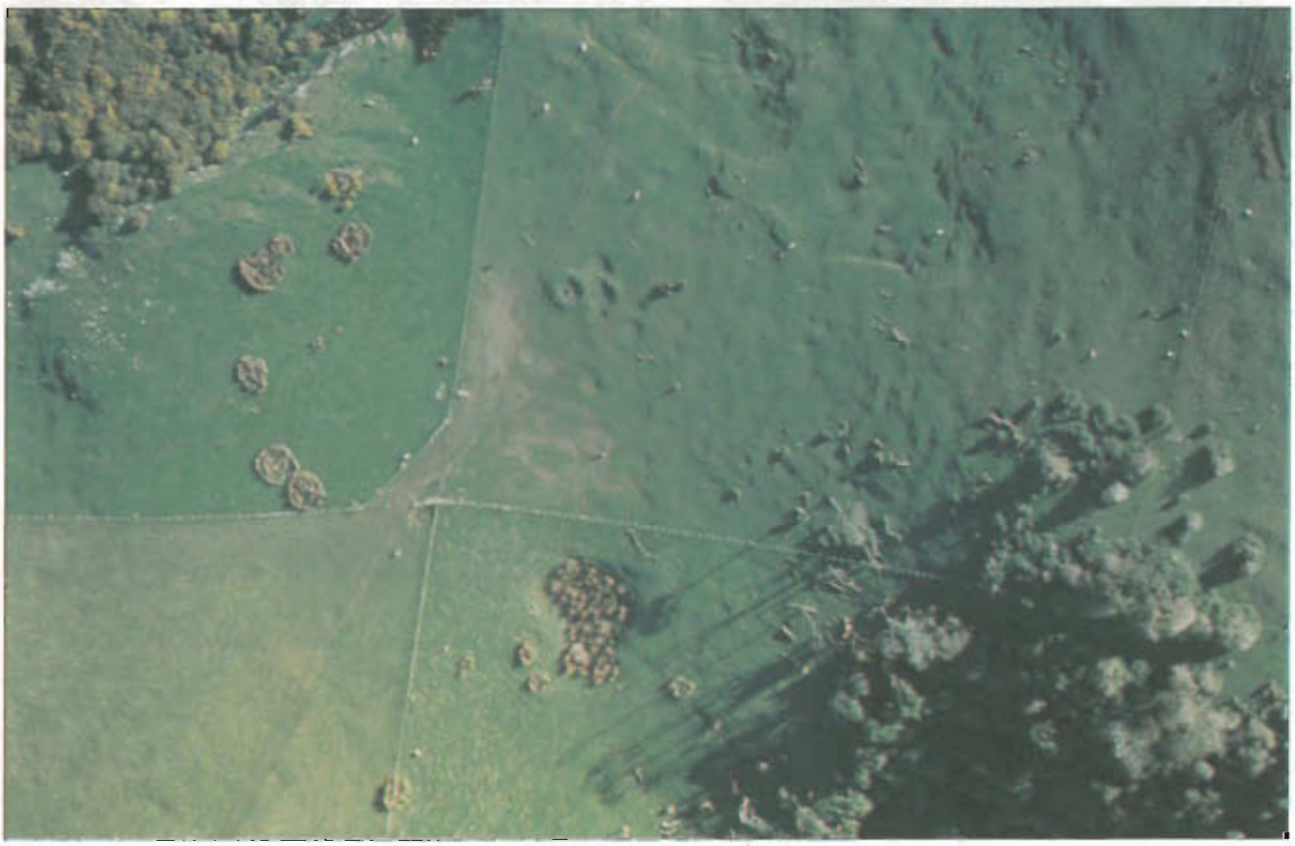
The archaeology of Maori sites is not about great events that affect the history of the world. It is not even just about the admittedly fundamental processes involved in survival, raising children and maintaining a vigorous lifestyle at a hunter-gatherer level of culture. The latter can be explored in many other countries, but Otago between the 16th and 18th centuries had a very special characteristic. It was populated by people accustomed to living in villages and

well aware of the advantages of village life enjoyed by relatives in the kumara-growing areas of the North Island. The movement south of Ngatimamoe and Ngai Tahu in the 16th century is seen, by Maori themselves, as a time of conflict, peace making, intermarriage, and the implanting of Classic culture (O'Regan in Waitangi Tribunal 1991: 177), but these northern people were village-dwellers who had to acquire the local's detailed knowledge of the hunting and gathering of widely distributed resources. Living in nothing, but constantly shifting campsites was apparently not seen as desirable. It must have required enormous determination to develop the social organisation and the pattern of seasonal gathering, preservation, and storage needed to support village life once again in 18th century Otago.



Katiki Point. The terraces at the upper left of the photograph are *inland* of the narrow neck, and not defensible from the landward side. The defensible terraces on the seaward side of the neck are more numerous. *Photograph: Kevin Jones, DOC*

Pleasant River Mouth. Most of the site lies in the brown area of salt marsh in the centre of the photograph. *Photograph: Kevin Jones, DOC*



Umu-ti and pits where cabbage trees have been dug out, on Otago Peninsula near Otakou. The shadow (upper centre) marks the location of two surviving cabbage trees.
*Photograph: Kevin Jones, DOC*

Huriwa Peninsula from the east, with Karitane village behind. The main areas of terraces are at the broad part of the peninsula, just past the razorback ridge. The whaling station was at the bar entrance, on the north side of the peninsula. *Photograph: Kevin Jones, DOC*

Northburn herringbone tailings which were drained down to the Clutha River in the foreground. Scraping with a grader to form border dykes has destroyed the head races and reservoirs in the background. *Photograph: Kevin Jones, DOC*

Stone fences on the Otago Peninsnla, outlining fields and along the edge of Centre Road. *Photograph: Kevin Jones, DOC*

The stone woolshed of Cottesbrook, near Middlemarch, was built about 1867 from schist slabs. It accommodated only 24 blade shearers, a small number for such a large property.

The Shag Valley station woolshed, built in the 1860s, is one of the oldest wooden and corrugated-iron woolsheds in Otago. It could accommodate 40–50 shearers, but the woolroom was relatively small.

The shearers' quarters at Shag Valley station were more solidly built than the woolshed, using the local schist with quoins and lintels of Oamaru limestone.

The Shag Valley station woolshed still has Lister shearing machines, which were installed in the 1920s. There is a flywheel above each shearer (and a modern fluorescent light).

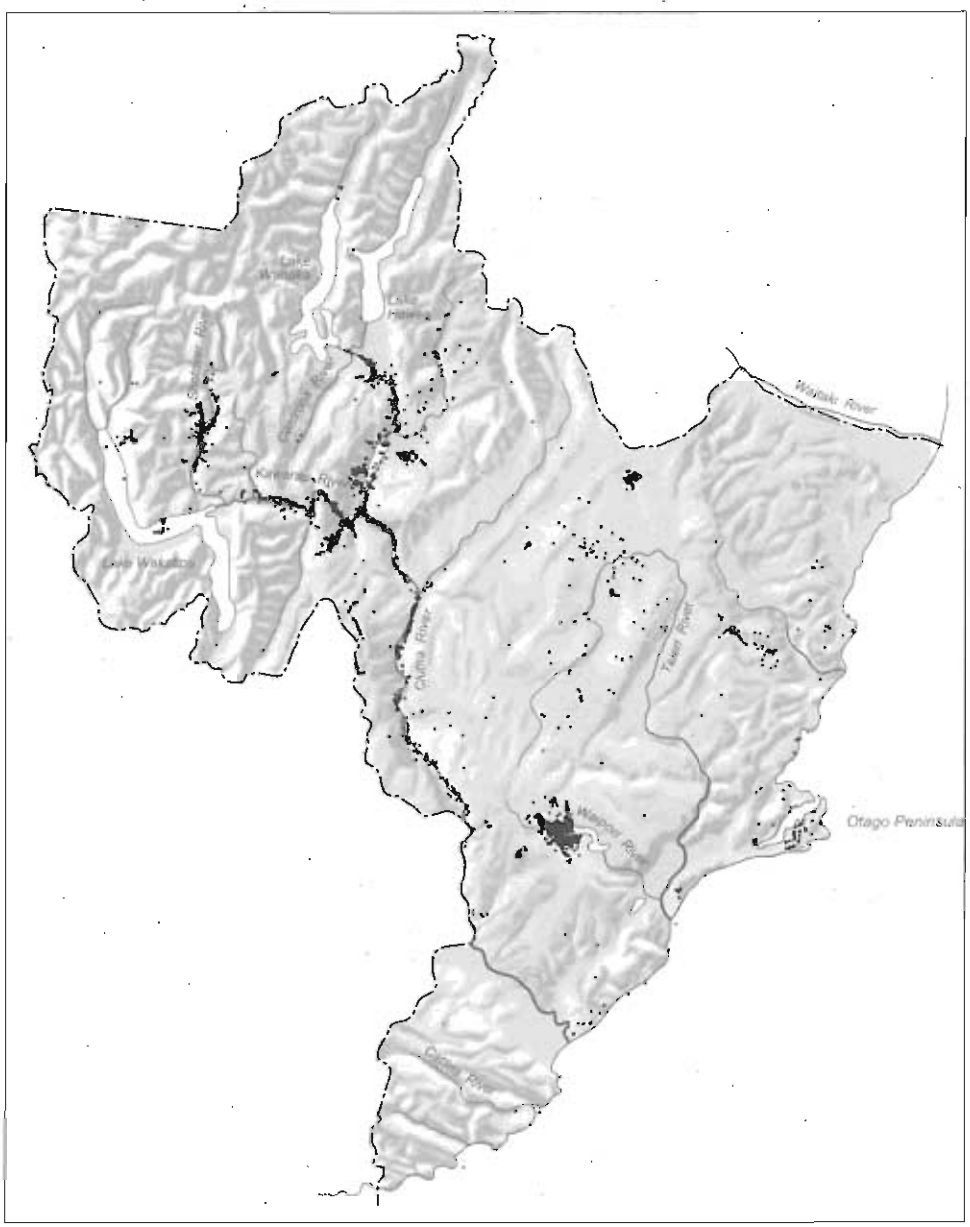
The Poolburn viaduct on the Central Otago Rail Trail. It is an American-type iron trestle bridge on piers of local schist stone, quarried from nearby. *Photograph: Kevin Jones, DOC*

Although this causeway crossing Blanket Bay was built about 1937, when the railway line was shifted and straightened, it is supported by the same sort of hand-stacked walling used around the Otago Harbour since the 1860s.

This was one of the first wire fences in Otago, built in the early 1870s at Longlands on the Maniototo, using kowhai posts brought up from Goodwood.

# Part 2 The historic period

Figure 14. Distribution of recorded archaeological sites of European or Chinese origin in Otago (data from the New Zealand Archaeological Association site recording scheme).



# 6. The first European settlers

## 6.1 HISTORIC BEGINNINGS

European sealers, whalers, and farmers colonised the east coast of Otago well before the formal settlement of Dunedin in 1848 (Fig. 14). They did so by agreement with the Kai Tahu rakatira. The first sealing ships were very reticent about their voyages, but there is sufficient evidence to show that a gang of 11 men were left by a brig called the *Brothers* on islands off the Dunedin coast over the summer of 1809/10, probably on Green Island opposite the mouth of the Kaikorai Stream. When the brig returned to collect the men in May 1810, the captain could find only two men, one of whom was the nefarious Tucker. The latter is blamed for causing a sudden change in Maori-Pakeha relations by stealing a preserved head from Foveaux Strait Maori, leading eventually to the burning of a large Maori village near the entrance to Otago Harbour in December 1817 (Entwisle 1998).

Though these sealers did not form the semi-permanent communities found on Foveaux Strait, the Green Island camp in 1809/10 must be considered technically to be the first European settlement in Otago. The men came from Sydney and were as likely to be from American as from British ships. The seal skins they took were traded to China, Otago's first foreign trade, if the illicit trade between the sealers and Maori is not counted[9]. The 1810 venture did not pay for itself, even though at least 2000 salted skins were picked up by the *Brothers*. The 11-man gang must have had a boat, if only to fetch fresh water from the mouth of Kaikorai Stream. Green Island would have been used to store skins, taken both from the island and elsewhere along the shores of the Otago Peninsula (Entwisle 1998). The north side of the Green Island estuary has a wide range of occupation sites in the dunes, and may therefore be the first site where Maori and Europeans lived together.

On the other hand, shore whaling stations set up by Europeans have been well-documented, both historically and archaeologically (Campbell 1992, 1993; Coutts 1976). They were relatively numerous: Moeraki (Site Record J42/136), Waikouaiti (I43/66), Purakaunui (I44/216), Otakou (J44/64), Taieri Island (I45/60), Molyneux (H46/53) and Tautuku (S184/82) and eight others along Foveaux Strait. Many of the men who established them came from Sydney and Tasmania, since shore whaling had started in Australia in 1806 (Prickett 1993). The earliest station in Otago was set up by the Weller brothers in Otago Harbour in 1831 and had the longest life of all, lasting until 1848. Most of the stations were short-lived, their locations and dates being: Moeraki and Waikouaiti 1838-1843, Taieri Island 1839-1845, Matau (Molyneux) 1838 and Tautuku 1839-1846 (Richards 1995). Other than at Otakou and Taieri Island, little trace remains of the stations. The whalers though must have made their mark immediately on the

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[9] Sealing gangs would have lost their rights to shares in the skins if they had been known to have traded or bartered with the Maori in any way (Entwisle 1989: 30).

adjacent forests as gangs of whalers and Maori felled trees for both firewood for the trypots and for timber to export to Sydney (Coutts 1983).

One of the whalers, John Jones from Sydney, saw other opportunities on the New Zealand coast. During his whaling days, Jones had acquired the right from Kai Tahu rakatira to establish a farm on the north side of Waikouaiti Bay. In his eyes he had bought the land from the Maori in the late 1830s. He was the wealthiest whaler on the New Zealand coast, with seven stations employing 280 men and running his own fleet of sailing ships between Australia and New Zealand (Olssen 1984: 14). In 1840 he claimed to have bought nearly two million acres, which he reduced to 20,000 when the British government began investigating land claims. He eventually received 2,560 acres (Olssen 1984: 18), but he bought up many more runs right through to the Dingleburn on Lake Hawea (Land Registry records).

Between 1838 and 1840 Jones tried to establish an English farm village at Waikouaiti (Fig. 15), bringing in twelve families, single men, a doctor, and a Methodist missionary. Unfortunately he settled the independent families at the foot of the Matanaka hill on marshy ground facing south, and provided nothing better than the local timber and clay for them to build wattle and daub huts with stone chimneys and thatched roofs. He also seemed to expect the settlers to live off the land and sea, as his hardy whalers had, and did not keep up supplies of stores to them with any regularity. The only other source of European food and goods was the Weller brothers' store at Otakou. Jones's second mistake was to put his brother in charge at Cherry Farm, the main grain and pasture area. The brother was not a competent farmer. By 1843 the settlers had left the district and there is now no surface trace of Otago's first European village at the foot of Matanaka hill.

Jones took over running the settlement himself in 1843. He imported stock and materials, including a kitset of timbers for a large house and farmstead on the Matanaka headland. The farmstead included not only the standard cottages, granary, and stable, but also a school and a three-hole privy. These are the oldest surviving buildings in Otago (Galer 1989). By 1844 Jones had 50 acres of grain, 150 acres in various crops, and was grazing 2000 merino sheep, 200 cows, 40 head of horned cattle, 100 mares, and 30 horses on 5000 acres of enclosed land. Two fence lines still in existence on the dairy farm immediately west of the SH1 bridge over the Waikouaiti River are the oldest existing fence lines in Otago (Land Registry records), though they have had new posts and wires several times over. Jones had built up the settlement of Waikouaiti to 30 families, who each carved out their own holdings from the coastal forest and shrublands behind the bay. His fleet of small ships must have been the key to this sudden growth. By 1849 he had 8000 sheep around the Dunedin hills and 600 acres of grain (Olssen 1984: 19), and was steadily supplying the new settlers at Dunedin with food via Otago's first road of any consequence—the bullock track from Cherry Farm, over Swampy and Flagstaff. He and his brother planted an orchard at Cherry Farm in 1847, of which a ruby pear tree survives, thought to be the oldest fruit tree in New Zealand now that an ancient tree at Kerikeri has died. It is certainly the oldest known exotic tree in Otago (Burstall & Sale 1984: 271). The tree is still in good heart and marks the site of one of the oldest European gardens in Otago.

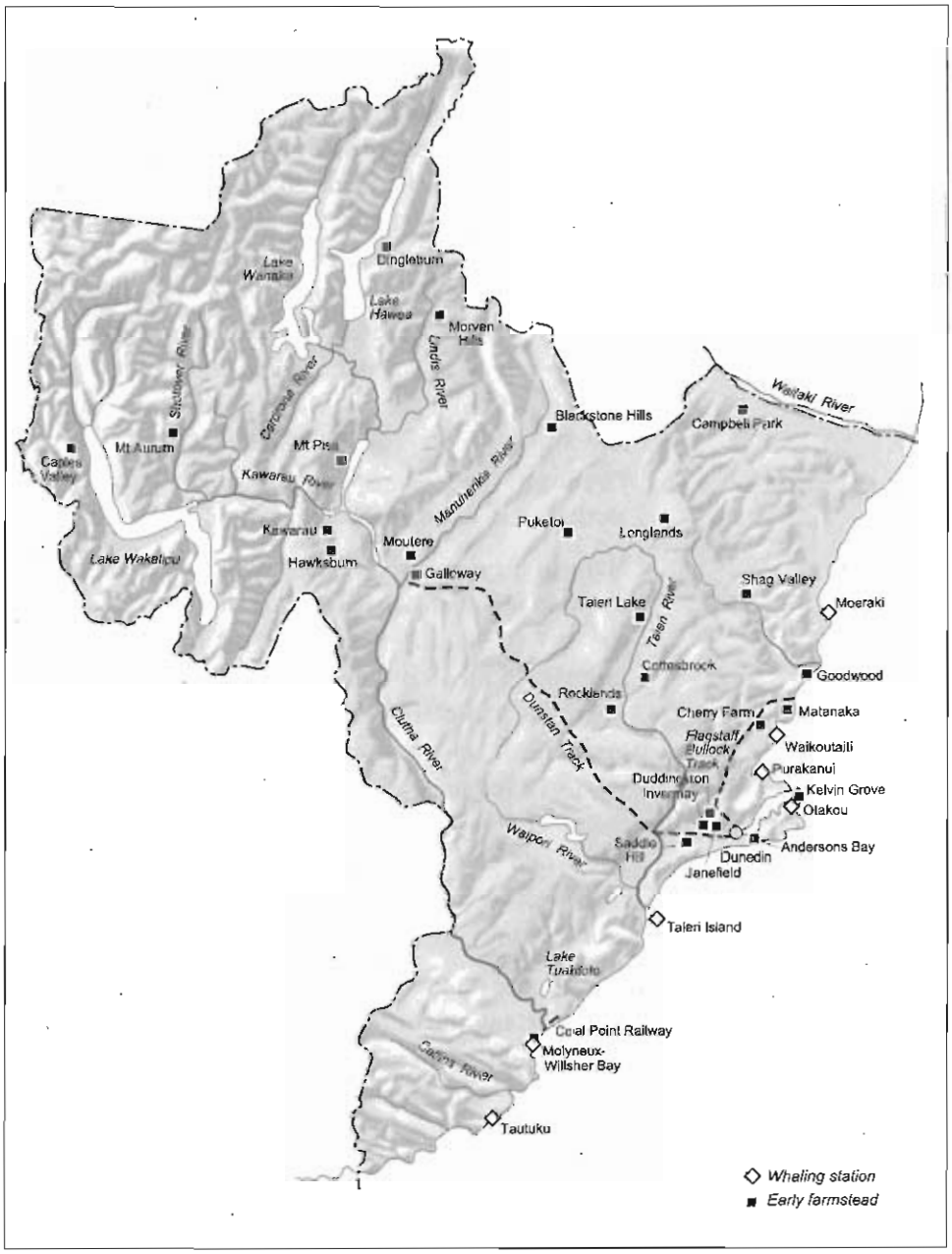



Figure 15. Sites of whaling stations, early farms and runs and early roads.

Other farms and gardens of the 1840s were adjuncts to the whaling stations at Otakou, Willsher Bay, and Moeraki. Kelvin Grove at Otakou was the first. Unlike Jones's effort at Matanaka, this was a single farm set up about 1836 by Octavius Harwood, the storekeeper to the Weller brothers. Though earlier than Cherry Farm, Kelvin Grove has been partly eroded by the sea as the shoreline has shifted inland and the rest is covered by sand (J44/96). Harwood's store shed (J44/64) still existed in 1974, as well as the site (J44/74) of Taiaroa's European house (Knight 1978). Te Ruatitiko (J44/97), the largest kaika at Otakou during the whaling period, suffered the same fate as Kelvin Grove. In 1844 a sealer from Codfish Island, Archibald Anderson, was farming Kelvin Grove with 30 cows, two horses, and 500 ewes. When the farm was taken over in 1862 by the Thomson family, the house was described as a structure of weatherboards and clay, possibly wattle and dab, roofed partly with shingles and partly with thatch

(Thomson 1944). This farm and the gardens of the Kai Tahu nearby provided the first food supplies to the European migrants at Dunedin.

At Willsher Bay the first livestock were brought ashore in 1840, and many of the pigs and goats escaped into the bush. George Willsher and Thomas Russell established farms of 10 to 20 acres and built three or four houses which were seen by Tuckett in 1844. The sections on which they were built near the mouth of Karoro Stream are clearly identified by Waite (1948: 20). At Tautuku, Palmer did not so much farm as garden, but he made an early liberation of rabbits in the sand dunes. These were isolated from the great grasslands of Otago by the dense Catlins forests and may not have contributed to the plagues of the 1870s. They certainly did not die out though, and early surveyors saw them along Tautuku and Tahakopa Bays in 1886 (Hamel 1977: 38). The Moeraki whalers took to farming to survive when their whaling station collapsed for want of whales. Nothing has been recorded of their early farmsteads.

Many of these whalers had established matrimonial links to the Kai Tahu hapu of the area who held manawhenua, the marriages often being firmly insisted on by the iwi (Belich 1996: 172). The methods of farming would have been an interesting blend of English peasant farming and the knowledge of their Maori relatives. This latter knowledge would have been derived from Polynesian growing of tuberous crops, like kumara and taro, and the semi-cultivation of wild species such as cabbage tree, bracken rhizomes, and flax. The knowledge about growing kumara and taro would have been tennous, since the southern iwi could not grow them, but the early success of southern Ngai Tahu in growing potatoes for export to Sydney suggests that in fact they were quite conversant with tuber cultivation.

These farms and their simple houses would leave no more trace than Maori middens, but the information to be derived from these and other Contact period sites would be extremely interesting. They represent a culture which Belich (1996) refers to as Old New Zealand, when the technology, far more than the people, of Europe flowed into New Zealand via the sealers, whalers, traders, and settlers, with southern Kai Tahu rakatira encouraging the flow. Some of these rakatira and their families crossed the Tasman and brought back clear ideas of what they wanted and how they were going to get it. Sydney was their shopping town—as it was to be for all Otagoites—until the development of rail in the 1870s made movement by land within New Zealand easier than movement by sea.

After 1848, European settlers, as well as goods, began to flow in, and Kai Tahu control could no longer be exerted by marriage alliances. Control passed to an elite of provincial officials working within a framework of the Presbyterian Church, though that was to change again in 1861 when the gold miners arrived, bringing a trail of bankers and merchants to join that elite. This interregnum of only 12 years had a quite distinctive character. The material culture of Britain was transferred in more or less integrated clusters to Otago, some of it by way of Australia. A selection of people, foods, clothes, tools, household gear, farming implements, raw materials, livestock, and ideas about the right way to live were brought to the shoreline of Dunedin and distributed, first into the coastal areas, and then gradually over the tussock ridges into Central Otago and Lakes District. The clusters centred around dairy farming, arable farming, small-scale sheep

farming on the British pattern, and extensive pastoralism on the Australian pattern. Some of the tradesmen, publicans, and small-scale businessmen who arrived via Australia were almost certainly freed convicts, moving to new and less prejudiced communities.

Archibald Anderson, the Codfish Island sealer farming at Otakou, bought land at Andersons Bay and on Saddle Hill in the 1840s. He brought out a Scots shepherd, Jaffray, and his dogs to farm the Saddle Hill property. Jaffray and his wife followed a Maori track along Kaikorai Valley on to the north-east slopes of Saddle Hill and took up residence in a Maori whare in 1849. His farmstead was the first south of Dunedin, and the new house that he built in 1873 was still standing a few years ago (Paterson 1974).

The Reverend Burns selected sections on the Taieri Plain and laid out the township of Mosgiel. On a pastoral visit in 1852 around the whole circuit of the plain, Burns provides fairly clear evidence of where the first farms were established (Shaw & Farrant 1949: 14 ff.). David Oughton's Janefield, Mosgiel, established in 1851 (Galer 1989: 77) is probably one of the best preserved farmsteads of this group, but one in a less built-up area such as Duddingston at North Taieri, built a little later, may have a better preserved 19th century curtilage underneath the turf. By 1855 the Tokomairiro Plain had also been settled, but the early houses there have not been as well-recorded as those on the Taieri Plain. By documenting early houses, the sites of many of the early farmsteads have been pin-pointed, even if their farm buildings have not been described (Galer 1981a, 1981b, 1982; Lemon 1970, 1972).

Small sawmills were set up beside the most accessible stands of podocarps, such as at Sawyers Bay, at Woodhaugh (Valpys in 1850), in the Catlins in the 1850s, and at Woodside Glen (about the 1860s). The first sawpits were at Sawyers Bay, the timber being rafted up to Dunedin in 1848 at the relatively high cost of 16 shillings per 100 feet (Wilson 1912). Some, such as Valpys and the Woodside Glen mill, were also flour mills (Petchey 1996j). Massive stone flour mills were built throughout Otago, some having vanished such as the one at Frankton Falls, others remaining as semi-ruins, such as those at Luggate and Oturehua, and others being 'recycled'. The Waianakarua Mill is a restaurant, and the Mosgiel and Milton buildings became incorporated into woollen mills. Numerous flax mills were established beside relatively small streams to scutch the native *Phormium*, but except for a strikingly intact example at Telford most have left no trace. Small lime quarries were opened, and the lime was often burnt to drive off water, creating the much lighter quicklime which could be more easily transported than limestone. Lime kilns still exist in obvious places such as at Dunback, but also beside minute deposits in unexpected places, such as at Sandymount on the predominantly volcanic Otago Peninsula and among the schist at Bobs Cove, Lake Wakatipu. These small local industries disappeared when better roads and the railways were built.

To the north of Dunedin, a Wellington publican, Charles Suisted, took up a large run from Goodwood north towards Moeraki and squatted on ground further north towards Kakanui. Like Jones he set out to establish a community, bringing in shepherds, carpenters, sawyers, a shoemaker, a blacksmith, and a brick maker. By 1853 he was exporting oats, bran, and wheat to Sydney (Olssen 1984: 50). His stables and the site of his farmstead still survive.

In 1849 the New Zealand Company built what was probably Otago's second road outside the town boundary—a dray road from Dunedin to the coal mines on Saddle Hill. The Flagstaff bullock track brought in food and the future main road south road brought fuel. The latter road greatly aided the settlement of the Taieri Plain and directed attention further south and inland. On both the plains and inland, bogs and mud were far more of an impediment to travel than steep slopes. The first tracks into Central Otago were made by the runholders who, in taking up runs in the late 1850s, were obliged to stock each of them with several thousand sheep. Some of them rented flocks from Johnny Jones (Olssen 1984), but most of them imported sheep from Australia, bringing them ashore at Moeraki, Blueskin Bay, Molyneux, and Bluff. They criss-crossed Otago by some incredible droving routes. In late 1855 William Cameron set off from Hindon with 600 sheep to a farm near Riverton, reaching there more than a year later with his mob intact. Watson and Alexander Shennan took a mob of ewes and lambs from the Tokomairiro to Galloway and Moutere. They followed as straight a route as possible, which took them over the highest part of the Lammerlaws. In 1859 William Trotter stocked his run between Garston and the Upper Nevis with sheep from his farm at Moeraki, driving them up the Shag Valley (Beattie 1947: 48 ff.).

Once they reached their runs, these pioneers had to look back along their droving routes and consider their use for bringing in a vast array of stores, and even more importantly for taking out wool, their only cash crop. At the runs, quick shelter was built for men and horses, using as much as possible the materials to hand—stone, earth, and as little timber as possible. Otago probably has the largest collection of historic earth and stone farm buildings in New Zealand, well documented by Thornton (1986). They range from the magnificent woolsheds of Moutere and Morven Hills to the lone boundary riders' huts to be found on nearly every early station. As well as buildings, the farmers constructed miles of sod fences in Otago, since there was no cheap timber for post and rail fences, and wire became generally available only after 1870. The best examples of these walls are not in the dry climate of Central Otago, but in the damper climate of the coast, where a more regular rainfall has maintained a protective cover of vegetation. One farmer, Adam Landels, surrounded his entire farm, between Lake Tuakitoto and the coast, with mile after mile of sod walls, some still 2 m high (Hamel 1984).

The larger farm buildings in particular have excited the admiration of architects, legislators, and the public, but less attention has been paid to the archaeologist's interest—their pattern on the landscape in relation to their use. The positioning in the farmstead of house, stables, storage sheds, and the all important woolshed had to strike a balance between the need for shelter, the working of large flocks of sheep to and from the best grazing on the run, and the connection by road to the nearest town and port. These farmsteads and dray tracks form the major archaeological expression of farm settlement in Central Otago in the 1850s and 1860s, and belong to a landscape and society wholly different from the present pattern. Some of these patterns will be described later.

In North Otago and the Waitaki Valley the easier terrain and shorter distances from the ports of Moeraki and later Oamaru, made farm development easier. A

totally different type of large farm was established here. Land prices were deliberately kept high to begin with. Many owners set out to develop feudal systems of large holdings worked by poorly paid labourers living in separate hamlets. The homesteads were built to impress, and the fields were so large that men rather than fences were used to control stock. William Menlove had a single wheat paddock of 1000 acres.

The unpopularity of artificially high land prices had some effect even as early as the 1850s when the Provincial Council decreed that depasturing licenses could be cancelled in some areas in favour of setting up Hundreds. These were areas where small farms of reasonably cheap land, traditionally one hundred in a group, were put up for sale with conditions, such as developments worth £2 per acre within a year of purchase. The Otago Block was split into three Hundreds (the Dunedin, Tokomairiro, and Clutha Hundreds), which strongly affected the future settlement pattern. Where Hundreds were declared inland at a later stage for the miners, they were not so effective, because of the economic difficulties of running small farms so far from ports and large towns (Olssen 1984: 54).

The political process of preventing the development of the English system of large land holdings culminated in the draconian Acts of the 1880s and 1890s, which enabled Sir John McKenzie to break up the enormous runs of North and Central Otago (Moore 1958). The nature of the land meant that Central Otago runs were still relatively large and required substantial farmsteads. There was a flurry of farmstead construction around the turn of the century, which had to respond to different factors from those of a few decades earlier.

The first runholders had two enormous advantages over these late comers. The pastures of native grasses, herbs and low shrubs into which they released their flocks were full of palatable species, whose only native predators had been insects (typically moth and beetle larvae and adult grasshoppers and wetas), paradise ducks and in the distant past various moa species. And there were no rabbits. The new, white, woolly herbivores creamed off the palatable plant species, and the montane grasslands of Otago have never again been able to carry the stocking densities of sheep that were present in the 1870s. An analysis by O'Connor of Lake County sheep statistics from 1880 to 1952 showed that in 1880 the mountain tussock grasslands were carrying ten times the number of sheep carried in 1950 (O'Connor 1982). The men who took up these runs had access to cheap shipping which they had used to bring in sheep, men, and gear. The wool went back on the return journeys to Europe. When the goldminers arrived in 1862, the runholders were well positioned to sell mutton and beef to a relatively captive market.

The profits were enormous. Some of the money went back into the farmsteads. Grander houses appeared, such as Campbell Park in the Waitaki Valley, built in part from the exploitation of the native grasslands of the Mavora Valley (Hamel 1992a). Innovative ideas in house building could be afforded. Invermay seems to be Otago's first concrete house, built in the mid 1860s by John Gow on his home farm on the Taieri. In 1862 he had taken up a run that was to become Glenaray and stocked it with cattle, which he was able to sell as fattened carcasses to the butchers supplying the miners. Invermay was probably the first grand house to be built on the profits derived from the miners.

The second major economic factor for farmers, after the price paid for land, was the price received for their products. The influx of the miners in 1862 was the first great change that allowed them to sell something other than wool, prior to the development of refrigeration. The whole social structure of farming in Central Otago could then change. From the simple pattern of large holdings controlled by a few men under depasturage licenses, a complex pattern arose. The miners held their claims and residences under a wholly separate system of warden's court licenses. These did not allow for land on which to rnn livestock. Once the rushes were over and miners brought in their families, they wanted room for a cow, a few sheep, gardens, and occasionally a horse. Commonages were declared adjacent to the large mining settlements, but these were often on steep and unproductive ground, so as to avoid both the gold bearing terraces and the wintering country crucial to the runholders. As the Hundreds were declared and a beginning was made during the 1880s to convert miners' residence and claim licenses to the standard Land Registry titles, small orchards and dairy farms began to develop along the main river valleys of the Clutha and its tributaries. Some races were converted to irrigation and began to be re-routed to water the surface of the soil rather than wash it away. In 1864, the first orchard and vineyard was developed at Clyde by Feraud, and the first dairy farm at Lowburn by Towans (Hamel 1996a).

Small townships had sprung up in the 1860s as service centres for the miners. Some like Naseby and Clyde were centred on the workings, and others, such as Cromwell and Queenstown, were at critical points on transport routes. Queenstown was not only established on the local runholder's farmstead site, but it was surveyed and ownership of sections assigned by tbe runholder, W.G. Rees, and the local warden in early 1863, before the official surveyors even arrived (Hamel 2000a).

The small farmers of the 1870s had two advantages over the earlier runholders. Transport systems, both road and rail, were developed rapidly in Otago, paid for by gold revenues and built to encourage further gold production. Since the small farmers were supplying a variety of dairy products, fruit, and vegetables to the miners and the towns, internal transport gave them direct access to their markets, and they were not dependent on shipping and a foreign market. Also cheap fencing wire began to enter the country in sufficient quantities to enable the small farmers to fence their own and the runholders' stock away from their crops.

Dunedin as a city of permanent buildings was established by the gold rush. Prior to the 1860s the streets were mud and the buildings wooden. With the gold came ships and the need for better wharves and a greater warehousing area. The mudflats were reclaimed, Bell Hill flattened (Olssen 1984: 101) and foundations for stone and brick buildings laid out, either on bedrock or on gravel pads on the reclaimed foreshore during the 1870s and 1880s. Brick making became an important industry in Dunedin, with 14 brick works established by 1864. A review of the building materials available in mid 19th century Dunedin is provided by Coutts (1983), including useful points such as the fact that the first machine-made bricks in Dunedin appeared in 1864 and heavy die-pressed bricks in 1882, features which could help date an old brick structure. Local bricks tended to be 9 inches long and some could be distinguished from imported English bricks which were 10 inches.

The earliest buildings and wharves of Dunedin were completely and quickly submerged by reclamation and by the building boom stimulated by 19th century gold mining. Details about the location of the early shorelines at the head of the harbour and the first buildings have been collated by Griffiths & Goodall (1980). McDonald (1965) provides a description of the 'village of Dunedin' in 1850, only two years after its establishment, and a remarkable number of professional photographers visited Dunedin. Archival material for the archaeology of early Dunedin is plentiful.

In 19th century rural Otago two quite different social structures were established. There were the communities centred on the farmsteads and homesteads of the big runs; small villages in a wilderness of matagouri and tussock. These developed a distinctive subculture which was strong in the 19th century, and socially speaking dominated Central Otago life through most of the 20th century. The homesteads of the big runs were centres of respectability and money with a strong hierarchical structure and strongly linked to each other by kinship. Their social structure was comparable to the House Society described by the French anthropologist, Levi-Strauss, as partly based on kinship and partly on wealth and power (Carsten & Hugh-Jones 1995).

Life in the townships was different. The towns were centres of basic administration; police camps were set up at an early stage, but the towns mostly lacked big family money and its associated social influences. The towns-people were middle of the road in both respectability and material wealth. Though the common law of England was adopted by New Zealand, it provided only a framework within which the new communities had to establish a new way of living. Conformity and uniformity in mundane customs, such as clothing, the wearing of hats, and choices of food and its preparation, carried great importance as signals of respectability. Archaeological investigation of residential sections in these small townships is ideal for investigating these aspects of social structure and the 'grass-roots' economics of 19th century Otago. So far such work has been carried out only in Queenstown, on seven residential sections (Hamel 2000a) and on a hotel/stores area which is yet to be reported on by Peter Petchey. Full evaluation of materials from these excavations should provide some valuable insights into the social structure and processes of establishing a new community.

## 6.2 WHALING STATIONS, EARLY ROADS AND RAILWAYS, AND EARLY DUNEDIN

Otago's earliest sites of its second colonisation are the faint remains of seven whaling stations (Campbell 1993). No archaeological evidence has been securely assigned to whalers on the sites of the Molyneux and Tautuku stations. Some midden evidence or terracing used to be visible at Moeraki, Waikouaiti and Purakaunui, but had vanished by the time of the 1990s survey. The Otakou station, which was the largest in Otago, is represented by the bricks and ash of the tryworks foundation sitting on Wellers Rock, which was excavated in 1991 (Campbell 1994). This site is well-documented, both with reports and sketches (Knight 1978; Coutts 1985). Confused stratigraphy in a confined area did not reveal anything useful about the structure of the tryworks, but an analysis of the

bricks suggests local manufacture. The whaling station on Taieri Island has more surface evidence than the others (Coutts 1976, 1985). There are three fire pits in a rocky cove on the western shore and terraces for two or three huts, with midden below them, on the eastern shore (Campbell 1993).

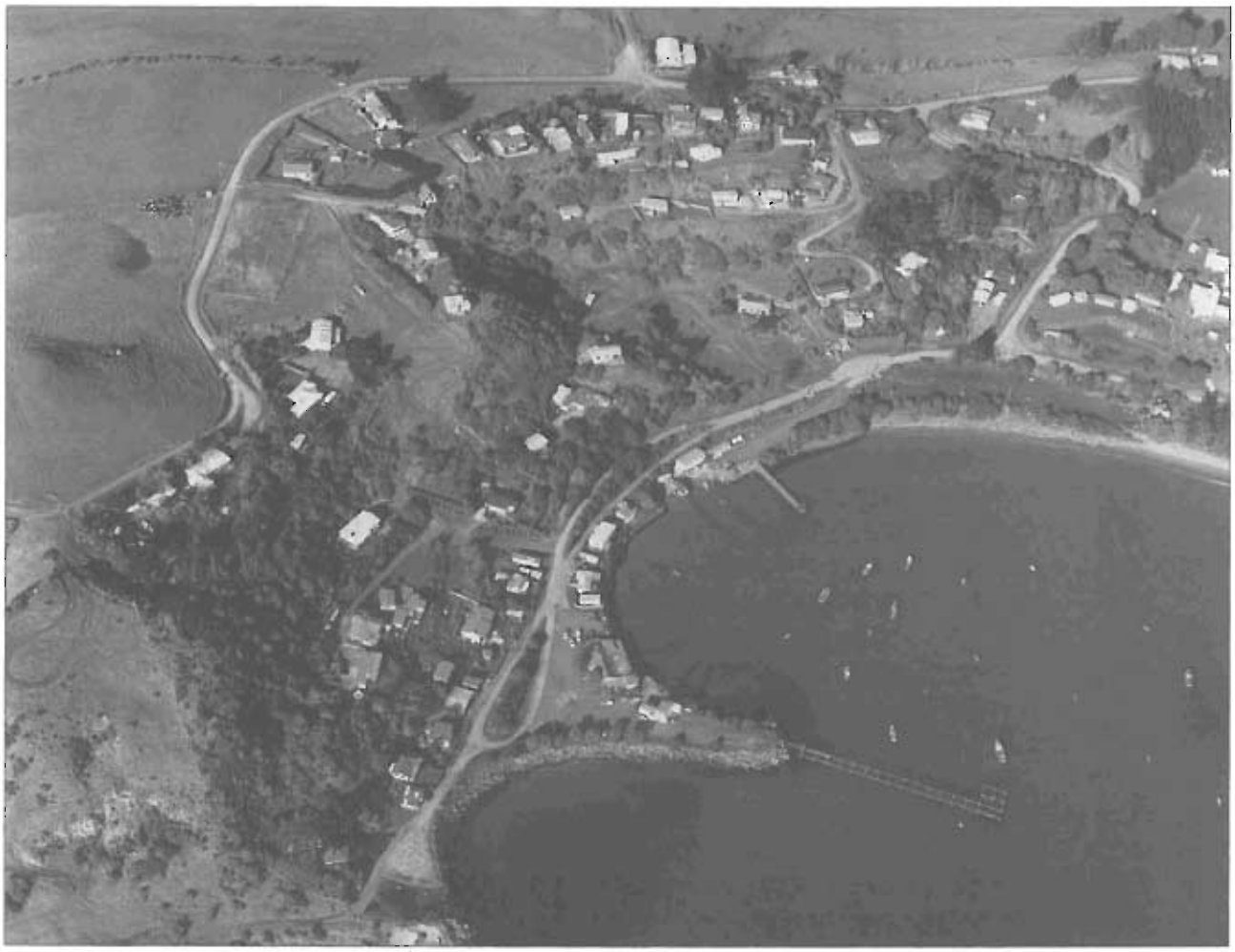
The oldest vehicle track still in use in Otago is a bullock track over Swampy and Flagstaff used by John Jones to get provisions to Dunedin in the 1850s. It has been modified to form a walking and off-road vehicle track over much of its distance, but short lengths of the original 3 m wide track still exist in places, if somewhat scoured by erosion. No survey has been carried out to see if there are any formed culverts or run-offs.

Before the access roads for carrying supplies to miners were formed, the runholders had developed a skeletal system of roads for droving stock inland and for drays to take their wool to the coastal ports. The main track south into the interior ran over Halfway Bush, skirted the plain to a ford over the Taieri near Outram and via Lee Stream to Campbell Thompson's Rocklands station in 1857 (Hangar n.d.) This road line was abandoned as a main route south by the Otago Provincial Council in 1861 in favour of the road to the coal mines at Fairfield and on over Saddle Hill via a ferry at West Taieri. During the gold rush both roads were used to reach the Dunstan Track at Outram. In the 1860s, they were dotted with short-lived hotels, providing accommodation, liquor, and hiring out horse transport to the miners (Hamel 2000b). The line of the Dunstan Track from Outram on the present State Highway 87 to Clarks Junction and Rocklands has been mostly replaced by a modern road. From Rocklands, over the Rock and Pillar Range, across the upper Taieri valley, over Rough Ridge, across the Ida Valley and over Raggedy Range to Galloway, it is now marked by gravel roads and farm tracks. It has not been surveyed for stone culverts and old bridges, but one of the hotel ruins of the gold mining era (Bairds Hotel, Poolburn, grid reference S134/384525) has been excavated (P. Bristow pers. comm. 1999). The stone walls of another one, the Oasis Hotel at Rocklands (H44/1006), still stand beside the road.

Another of these early roads to the goldfields followed the present Shag Valley Road across the Maniototo to Puketoi and via Shennans Track to the Poolburn and by a route not known now to the Galloway. This track was formed by the Shennans, and the Murisons helped to complete the route to the coast via the Shag Valley (Hangar n.d.). The third route was influenced by the McLean family at Morven Hills who sent their wool out via the Waitaki Valley. The road was brought in over the Lindis Pass and down to a ferry over the Clutha at Newcastle (Albertown). It was these latter roadmen who started Otago's first gold rush, when they downed tools and started working the Lindis River bed in March 1861 (Hangar n.d.).

The early road bridges to the gold fields were often suspension bridges with piers built from the local stone. This one is across the Taieri River near Sutton.

When the gold rushes converted this skeleton into a network, two routes from Dunedin to Lawrence were formed: a long one via Milton and Glenore and a short, but rough one via Lee Stream and Waipori. Both are now followed by modern roads.



Moeraki. The whaling station lay in the curve of the bay. The iron wharf was built in 1873, but the port never achieved its potential, mostly because unstable ground along the shoreline prevented the development of onshore facilities.

*Photograph: Kevin Jones, DOC*

From Lawrence the road inland took to the high ridges to avoid having to cross the Clutha, and can be traced on old cadastral maps running well east of the river to Raggedy Range and across the Manuherikia to Galloway. The main land route into the Lake Wakatipu area was up the Cardrona Valley and over the Crown Range, but the line taken south off the Crown Range saddle is not known. Access by boat from the south was also used at an early date.

Most of the dray roads avoided sidling across slopes. The dray men dealt with steep slopes by using bullocks to pull straight up them, and going down hill threw out enough stones and logs on ropes to act as drags so that they could slide the drays down on locked wheels. The latter technique quickly formed deep grooves which scoured out, and subsequent travellers simply moved further along the hill slope. This messy practice drew the ire of the early road boards when roads were being formally gazetted and sidlings properly cut. Examples of this pattern can be seen at Dead Horse Pinch, an Otago Goldfields Park site in the Shag Valley, and near Patearoa on the Dunstan Road.

The line of the present State Highway 1 close to the coast was not completed until the 1860s, taking over from coastal shipping. Bridle tracks were numerous, and examples such as the Mopanui Bridle Track and the Highcliff Road from

Andersons Bay indicate the tendency to stick to ridge lines where the forest was thinner and the ground better drained. Some early bridges were built with dry stone abutments which have mostly been replaced by concrete culverts. One surviving example is known where State Highway 6 crosses the Albertburn near Luggate (S124/398). It was built with dry schist slabs about 1863, and is still standing up to 4 m high (Hamel 1993d).

Some of the earliest railway lines in New Zealand were built in Otago. The first were tramlines running out of coal mines, and the earliest of these in Otago is the track from a mine on the coast north of the Clutha River mouth, built by James George Lewis in 1861. It ran from his mine near Coal Point for about a mile to the edge of the Matau branch of the Clutha River (Dangerfield 1991). The first public rail in Otago was built between Dunedin and Port Chalmers by the provincial government, on a 3 foot 6 inch gauge line, about 1869. The first part of Vogel's great national rail system was a pilot section laid from Dunedin to the Clutha River about 1872. These early railway formations are buried beneath decades of subsequent maintenance, but the branch lines built at the same time, such as the Tokomairiro and Ngapara lines and subsequently closed down, are useful indicators of earlier railroad building techniques. Their bridges and tunnels in particular are very much as they were built. The Manuka Gorge tunnel (442 m long) is a good example of an early railway tunnel, and has well-made masonry portals and some sections of old brick linings.

The Central Otago railway was built relatively late and slowly—between 1879 and 1921. When the Rail Trail section from Middlemarch to Clyde was taken over by the Department of Conservation in 1993, an archaeological assessment of the trail found that many of the 52 bridges and numerous culverts were well-built in fully brought-to-course stone work. Along with the other wooden and iron bridges, they provide a technological series of bridge types, running from typically Victorian

A railwayman's hut (*above*) near Waipiata on the Central Otago Rail Trail, built with a stone chimney. *Photograph: Peter Bristow*

The Hindon to Barewood section of the Central Otago Railway through the Taieri Gorge took eight years to build. This may be why the huts of the railway camp near Flat Stream (*right*) had well-built stone chimneys which still survive at this remote site in the Gorge.

The portal of the Manuka Gorge tunnel on an old branch line to Lawrence.

stone work to American trestle bridges (Hamel 1994b, 1995d).

Though there are numerous photographs and maps of early Dunedin, its archaeology is sparse. Research on the location of foundations of early buildings lying under modern buildings was started in 1991 with a survey of the blocks around the Exchange, either through searching basements or as buildings were renewed. The 70 site record forms (I41/222-292) produced included floor plans of old buildings drawn from fire insurance records, descriptions of any visible remains, and historical data from early photographs and local informants. The remains of many pre-1860 buildings and materials were found, showing the value of archaeological investigation of urban foundations (Hall 1993).

Some of the most massive European archaeological sites on the Otago coast are the remains of coastal defences, which were begun in the 1880s as a response to Russian imperial moves into the Pacific, and continued to be built up to World War II. The most impressive of these are at Taiaroa Head and include the only intact and operational Armstrong Disappearing Gun in Australasia, with its associated observation post. The complex

The stone bridges (*above*) on the Central Otago Railway were carefully built of stones trimmed to even sizes and so 'brought-to-course'. This one is over the Capburn near Hyde.

*Photograph: Peter Bristow*

This bridge (*left*) at Alexandra on the Central Otago Railway shows the change from the stone piers of the earlier bridges to concrete piers.

The Otago Harbour wall comprises over 37 km of hand-stacked stone walling, holding up the roads and the railway along the harbour edge. This representative section shows that the stones were laid to an even face, but they were not graded in size from top to bottom.

on Taiaroa Head includes concrete gun emplacements for four other batteries, along with underground ammunition stores, a stable and living quarters, search-light pads, and the foundations of a village behind a stone parapet wall. Below the headland on Pilots Beach there is a well-built stone wharf, sea wall, and the remains of a tramline used to transport the guns and other materials up on to the headland (Hamel 1993e). Similar, but smaller, concrete gun emplacements were built at Harington Point inside the harbour mouth and at Tomahawk on the outer coast. The entire system was known as Fort Taiaroa and was maintained by the New Zealand Army in some sort of readiness from about 1888 until after World War II. Other than a general survey (Wiltshire 1993) and a sketch plan of Taiaroa Head, there has been no archaeological investigation of these sites. The Armstrong Gun and Observation Post are maintained by the Otago Peninsula Trust as part of their tourist operation. Gun emplacements were also built on Beachy Head, Oamaru, but are unrecorded.

Shipwrecks as archaeological sites have come under increasing scrutiny in the last 20 years. The Otago coast has its fair share of wrecks, dating from 1837 when the *Sydney Packet*, one of John Jones' ships, was wrecked off Waikouaiti (Ingram & Wheatley 1936). The positions of wrecks in Otago are mapped in McLintock (1951), and archival material has been collated more recently by Wilson (n.d.). None of the Otago shipwrecks have been examined by archaeologists, though the position of a fly wheel off the *Victory* is recorded (J44/88). As well as wrecks, there is an early shipyard (1857) on the north side of Careys Bay with an abundance of material in the form of old slipways and at least two hulks—the *Moa* and the *Prince Alfred*. Boats were built at this yard by the Isbister family from 1863 into the 1950s (Debreceny n.d.). There are various interesting old piers and wharves around the Otago harbour, including a reclamation and pier for a World War I torpedo boat moored at Deborah Bay (I44/295). Except for a stone wharf at Pilots Beach for landing the material for Fort Taiaroa (Hamel 1993e), these have not been documented. The 37 km of hand-built stone wall surrounding most of the Otago Harbour was built and rebuilt between the 1870s and the present day (Hamel 1997), and is a Category I structure under the Historic Places Act (1993).

## 6.3 THE ARCHAEOLOGY OF FARMSTEADS, HUTS, AND FENCES

Several categories of domestic and industrial sites of 19th century Otago are very poorly recorded, such as coal mines, factory sites, brick works, flax mills and small agricultural settlements. Many of the structures lie on the difficult legal boundary of 'archaeological site' and 'building' to which different protection measures are applied. There is a wealth of material available, though, on early large farmsteads in Otago, and the deterioration of many of their structures means that only archaeological investigation will reveal their nature.

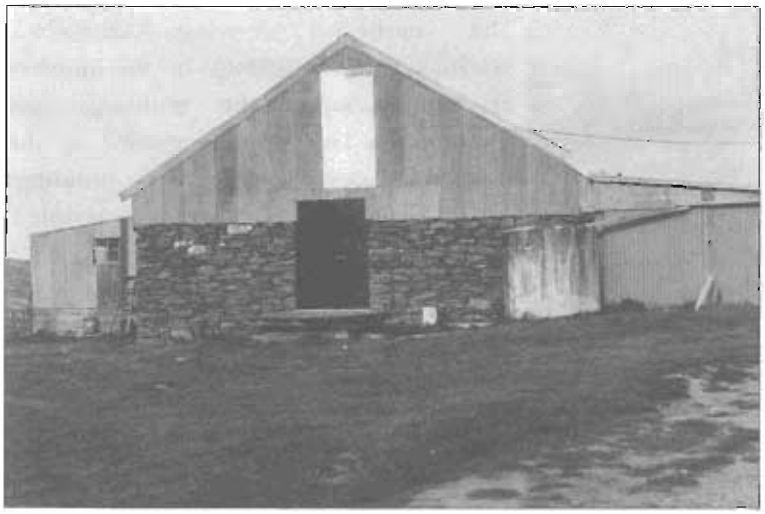
The first house at Rocklands Station had a mud-brick chimney supported by wooden framing. Although the method of construction looks fragile, the chimney has survived for over 120 years.

The earliest surviving farmstead, Matanaka, was 'tidied-up' by the Ministry of Works when the buildings and surrounding land were acquired by the Historic Places Trust in 1976. Buildings were moved and the ground levelled. Fortunately an investigation in 1975 (Knight & Coutts 1975) recorded many details about the layout of the farmstead, and it is likely that much information survives below the plough line. It is interesting to compare Matanaka, built by an Australian whaler, with the more compact layouts of the farms built on the Otago Peninsula, at Halfway Bush, and around Mihiwaka by Scottish farmers. Many of these were dairy farms, and are marked by well-built stone field walls. One has been excavated and two surveyed between Mopanui and Mihiwaka. The stone-walled byres on these farms were used for milking cows, rather than housing them for the winter. The buildings at Mihiwaka were relatively small and built with locally available materials (Connolly 1993). At Halfway Bush the stone cow byres are larger, L-shaped and could house up to 40 cows overnight, a large number for a hand-milked herd (Hamel 2000b).

Thornton's (1986) work on farm buildings throughout New Zealand provides useful descriptions and pictorial coverage of the *types* of farm buildings, right down to stores, sheep dips, and dairies. Otago's early buildings are well represented. Thornton also provides a brief history of farming *per se* in his introduction. The functions of buildings and the history of processes such as blade and machine shearing, wool scouring and butter making are given, providing good background material for the archaeologist (Thornton 1986).

Thornton (1986) does not describe either the positioning of the big farmsteads within their landscape (it was not his brief) nor the relationship of the buildings within a farmstead to one another. It is possible to compile a list of buildings for a given farmstead by working through each section on houses, stables, woolsheds and so on (Thornton 1986), but without any assurance that the list is complete. During the 1980s the Historic Places Trust developed a system of registration of individual buildings, as well as the concept of the precinct, which allowed the description of farm buildings as a unified group. The older buildings of whole farmsteads, such as Morven Hills, Lauder, Moutere, and Galloway, were linked together, but the buildings were still registered one by one, and the farmstead as a functional whole was not described. Reports compiled for the Department of Conservation during the last decade do contain sketch plans of farmsteads as functional entities (see Appendix 11).

In deciding the position of the farmstead on the run, access to a good line for a dray road eastwards to the coast may have been a dominating factor. Morven Hills was originally built on a cramped flat, higher up the Lindis Valley than its present position, because the wool went out over the Lindis Pass and down the Waitaki Valley. As roads were developed within Otago, the disadvantages of the site must have become apparent, and so the stones of the largest stone



In the 1860s Teviot Station built a U-shaped stone wall. It sheltered shearers when they were working on the far side of the Clutha River from the main shearing shed. When the station was subdivided, corrugated iron was added to make this woolshed, still standing above the Roxburgh Gorge.

woolshed in Otago were transported down valley, added to and the present structure built (Hamel 1990a). A cursory survey suggests that the disadvantages were lack of flat ground to assemble sheep on and the greater frequency of snow higher in the valley. Other than such simple observations during the course of surveys of historic values on pastoral leases, no detailed analyses have ever been done on the development of fence line patterns, track-ways, and positioning of buildings relative to topography on Otago runs.

The main source of information on the layout of the 19th century farmsteads of Otago are the reports compiled by Hamel between 1982 and 2000 for the New Zealand Forest Service and for the Department of Conservation under the PNA Programme and land tenure reviews. These include sketch plans of 4 small farms in coastal Otago, 11 major farmsteads in Central Otago, and 3 subsistence farmsteads belonging to miners.

The spread-out nature of the buildings, which are usually grouped only very loosely around a large open space, is the most obvious difference from the British pattern. Many of these farmers had been trained in Australia, and they already knew that the buildings did not need to huddle together for warmth and protection from wind and low temperatures. They knew it was highly desirable to separate the yards and the woolshed with its smell and dust from the houses. It is even possible to see a progression on some sites of yards and milking sheds being rebuilt further away from the house.

On nearly every large Central Otago farmstead (with a few notable exceptions) all living quarters are also built to the north or west of the yards to avoid the effects of the 'nor-westers'. It would be interesting to know why the shearers quarters were placed on the eastern side of the Blackstone Hill shed (Fig. 16; Hamel 1992b) and why the modern shearers quarters at Morven Hills are placed precisely south-east and well-centred on the long set of yards (Hamel 1990a). At least the Blackstone Hill quarters have been deliberately removed, the only major building lost from this most intact of all mid 19th century farmsteads. The other constant in the pattern of the Central Otago farmsteads is that almost invariably the woolshed is the outermost building relative to the road, e.g. Glenaray, Moutere, or Kawarau. At Kawarau it appears that the woolshed is behind the house, as approached from Bannockburn, but the first road into the farmstead came from Clyde on the opposite side (Hamel 1988a). The heaviest and most awkward objects that had to be transported by road were the well-pressed wool bales, and possibly this was the reason for putting the woolshed as close as possible to the public road. Other patterns, such as the evolution of yards, sheep dips, and wool scours, are likely to appear with further and more detailed analysis of these interesting mini-settlements.

There is virtually no information on the development of the curtilage of the main houses, with its paths, gardens, glass houses, hen houses, and hahas. These features are unfortunately ephemeral in that they are constantly being

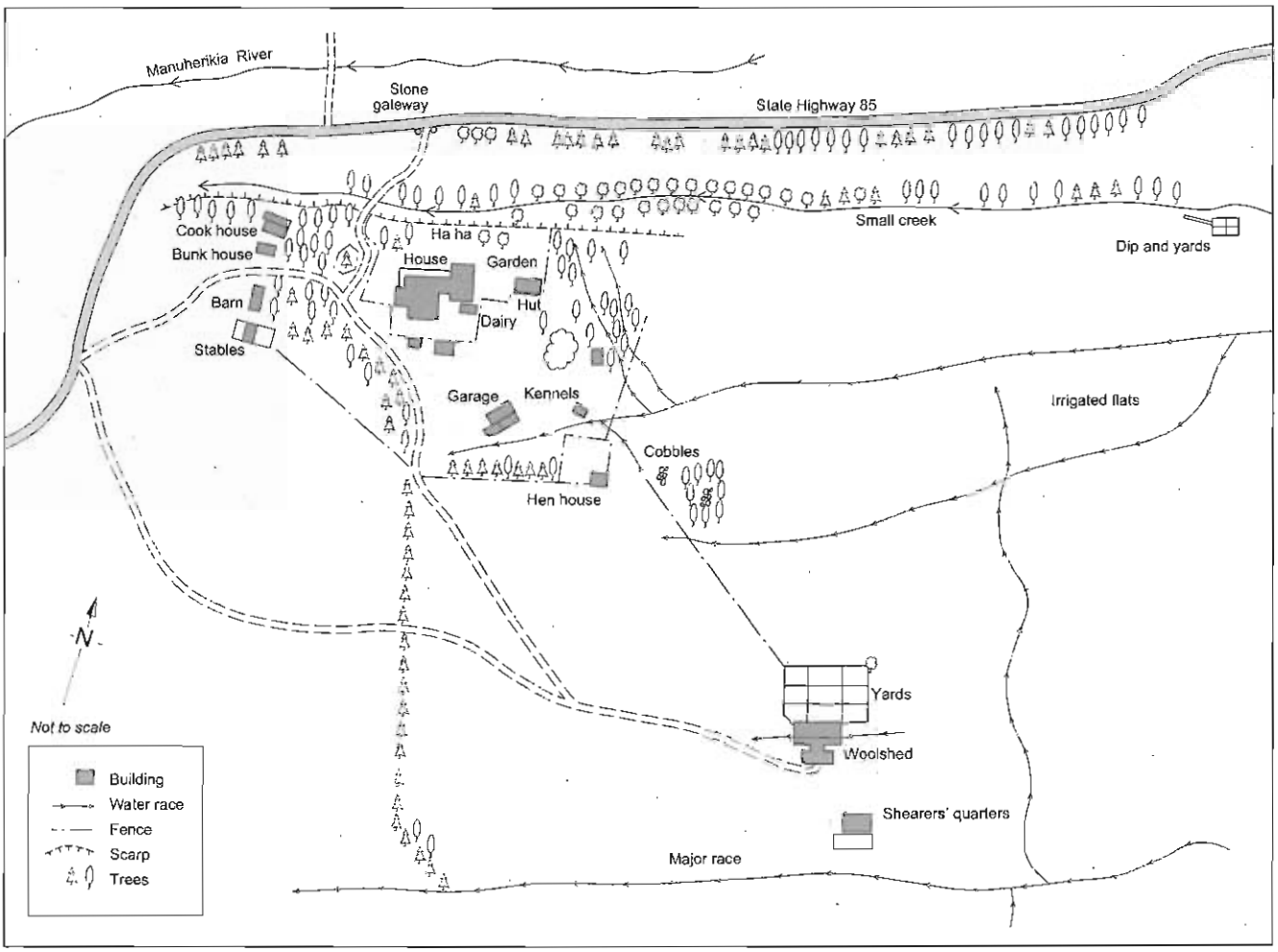



Figure 16. The layout of the early farmstead at Blackstone Hills (Reproduced from Hamel 1992b).

redeveloped, and it will only be by excavation linked to old photographs that we will be able to gain this information. Sod and stone walls around the buildings are the most durable items, but most of those recorded are around miners' dwellings (see below).

Two early farm houses have survived relatively intact because they are in remote valleys: Mt Aurum homestead (about 1867, S123/157), and the Caples Valley homestead (1872–1877). Both are simple weatherboard buildings with corrugated iron roofs and the remains of very simple gardens around them.

There is no such thing as a typical building plan for the first large houses at the farmsteads, other than a tendency for the house to be a simple square or rectangle. Thornton (1986) sees these early farm buildings as 'one off' designs, which were neither architect-designed nor factory-produced, and implies that there were few constants. From a national perspective, this may be so. From a provincial perspective, it is noticeable that Otago farmers, coming mostly from Australia, used a square floor plan and the Georgian hip roof, rather than the complex floor plans, proliferation of steep Gothic gables and Classic pediments prevalent in the Dunedin houses built at the same time. The difference emphasises the fact that Australia was settled a whole generation earlier than New Zealand. Dunedin was settled by people who were far more likely to have

**Blackstone Hill farmstead**

Blackstone Hill farmstead and its trees comprise a remarkably intact group of farm buildings of the 1860s. The oldest part of the house with its typical veranda (*above*) was built of local schist. Even the the commodious hen house (*left*) and the dog kennels (*below*) at Blackstone Hill were made of mud bricks.

The Blackstone Hill woolshed (*above*) has large corrugated iron extensions around an earlier stone building. The tower for the old screw press still juts above the roofline.

The men's bunkhouse (on the right) and the men's cookhouse (on the left) shelter under the main group of trees around the homestead (*right*). The unplastered stone extension, attached to the cookhouse (on the far left) is the bread oven.

The shearers had their own cookhouse (*below*) out on the paddock behind the woolshed. Their mud-brick bunkhouse used to stand immediately behind the cookhouse. The cookhouse had its own bread oven (*right*). The collapse of the outer wall shows that the oven was made like a small brick kiln.

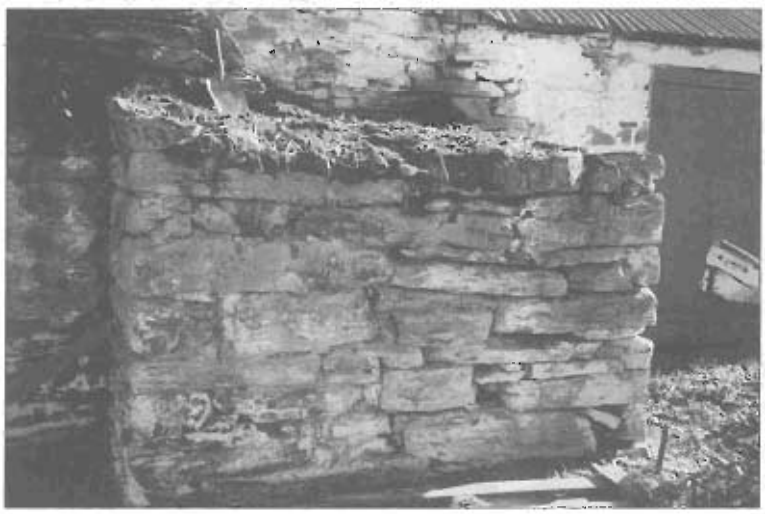
Second-generation homesteads were well-built and included extra buildings, such as this three-roomed gatehouse at Strathburn on Gladbrook (*right*). However, they were still conservative in building design.

These Georgian hip-roofed shearers' quarters at Bendigo (*below*) were probably built at the turn of the century. The building has been modified for modern use by the addition of glass doors.

come directly from Britain, where the Victorian taste for variety was taking hold.

Two other details of the early house plans are interesting. An odd feature appears in the farmsteads around the Maniototo and Shag Valley area (Hamel 2000c). The kitchens of the main house were very small by our standards and lacked cupboards. Storage space was often provided by a neat line of small rooms built as a simple rectangle across the back of the house and separated from it by a narrow path. Shag Valley, Cottesbrook, Strathburn, and Taieri Lake have good examples of these narrow storage buildings. The second interesting structure is the kiln-like bread oven, which is usually built into a wall beside the cookshop fireplace. Most have been demolished, accidentally as at Hawksburn or to retrieve the bricks from them. The best recorded example survives at Lauder, attached to the cookshop (Hamel 1990b). Bread ovens in Otago occur in all shapes and sizes, from the structures built by lone goldminers that look like small dog kennels built of stone slabs and covered with earth (upper Pomahaka) to stone-walled rooms containing the oven and chimney complex (Bendigo township and Moa Flat men's quarters).

A bread oven built into the chimney wall of the men's quarters at Lauder.



The actual structure of farmstead buildings can be examined archaeologically, as was done at Matanaka (Knight & Coutts 1975). There are useful details in Thornton (1986) and exhaustive information in Salmond (1986) on the various materials used. There have been no excavations in Otago of the foundations of early farmsteads, or their associated rubbish dumps.

When the large runs were divided into smaller farms, some of their owners were eventually able to build handsome stone farmsteads, such as Butlers at Fruitlands. Butler's handsome two-storied house (*right*) was built to a firmly Georgian style.

Typically, the stable and barn (*below*) are built together to form a sheltered yard.

Three other types of man-made structures associated with early pastoralism are:

- Remote huts, at first for boundary riders and later musterers
- Stone stock yards
- Fences

A group of the most interesting and varied farm huts is just south of the Otago boundary, on Glenaray station. These huts range from ordinary corrugated iron, to huts built from beech logs. The latter are a real oddity and were built by a handyman called Tom Cockburn, employed on Glenaray between 1898 and 1930 (Chandler 1984: 64). The only feature that differentiates musterers' huts from those built by miners is the row of oil drums or small stone boxes used to kennel the dogs. Many of the stone huts are very well built, and it is common to find two and even three huts of different ages at a site, e.g. at Blue Lake, Glenaray, and in Soho Creek, Glencoe. These huts have been recorded by Ritchie in his surveys of the Clutha catchment and by Hamel in her surveys of pastoral leases, e.g. Hamel 1990c. An unusual mud-and-stud hut still stands with its flat iron roof and stone chimney at Dingleburn Station homestead (Hamel 1993c).

Stone stock yards are found from the Strath Taieri and Shag Valley westwards, all built of schist. Rough versions of the Galloway double-dyke method of building are usually used (see below), with heavy capping stones. The yards range from complex ones with a full complement of small and large pens, as in

Massive stone sheep yards at Moutere (*right*), probably used when the sheep were dipped for scab.

The boundary fence (*below*) is between the early runs of Kawarau and Hawksburn where it crosses Duffers Saddle into the Nevis.

one near Middlemarch, to simple large pens which were probably used when dipping large mobs for the parasite called scab (Hamel 2000c). The latter are more common, e.g. Mt Ross, Moutere, and Shepherds Creek, Bendigo. A stone outer wall and inner pens of timber is also a common pattern, e.g. Gladbrook (Hamel 2000c). Smaller structures with high walls for holding horses are not common, and one in the Shag Valley east of Red Cutting is unusual.

Of fences, only stone and sod walls are usually recorded. Stone walls as paddock boundaries are common only on the Otago Peninsula and in areas around Dunedin with volcanic rock as a substrate, e.g. Mt Cargill, Purakaunui, and Chain Hills. Isolated examples built of schist occur in Central Otago, e.g. on Glencoe Road, Crown Terrace (Hamel 1996b), and at Long Gully, near Luggate in the upper Clutha. (Road edges on steep hillsides, such as on the Skippers, Macetown and Crawford Hills Roads were frequently edged with schist walls rising from revetments.) The basic form is that of the Galloway double dyke (Higham 1986), with two carefully placed layers of stone on each face rising from a broad base to a narrow top with long, side-stacked capping stones on top, and a rubble fill in the centre. Long 'through' stones should be placed at regular intervals about 60 cm above the ground surface to tie both sides together, but this is rarely done and the only good example is along the top of Orokonui Reserve, on the Mopanui Bridle Track. Occasionally the stone is built into a consumption wall in order to get rid of stone off the paddocks, and the resulting wall can be wide enough on top to walk along with ease, e.g. Brinsdon Road, Brockville. Higham (1986) found that the degree of batter and height of the walls were similar to those of Aberdeenshire and Galloway rather than those of the Cotswolds or other English traditions. Higham (n.d.) described stone walls round Dunedin as part of study of lichen growth on them that might provide estimates of ages of the walls. Using dated tombstones in local cemeteries, she found that variability due to aspect and stone type made the technique cumbersome, but potentially useful.

In Central Otago schist slabs were widely employed for buildings of all sizes, as well as for revetments, bridges, culverts, garden walls, sheep yards, and walkways. If long walls round paddocks were required, sod was the usual

Some of the new runholders on the small runs at the turn of the century built only small woolsheds, such as this one (*right*) near Bannockburn, which was probably originally a miner's hut.

An early lime kiln (*below*), built at Bobs Cove to burn lime from an isolated deposit of limestone on the edge of Lake Wakatipu.

*Photograph: Peter Bristow*

building material. In the wide acres of Central Otago, farming was less intensive and clearing the paddocks of stone was either impossible or not economically useful. Mud bricks were occasionally used for garden fences and horse yards, but more generally sods were cut from long strips down either side of the wall and stacked upside down in five to eight layers. Each sod was cut with a sloping cut across the short ends, and a properly made wall showed a herringbone pattern on the face as each layer of sods was stacked with the angles alternating to the layer below. The sloped ends allowed each relatively fragile sod to pack down against its neighbour, but the alternation of layers entailed the builder walking to and fro along the fence putting down one layer at a time. If a stout post or rock was available as an end, a lazy worker would stand in one place and build up the whole height of the wall over about 1 m wirh all the slopes leaning one way towards the end and thus inherently unstable. Walls in coastal Otago were often topped with gorse, or short standards were driven in and two wires strung. Walls on the hills between the Taieri Plain and the coast became covered with gorse, tussock and fern and are well preserved, sometimes to their full height (Hamel 1984). Similar walls in Central Otago under arid and frosty conditions did not grow a protective cover and gradually dissolved back into the ground, or else their foundations collapsed and the wall fell over. Some of the longest walls, such as that crossing the Nenthorn Road (I43/67), may never have been full-height walls, but rather a line about two sods high used to demarcate a boundary between two runs for the sake of the boundary keepers.

Other historic fences of Scottish No 6 wire and old wooden fence posts can be found between early runs such as Hawksburn and Kawarau, but very few have been recorded. The wooden posts were generally bored for the wires. Around the Strath Taieri and Macraes districts, slabs of schist were often set on end in the ground, also with holes for the wires, except at strainer posts where the stone might be grooved for the wires to be wrapped around. These slabs are often left in place when the fence is removed, creating a small, but durable monument to the past.

It is only in the last 20 years that it has been realised that the archaeology of 19th and early 20th century European settlement has a tale to tell. Though we realise that the past, in general, is a foreign country, there has been less perception of this concept applying equally to the dwellings of 1870s Europeans in Otago as to those of 17th century Maori. Fortunately the sites left by gold miners in Otago were so spectacular that they have attracted archaeological attention, and some of this has spilled over into the archaeology of farmsteads and early settlement.

# 7. Gold mining in Otago

## 7.1 A BRIEF HISTORY

There is an important anthropological distinction to be made between the gold rushes and the more settled mining of subsequent years which created nearly all the existing gold fields' sites. Men who arrived early on in the discovery of a gold field were assigned small areas of ground—at first only 8 × 8 yards square. They removed any topsoil or overburden by piling it in a heap beside the pit and then lifted out the gold bearing gravel, using at most a whip—a pole swivelled on a post with a counter balance at the other end. The gravel was washed in pans or wooden cradles, using buckets of water or a primitive device called a Californian pump. (This was a continuous, hand-driven belt with wooden blocks attached, which elevated water up an inclined trough.) The resultant diggings were a chaotic series of mounds and potholes.

The men lived in tents with low walls of stone or sods to create a firm surround, a sod chimney and bunks of manuka poles. At Goodgers Flat in the Lindis Valley (see Fig.17), the site of the first gold rush in Otago in March 1861, a miner described the flat as covered with hundreds of such tents, but when he passed through the valley a year later there were only the dissolving mud walls and irregular holes (Duff 1978). Tailings were disposed of into the river, and the stacked mounds of stones, seen at later workings, were not created at gold rush sites. The shopkeepers, who followed the miners, set up a line of tents which also left little trace. The Lindis rush involved only 300 miners and a few months' activity. The next rush was larger, led to prolonged mining and is usually considered to be Otago's first.[10] This was at Gabriels Gully in May 1861, and a famous photograph of the early stage of the rush shows the irregular pattern of workings clearly (Olssen 1984: 57). These were later entirely destroyed by hydraulic elevating and outwash from sluicings upstream.

Over the next two or three years, most of the major fields were discovered, each setting off a major rush. In the winter of 1862, Hartley and Reilly found gold-rich sand bars in the Clutha River near its junction with the Kawarau River and started the Dunstan rush in late August of that year. A shepherd at Puketoi station described the sudden nature of the rush. On a Saturday at the end of August all was quiet. On Sunday morning the start of a continuous stream of men passed by on the Dunstan track, some leading pack horses and bullocks or dogs with panniers, but most carrying a swag on their back. Few if any could afford to ride hacks. A station might find itself with 200 men willing to buy a meal or a night's accommodation in a barn (Olssen 1984: 59). Once gone there was no permanent trace of their overnight camps.

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[10] The existence of gold throughout Otago had been known since 1850, but mining was discouraged by the local authorities on the grounds of social disruption. By 1860 gold had been reported from places later named as Hampden, Beaumont, Alexandra, Hindon, Evans Flat, and Woolshed Creek (Salmon 1963: 48)

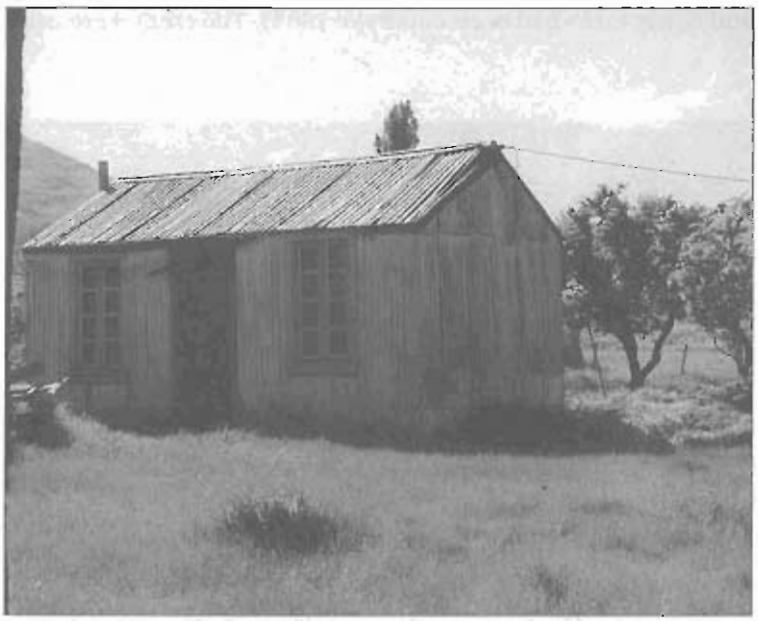
Figure 17. The gold rush sites and alluvial workings of Otago.


Rushes followed into Waipori (early 1862), Trimbells Gully and Murphys Flat near Macraes (winter 1862), Bendigo (September 1862), Bannockburn, the Kawarau Gorge, and Lowburn in October 1862, the Cardrona and Arrow Rivers (October/November 1862), into the Moke, Moonlight, and the fabulous Shotover and Skippers Rivers in November 1862, and the lower Nevis in March 1863 (Pyke 1863; Parcell 1976; Olssen 1984; De la Mare 1993). Further south they moved into Nokomai (September 1862) and Switzers beside Waikaia, and then fanned out into every gully where gold might be found. Later rushes were to Ophir (April 1863), Campbells Creek (May 1863), Serpentine (June 1863), and to Naseby and Hamiltons in July and November 1863 respectively, and St Bathans in July 1864 (Pyke 1863; Cowan 1948; Salmon 1963). There were minor rushes all through this period to other smaller sites, and occasional rushes at later dates, such as the one to Long Gully, Hawea in the 1880s. One of the most unusual and very early finds was gold among the black sands on Hampden beaches, mixed with zircons and garnets (Pyke 1863). The discovery of rich

diggings on the West Coast rapidly drew the gold-rush miners away during 1864, and the nature of mining and the mining communities changed entirely within 12 months. The major gold rushes of the three years from March 1861 to mid 1864 were politically and socially significant, involving thousands of miners, but archaeologically they left few traces.

The earliest diggings were on the river beaches and the lowest terraces, but when the rivers flooded the miners who wished to stay were driven on to the higher terraces. Here there was more overburden to remove, and more water was needed. The miners very quickly began constructing water races to sluice their claims. By 1863 when the population of Gabriels Gully and Wetherstones had settled down to about 400 miners, the length of head races cut was estimated at 120 miles in total, representing 200 sluice heads of water and supplying many reservoirs (Drummond, quoted by Pyke 1863). The Naseby goldfield was discovered in May 1863 and by November a race 11 km long had been constructed from the East Eweburn (Hamel 1999). Keddell, at Dunstan, reported that by the winter of 1863 the 3200 miners in the district had settled down to sluicing works, having diverted all the useful streams into water races. In the Shotover the miners had discovered they would have to co-operate to deal with the superabundant water. In Moke Creek, long and costly races had been cut (Pyke 1863). The races were used

Murphy's Flat. This is one of the few untouched gold rush sites in Otago with mound and pothole tailings by the creek and later linear tailings. All the nearby tributaries have been ground sluiced. *Photograph: Kevin Jones, DOC*



Goldfields dwellings

Great skill was shown by the early miners in making large buildings with available materials. This mud-briek hall (*top left*) at St Bathans was built on foundations of rounded river-boulders, held together with mud mortar.

Where there was only rock, a house had to be built of rock, often taken from elose by, as at this stone cottage (*top right*) on the northern face of the Pisa Range.

Where the drays could cart in corrugated iron, it was used to build the simplest of houses, some of them with an early form of casement window, as on this house (*centre left*) at Bannockburn.

A minor's hut at Stewart Town in the Bannockburn diggings (*bottom left*) shows the marks of construction by the shuttered cob technique. This seems to have been a popular metbod in Central Otago. *Photograph: Peter Bristow*

If children were to be reared close to the dangers of high sluice faces, high garden walls were needed. This remnant (*bottom right*) is from a mud-brick wall which once completely enclosed a garden beside the sluieings at Bannockhurn.

Chimneys allowed the builders of early stone houses scope for idiosyncrasies. The ruins of the Lindis Hotel (*top right*) still display its massive chimneys. One of them (*top left*) has a very low base.

The stubby chimney (*right*) built beside the Roxburgh Gorge, was originally a much more usual shape than those on the Lindis Hotel. *Photograph: Peter Bristow*

Morrell's was a very remote hotel on the Lowburn-Cardrona pack track. Its chimney (*bottom right*) has been cleverly made by stacking the stones on edge.

Maeetown (*bottom left*) retains the feeling of a deserted goldfields town, with its deciduous trees and wild daffodils beside the remaining stone houses.

Georgian symmetry remained popular right through to the turn of the century, which is probably when this cottage was built in Lawrence.

mostly for ground sluicing. The use of hydraulic nozzles for directing a powerful jet of water on to a face came into general use a few years later.

Otago's first quartz mine, on the Shetland Reef in the Waipori field, was started by the Otago Pioneer Quartz (OPQ) Company in 1862. Many quartz mines were opened in Otago, but very few made money for their developers, and it is estimated that only 3% of the eight million ounces of gold won in the first century of mining in Otago came from hard-rock mining (Williams 1974: 78). Some of these mines were more profitably worked for the associated mineral, scheelite, than for their gold, e.g. Glenorchy and Golden Point. The more notable of these quartz mines were on the Glenorchy–Kelly lodes, the Bullendale group (Achilles/Phoenix), the Macetown group (Tipperary, Sunrise, and Premier), the Carrick field, the Bendigo lodes, the Oturehua lodes, the Macraes–Nenthorn field, and Barewood lode (Williams 1974). There were workings on small lodes in many other places.

A very successful quartz mine was worked by the Bendigo Quartz Mining Company, which struck rich patches on the Cromwell Reef between the years 1869 to about 1875. Its four owners made fortunes, though only one, Joe Hebden who sold his share for £12,000, managed to establish a successful business subsequently (Parcell 1976). Work continued on the field, which extended from the Martha Battery up to the Rise and Shine lodes near Thompsons Saddle into the 1930s, but no more fortunes were made. One of the most historically interesting quartz mines was at Bullendale, not because of the mine itself, but for the early use of the new technology of hydro-electric power in the mid 1880s (Chandler & Hall 1986).

The great alluvial fields of Otago were at Waipori (ground sluicing and dredging), Gabriels Gully/Tuapeka (hydraulic elevating and tunnelling), Roxburgh/Fruitlands (hydraulic elevating and dredging), the Clutha terraces from Alexandra to Luggate (ground sluicing and dredging), Bannockburn (hydraulic sluicing and tunnelling), the lower Nevis (hydraulic elevating and dredging), Naseby (hydraulic sluicing), upper Manuherikia (hydraulic elevating), Arrow River (ground sluicing), and richest of all the Shotover River (hydraulic sluicing and dredging). There were also some interesting fields at high elevations where old sediments had been trapped in small faulted pockets, such as at the Criffel, Pisa Range, and Potters No. 2, Old Man Range, or linear fields where the head waters of streams run along the tops of the ranges, such as in the Roaring Meg and the Upper Fraser River. Many of these fields were worked over a long period from the mid 1860s to about 1910.

## 7.2 THE GEOLOGICAL NATURE OF THE GOLD FIELDS

Otago gold lies in a belt of gold-scheelite mineralization in the rocks of the New Zealand Geosyncline, deposited around the Carboniferous and/or Early Permian. The degree of metamorphism of these rocks influenced the distribution of the minerals to some extent, the Otago and Marlborough schists holding the only profitable lodes. In Otago, the Tipperary (Macetown), Achilles (Skippers), and the first mine at Bendigo, were the most productive quartz mines (Williams 1974: 41).

Nearly all the lodes strike north-west along the line of the geosyncline, and as well as gold, contain scheelite, often in high proportions, and relatively low proportions of silver. The minerals have precipitated out of siliceous solutions, and quartz in various states is a strong marker of goldfield tailings. Arsenopyrites associated with the ores and mercury used in the extraction of gold have produced toxic wastes. (Mercury escaped so frequently from amalgamating plates that hobby gold miners using suction dredges in streams such as the Tuapeka retrieve payable quantities of it.) In some places such as the Criffel Range, broad sheets of quartz grits are still sterile and uncolonised by vegetation.

The miners' concept of the origin of gold was that it lay in 'mother lodes', comprising veins of solid gold in the rocks. They considered that alluvial gold was formed when particles of gold were eroded out of the lodes, the particles being ground down ever finer as they were transported, sorted and concentrated by water and gravity in channels in the fluvio-glacial gravels. Gold within the basement schists of Otago does lie in lodes scattered over 2000 square miles (Williams 1974: fig. 7.1), but the mineralisation of the gold was never strong within the lodes which tended to be short or faulted. Otago has been above sea level since the Cretaceous, and long periods of denudation and deep weathering of the schists, along with deposition in inland basins, has produced a complex geology of gold-bearing sediments over a period of 100 million years (Williams 1974: 78). Recent work on these complex and old sediments suggests that gold is more soluble within ground water than previously thought and that it precipitates out within gravels under certain chemical conditions. This is a model which would explain why rich pay dirt often lies below deep layers of overburden (John Youngson, Geology Department, University of Otago pers. comm. 1997).

The sediments which were worked for gold included Cretaceous gravels of alluvial fans, early Tertiary quartz sands, grits and gravels, and Quaternary schist gravels in terraces and river edges—the latter including material from the earlier gravels, and most of the gold that was won. 'Maori Bottom', a term used extensively in early Otago mining literature, referred mostly to iron-stained deep layers within the older gravels, and does not have a precise geological meaning.

Some of these older gravels are strongly cemented, such as those at Gabriels Gully referred to as 'Bluespur Cement'. They were often firm enough to allow extensive tunnelling along a gold-rich level, as at Bluespur and at Bannockburn. Subsequent faulting has often tipped them at an angle, with frustrating amounts

of unstable recent silts laid down over the top of them. The Gabriels Gully deposit was relatively free of overburden and about three-quarters of the estimated 10 million cubic yards could be worked. The bottom layers were rich enough to be worth crushing, resulting in hard-rock methods being used on alluvial gold.

Early Tertiary quartz grits and gravels occur all round the edges of a large inland Tertiary lake in the Manuherikia and Ida Valleys and the Maniototo Plain, as well as in the Nevis Valley and at Bannockburn. The red clays within in them indicate weathering under a much hotter climate than at present. 'Chinamen stones'—the Sarsen stone of Europe—are common through these deposits and include the fine material known as silcrete, which was extensively used by early Maori for tools. Silcrete is very hard and has been recycled through later gravels. Quartz grits can dip steeply and include loose running sand. It is usually the disturbed, re-sorted and iron-stained layers of these gravels, lying along the foot of rising scarps, which were referred to as Maori Bottom gravels.

Morainic outwash from the great glaciers of western Otago piled up high terraces during the Pleistocene, which were usually light in gold, but worth washing where there was enough water. It is from the Recent gravels, in stream and river beds, that the great bulk of Otago gold was won. The shallow beaches could be worked with cradles and long toms, the small creek beds by damming and diverting, and the larger river beds by river dredges, and their adjacent flats by paddock dredges and hydraulic elevating. Little of this gold seems to have been redeposited on the Otago sea beaches, though some black sand mining was carried out very early on the Hampden beaches (Williams 1974: 78–85).

# 8. Alluvial gold mining

Given the wealth of gold mining sites in Otago, it is not possible in a review of this nature to describe all the sites. A typological approach provides one sort of framework, but has the major disadvantage of ignoring the integrated nature of sites. Goldfields sites are not discrete patches of disturbed ground, but integrated working systems, usually created by small groups of men. These groups range from partnerships of two friends, to registered companies employing dozens of people. Linked to them is an infrastructure of storemen, packers, government officials, road makers, pub keepers, and others, who leave lesser traces of their activities on the landscape. To partially solve the dilemma between the typological approach and the more anthropological approach of describing whole systems, sites will be described in groups determined mostly by their major technology, although gold rush sites will be described as a group. When a site, such as the Bannockburn sluicings is selected as demonstrating the use of hydraulic sluicing, the major features of the whole system will be described, not just the effects of hydraulic sluicing. (*Italics* are used to highlight such a site.) Large race systems and townships will be described with the sites that they are linked to and not as separate entities.

## 8.1 THE EARLY SITES

Ground evidence which can be tentatively assigned to gold rushes, in the sense of the first workings at each gold field, is sparse. Goodgers Flat at the Lindis has been ploughed. Gabriels Gully has been covered by tailings from later workings. Waipori is under the hydro lake of Mahinerangi. One of the Bendigo flats was destroyed by modern mining. The Dunstan workings (Clutha gorges, Kawarau Gorge, Bannockburn Creek, the Lowburn section of the Clutha) and those in the Lower Nevis, Arrow, Shotover, and Skippers were mostly within the river banks and have been destroyed by flooding, later dredging, or hydro dams. The Moke and the Moonlight have not been surveyed, but it is likely that their first workings were within the river banks. The Ophir workings have been flooded or ploughed. The creek workings around Naseby have been washed out by later sluicing and covered by pine plantations. Hamiltons has not been surveyed, and only part of the Serpentine field looked at. Among the sites listed above, this leaves Murphys Flat, Trimbells Gully, a small section of Bendigo Creek, Brackens Gully, Upper Cardrona, Campbells Creek, and Golden Gully at the Serpentine.

The name *Murphys Flat* seems to have been applied at first to the flats opposite Macraes Flat township, which have been sluiced and ploughed, but after April 1865 the name was applied to a flat within a large meander of Murphys Creek near Redbank Farm (Peter Petchey, Dunedin pers. comm. 1998). This latter flat still carries a clear pattern of tailings with mound and pothole workings close to the creek and long sinuous tailings across the bend created by a simple diversion of the creek itself (I42/40). The position of a short line of foundations

of mud huts is marked on a survey map (S.O.421) of 1891 as 'Chinamen's huts', but the huts were probably occupied up to the 1930s (Peter Petchey pers. comm. 1999). Further up Murphys Creek there are confused mound and pothole tailings (I42/35-37) which have not been washed away by flooding because the creek is so small. Similar tailings occur in Deepdell Creek within Golden Point Reserve (I42/19-20). (The Golden Point battery and mine are described below in Quartz mining, section 9.5.) The evidence for the tailings being gold rush sites is circumstantial in that there was a rush to this area in 1862, and the pattern of tailings is typical of pothole working on small claims (Hamel 1991b).

*Trimbells Gully* is a headwater of the Mareburn, lying between Hyde and Macraes. It drains due west off Highlay Hill and, along with two other gullies to the north, has been worked by potholing and ground sluicing along several kilometres of stream bed. There are several areas of potholing, especially just above the confluence of Maori Hen and Trimbell's Gully which have the appearance of early workings. Settled miners brought in races and worked the adjacent creeks by ground sluicing, and lived near their workings in rock shelters and small mud and stone huts. In some areas heavy tailings have been formed into parallel rows with short tail races between them (Peter Bristow, Department of Conservation, Dunedin pers. comm. 1997). These workings probably ceased by the early 1870s. One of two major races to Fullartons opposite Hyde begins in Trimbells Gully and runs down the true left of the Mareburn and then south to the big sluice pits at Fullartons. Since Fullartons was mainly worked in the late 1860s and 1870s, this water right must have been obtained when Trimbells Gully was being worked or very soon after.

In the lower part of *Bendigo Creek* a large area of mound and pothole tailings in front of Goodall's hotel ruins was mined and then levelled in 1990 (S124/242). They were described in 1980 as covering an area about 1 km long and 250 m wide. Adjacent

The ruins of Goodall's Hotel in Bendigo Creek (*above*) is close to a large gold-rush site of mound-and-hollow tailings, only recently destroyed. *Photograph: Peter Bristow*

Looking down Brackens Gully (*right*). The gold-rush workings were in the creek bed and the distant races and hamlet in the trees in the distant centre belong to the turn of the century.

ground was probably worked for a few years after the initial rush as well, since Goodall built a stone hotel and there were several stone and mud brick cottages on the edges of the tailings. Downstream of the hotel flat, there is a smaller flat of about 200 × 400 m covered with pothole type workings (S124/236-241). Within the workings there are some sections of walling, tail races, and stone platforms of unknown use (Hamel 1993a). (Bendigo field as a whole is described below in Quartz mining, section 9.4.)

*Brackens Gully* (Fig. 18) is a large tributary of the Arrow River, described by Warden Beetham as part of the area being worked by 2000 miners in March 1863. There appear to have been three separate periods of workings in the gully:

- The gold-rush period, potholing and using only the run of the river from late 1862 to March 1864
- A middle period using short races on the higher river terraces from 1864 to 1877
- A later period of higher-level workings from about 1877 to about 1910, using large and high races

Along about 2 km of the creek there are mound and pothole tailings on level terraces close to the river. Subsequent workings have moved away from the river, and at the lower end of the flats revetted tail races were run through the earlier workings. A group of stone fireplaces could mark tent sites, but may also be later. High on the sides of the valley, races have been brought to C-shaped earth reservoirs and used to ground-sluice deep sediments on three major spurs. Three small parties of miners worked here for about 25 years, living in a small group of huts among poplars at 900 m a.s.l. There is an easy saddle at the top of the flat into the head of New Chums Gully where there are similar mound and pothole tailings (Hamel 1996b: 29, figs 27, 28). A well-formed pack track sidles through a very steep gorge of

Potters No 2 goldfield (*above*) on top of the Old Man Range was the most exposed of the early gold-rush fields.

When a miner died it was not always possible to carry his body out. The grave for William Pitt (*right*) lies at 1350 m a.s.l., above Potters No.2 goldfield on the Old Man Range.

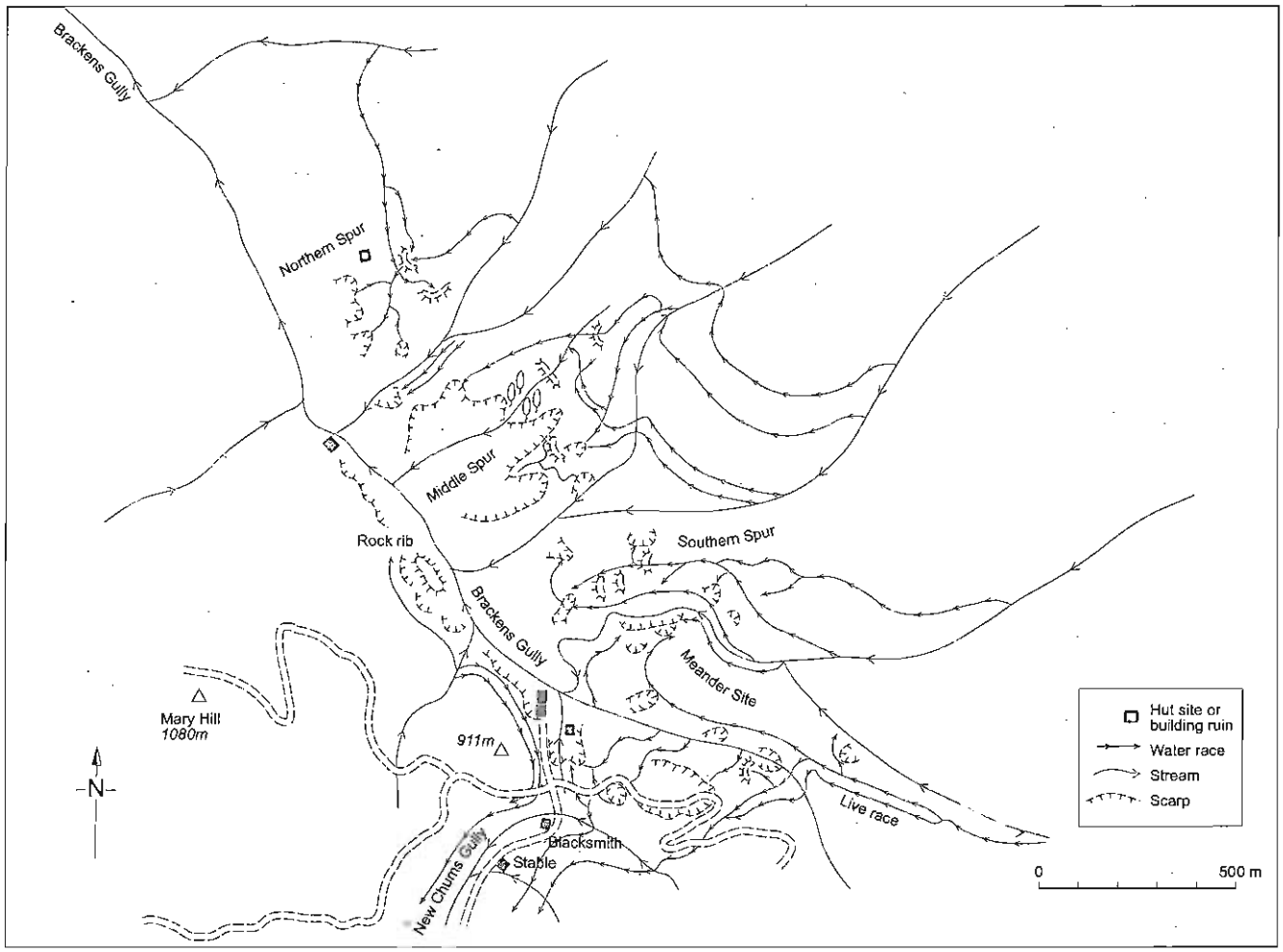



Figure 18. The layout of a large set of sluicings at Brackens Gully. The earliest sites were in the gully near the rock rib, and the complex high races and their sluice pits are from the turn of the century (Reproduced from Hamel 1996b).

New Chums Gully to the Crown Terrace, and was the miners only access to Arrowtown.

It is likely that much of the gold-rush workings in the *Upper Cardrona* were in the creek itself, but Michael Grogan is described as coming upon gold in the *slips* beside the Cardrona River in October 1862. The Cardrona was used as a major route into the Arrow River during 1862 and 1863 and was worked at the same time (Hamel 1996b: 7). Small and heavily over-grown tailings in the Upper Cardrona tend to concentrate around and below the confluences of side creeks, from Fox's Gully to Maori Gully. They include irregular mound and pothole tailings and numerous small diversions of the creek. At Fox's Gully they run for a kilometre down the creek edge, and these look to be the earliest workings, judging by their nature. Below the mouth of Coal Creek the creek edge workings give way to sluicings on a higher terrace which were probably worked by the more settled and smaller population of miners in the late 1860s. The workings beside Maori Gully are also likely to be post-rush, since they required the building of a water race out of Maori Gully (Hamel 1996b).

*Campbells Creek* includes workings along the creek bed itself and the higher flat known as Potters No. 2 workings. Lying at 1200 m a.s.l. and exposed to the

south on the flanks of the Old Man Range, the severe winters affected the way in which this field was exploited. During the summer of 1862/63 miners worked both in the creek and on Potters No. 2, but the field was not reported until May 1863, probably when the miners came down for the winter. Despite the cold conditions, there was a rush during July. A severe snow storm in August snowed the miners in and between 17 and 35 died of exposure trying to return to the settlements in the Clutha Valley (Bristow 1994a). The mortalities associated with this rush have been commemorated with a memorial at Gorge Creek, although it is likely that similar numbers of miners were drowned during winter and spring floods of the Clutha in 1862–1864.

Campbells Creek continued to be a popular summer area for miners through to the 1870s, so that distinguishing where the first miners worked is difficult. Amorphous tailings (S143/181) well below the upper peat swamps of the headwaters could be the result of potholing, and fit with a description of the 1863 township of 150 miners, four stores, a butcher, and a baker, visible from the snow pole track (Bristow 1994a: 42). In February 1864 there was another rush to the section of the creek below its junction with Potters Creek, and the river has been worked by diverting it out of its bed with stacked stone walls over a considerable length. Amorphous tailings are associated with these walls (Bristow 1994a: 43). Though Potters No. 2 flat was worked early, the tailings on the flat itself are relatively well-organised, with long races running to the sluiced edges and probably represent later workings. There are some amorphous tailings where the creek runs out of the flat and down the creek itself (Hamel & Gordon 1989). Miners continued actively working at Potters and at the Tunnel Claim in Campbells Creek through to the 1890s. Three stone huts at the Tunnel Claim are some of the largest and best preserved of back-country miners' huts, though they have lost their corrugated iron roofs, the largest being 7 × 14 m.

The pack track (*above*) from Chamonix to Potters No. 2 and Campbells Creek over the Old Man Range at 1600 m a.s.l. The cairns at regular intervals once carried snow poles and were linked by a wire to help miners find their way in white-out conditions. *Photograph: Peter Bristow*

The ruins of a grog shop and store (*right*) on the Chamonix to Campbells Creek pack track. This building was low down at only 700 m a.s.l. There was a smaller stone shelter on top of the Old Man Range.

The Serpentine Church was built in 1873 at 1000 m a.s.l. Now owned by the Department of Conservation, its stone walls have been stabilised to last another 120 years. *Photograph: Peter Bristow*

The rush to the *Serpentine* in June 1863 began when miners found gold at the confluence of the Waimonga Creek and Taieri River and followed it up to the flat (Golden Gully) around the present stone church. Only the headwaters of the Waimonga Creek around the church have been surveyed, and here there are mound and pothole tailings in the swampy creek bed. An early map shows tailings distributed all down the Waimonga and Deep Creeks and the section around the church as very minor (Hamel 1992c). The gold-rush sites are likely to be relatively undisturbed by later workings for a considerable length of both creeks.

The Serpentine township at 1000 m a.s.l. was the highest goldfield settlement that could be called a township. The stone church was built in 1873 when there were three stores and hotels, a cemetery, and a cottage used as a school. The church became a miner's cottage about 1889, but the hotel and its billiard room continued as a focus for the surrounding district well into the 1900s. The church is the only surviving building and is still in good repair. Mining in the immediate vicinity included not only ground sluicing from long races, but also tunnelling minor lodes. A battery was set up at German Jacks in 1878, shifted to the head of Deep Creek in 1882, and then to Long Valley in 1890. Here it was driven by an overshot wheel, and the ore brought down a long incline from the Golden Gully mine which is still marked by a drive into the hill. The 25-foot-wide wheel and the 10-stamp battery are still standing in place, the only surviving pair in Otago. Analysis of the wheel and battery by Petchey (1996j) shows that the wheel ran at its optimum speed, but the battery was run relatively slowly, suggesting that they were not a well-matched pair. The mine was not successful and the battery ceased operation in 1891. Above the drive there is an interesting line of stone and mud cottages, one of which has a windowless room and very thick walls. Immediately above it is a large tor with a massive iron hook 4 m from the ground and a small stone walled stock pen. This group has been interpreted to be a simple abattoir and carcass room, the only such butchering site known in Otago. At 1090 m a.s.l., it is certainly the highest (Hamel 1992c).

## 8.2 GROUND SLUICING SITES

Miners from Australia, who arrived as part of the gold rushes, were quick to apply their skills in race building to the New Zealand conditions. When floods prevented them from working in the creek beds, they constructed water races to work the river terraces. The over-steepened faces which quickly developed from letting the water pour down over them were usually feather- and finger-shaped in plan view. Small head races led the water to canvas hoses which could be shifted along the face and had the advantage of preventing the water

from getting into cracks behind the face. If this happened on a high face, as at Naseby, large sections of the face could collapse onto the men below. Strongly patterned herringbone, parallel, boxed, and fan tailings on gentle terraces, such as those along the Upper Clutha River (Ritchie 1981) were formed mainly by ground sluicing, supplemented by low-pressure hydraulic sluicing.

Ground sluicing is first recorded in Otago at Gabriels Gully in mid 1862, when James Meehan and party completed a medium-sized race on to Blue Spur in June, and another miner nearby in Munro's Gully, 'Californian Jim' Graham, started using a small race in May (Mayhew 1949). Other much larger races from the Waipori River were started soon after. The local carters became agitated that they would lose their work of transporting pay dirt from dry claims to the creeks. In particular the value of Gascoigne's Phoenix Race, 9.5 miles long, had to be explained at two public meetings in 1862 (Salmon 1963: 59). The Phoenix Race, started in April 1862, is probably the oldest 'big' race in Otago that can still be defined on the ground. Since it is now used for town-supply water, it is still live. This is one of only 24 identifiable races in Otago formed in the first gold-rush years 1861–1863 (Otago Regional Council records). Hydraulic sluicing was in use by the late 1860s, but its first use is not recorded, though it was probably at Gabriels Gully. It was the Phoenix Race again which was used by a Thames engineer, J.R. Perry, to set up the first hydraulic elevator in 1879, lifting up to 70 feet in a single lift. (Gabriels Gully as a site is described below under section 8.4.)

Judging by historic records and the shallow terrain, the *Naseby* gold field has large areas which were worked mostly by ground sluicing. The miners who opened the field in 1863 brought in a long race, the Enterprise, from the Eweburn within 6 months. Unlike the 1862 Phoenix race at Lawrence, it has not been used for anything except gold mining and has always been maintained by hand. Excavation showed that it had steadily silted up over the years, and both the line of the race and its profile provide a useful example of the race-building technology brought into New Zealand by ordinary miners, a technology not documented in written records (Hamel 1999a, b).

Even though hydraulic sluicing was understood and being used by 1870, the Naseby miners were mostly ground sluicing in the 1870s. The problems with tailings were horrific, because the fall of the Hogburn to the Taieri River 10 miles away was only 850 feet, an average fall of one foot in about 62, with long sections of even less fall. The town itself was almost overwhelmed by tailings. The races used to manage the tailings from this field were the Mouut Ida Race and the Hogburn Sludge Channel, both built between 1873 and 1877. The Mount Ida Race is one of the longest races in New Zealand, about 107 km long, transferring water from the headwaters of the Manuherikia in the Clutha

The whole of the Maerewhenua field must have been worked by ground sluicing since it lies in gently rolling country.

Reservoirs were cunningly fitted to the terrain. This one (*right*) is in Potters No. 1 Creek above the Nevis gorge.

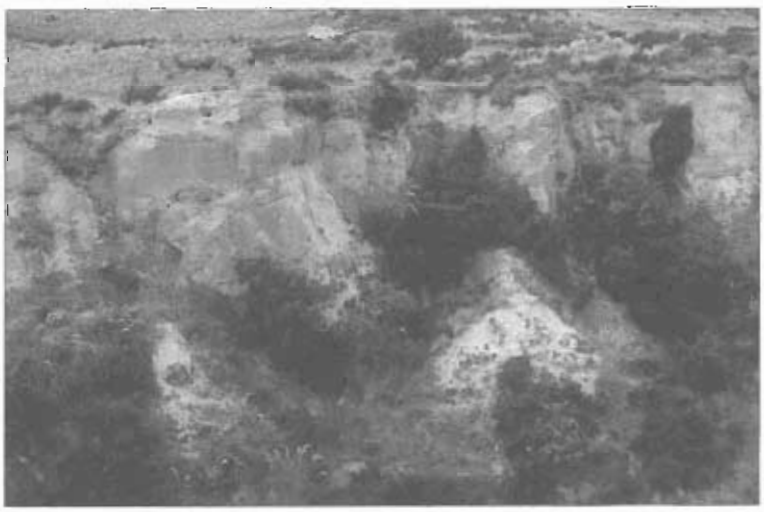
The exposure and remoteness of the some of the alluvial workings on the Old Man Range were extreme. These tailings (*below*) are in the middle section of the Upper Fraser Basin at about 1300 m a.s.l.

catchment to the Taieri River. The race has been modified over the years, but was originally built to carry 25 sluice heads, though 12–15 heads is more likely to have been its usual capacity. It was built with only one thing in mind—to flush the tailings from the Naseby goldfield down the Hogburn Sludge Channel. Though this 10-mile long, stone-lined channel was 6 feet wide and 3 feet deep, it was rapidly buried under the silt flushed down it. In 1899, the water system was supplemented with one of the largest earth dams of its period in New Zealand, the Eweburn Dam built across the West Eweburn. Today the race is divided into sections and supplies a number of irrigation schemes (Hamel 1985b).

The main areas of ground sluicing at Naseby are now covered by self-seeded pine forests, but early aerial photographs show complex dendritic patterns of sluice faces fingering back into relatively shallow sediments in Wet Gully and Coalpit Gully. Where steeply dipping sediments run under the eastern cliffs of the Hogburn above the town, relatively high sluice faces have been formed. In Spec Gully there are elaborate, long-fingered sluice pits running back into Surface Hill, a broad ridge running down the true left of the Hogburn. Water was brought in from east and west to reservoirs immediately above the sluice faces since no great water pressure was needed. In later years, not only were broadly rounded sluice faces formed by hydraulic sluicing, but also some areas were worked by small hydraulic elevators, leaving interesting ponds such as Hoffmans Dam. Naseby is an unusual field in that there are almost no residence sites among the sluicings. At night all the miners went home to Naseby, because the topography was so level and the workings so compactly arranged around the town (Hamel 1985b). The same was probably the case at Matakanui, Drybread, and St Bathans where the gold was similarly located in well-defined areas (Peter Bristow, Department of Conservation, Dunedin pers. comm. 1998).

Other sites where the terrain and pattern of tailings suggests that ground sluicing must have been the main method of working include many of the sites along the *Upper Clutha* (Ritchie 1981), especially the enormous stretch of herringbone tailings at Ah Wee's site, S115/52-54 Luggate (Hamel 1995c), and the Northburn herringbone tailings protected on a high terrace at Quartz Reef Point (Smith, P. 1990). Mining along the river edge of the Upper Clutha was carried out in an unusual way. The heavy gravels on the edges of the numerous meanders were worked by the relatively cheap method of ground sluicing, possibly because the river edge was too far from hill slopes that would have provided a position for a reservoir for a pressure pipe. Lack of pressure to move rocks necessitated the tidy stacking of large volumes of rock, and several major patterns were developed—herringbone with rounded ridges, herringbone with feathered ridges, fans, parallel ridges, and boxed parallel ridges. These patterned tailings occur at 26 major sites between Albert Town and the Lindis River (Hamel 1995c). The remains of small stone and mud-brick huts lie beside most of the tailings, and from archival material and excavation it seems likely that many were Chinese. Some of the categories of tailing patterns described by Ritchie (1981) were used on only one or two sites, suggesting individual approaches to the problem. Strongly patterned tailings occur only intermittently elsewhere in Otago, and the Upper Clutha is distinctive in this respect. Most of the sites are under threat from hydro-electric development.

Other sites of ground sluicing can be distinguished by their occurrence on gentle terrain where it was difficult to achieve pressure for hydraulic sluicing. Many of these would have been along the main stem of the Clutha between the Kawarau Gorge and Cromwell, and between Clyde and Alexandra. Most have been destroyed by subsequent dredging or modern mining. There is a large intact stretch above Bannockburn between Long Gully and Walkers Creek (F41/456), which runs for about a kilometre down the river with sluice faces only 2-4 m high. They have the typical broken edge of ground sluicing,



The high-altitude sluice pits (1200 m a.s.l.) of the Buster Diggings (*above*) are in a fine, white, sterile gravel on which, over 100 years later, vegetation still does not grow.

Old sluice pits (*right*) at the Fullarton Diggings opposite Hyde in the Strath Taieri. A very long race from the Shag River failed to reach over a saddle above these workings, and the heavy overburden has been only partially sluiced away.

Remote creek-bed workings in the upper parts of Deep Stream in the Lammermoors.

and were worked from races from Long Gully which have been destroyed by ploughing.

High-altitude workings had often to be ground-sluiced because the tops of Otago ranges tend to be flat and boggy. The extensive workings in the Upper Fraser basin were all ground- sluiced or worked by diverting the creeks (Hamel 1994c), as were the many small workings all through the head waters of the Pomahaka (Hamel 1988b, 1989b). There is a group of remarkable high-altitude sites on the southern end of the Pisa Range, two of them being worked by a long race out of the Colour Burn: one in the head of Mitre Creek and the other in Winters Creek. This race drops from 1520 m a.s.l. to the workings at about 1220 m (Hamel 1996a). A shorter race in the head of Skeleton Stream runs to a stone-walled reservoir at 1200 m. Another race, rising in the Leopold Burn at 1770 m, was built to supply water to miners at Lowburn and is still used as an irrigation race (Hamel 1991d). The Carrick Race, the other notable high altitude live race, rises at 1200 m, but running for 22 km it is a much longer race than the Pisa races (Hamel 1994a). The use of old miners' races for irrigation is common throughout Otago and the water rights are highly valued. One of the smallest gold fields in Otago was worked by ground sluicing, and comprises a short race, one reservoir (24 × 17 m), and two sluice faces in Trotters Gorge (J42/72).

## 8.3 HYDRAULIC SLUICING

Although ground sluicing was used to great effect in many other workings, the hydraulic nozzle firing water under pressure from a reservoir, which might be 300 feet above the claim, was a prevalent sluicing tool from 1870 onwards. The presence of a reservoir high on a hillside above sluicings with a straight scoured line running down the old course of the pipeline is the clearest indication that hydraulic sluicing was used at a site, rather than just ground sluicing. These traces are often difficult to find, or have been obliterated by erosion. Broad, flat, or slightly scalloped faces were generally formed by swinging the nozzle to and fro.

The best examples of hydraulic workings in Otago are at the *Bannockburn* sluicings, where sediments 20 m deep have been sculptured by hydraulic nozzles into round pits and straight vertical walls set almost at right angles to each other. Ground sluicing was also used where water pressure was low, cutting shallow ground into long feather-shaped pits. The sluicings cover over 145 ha (Department of Conservation Land Inventory), with adjacent smaller areas in Smiths Gully, on top of Templars Hill and above the mouth of Bannockburn Creek. These sluicings are relatively late, the gold-rush workings of the area being at the mouth of the Bannockburn Creek. They were actively

worked up to about 1910, using water from the Carrick Race and Long Gully, with the miners living to the east of the workings in the reasonably compact township of Bannockburn. Spread out over two terraces, it included a school, a hall, two or three hotels, several stores, at least two churches, two or three blacksmiths, a post office, a bakery, a butcher's, and over 100 huts and houses. This grouping was typical of 19th century townships in the area. The bakery, being a specialised building with its kiln-like oven, took special skills to construct. One man, James Lawrence, was responsible for building ovens at about seven of these townships in the 1860s (Hamel 1994a: 22) and, though now semi-ruinous, they have survived better than many of the other buildings.

Three major reservoirs were built to provide water to the Bannockburn sluicings: Carrick and Tippett's on the true right of Pipeclay Gully, and Menzies' on the true left. Pipeclay Gully, below them, carried a stone-lined sludge channel about 2.4 km long to dispose of water and tailings. Raupo Gully (now Baileys Gully) drained the northern part of the workings. Tippett's and Menzies' Dams, each enclosing about 2 ha, are the largest miners' dams in Otago. Both are on gently sloping ground with a ridge of earth, lined inside with stone revetments, and forming broad C-shaped enclosures. Tippett's Dam was fed from the Carrick Race and Menzies' mostly from Long Gully with some extra water brought into the top of Long Gully from a Nevis tributary (Hamel 1996c: 13). These were long-lived schemes, using very long water races to work in the driest region of New Zealand. With 2.4 km of sludge channel to flush, a low-level dam was built to accumulate a head of water, and it is likely that extra water was poured over the faces just to wash the overburden away.

The water from Tippett's Dam at Bannockburn ran into a distinctive system of about seven, deep, short, parallel races on a steep slope immediately above the sluicings on the true right of Pipeclay Gully. These deep short races above sluice faces have been recognised also at Gees Flat and Gabriels Gully (on Pollans Hill) and could have pro-

Massive and extensive sluice faces (*above*) in the Bannockburn diggings. *Photograph: Peter Bristow*

The Bannockburn diggings (*right*) are being invaded by wilding pines and gorse. Their appropriate state is a bare wilderness of clay and gravel, and in parts of the diggings this invading vegetation is being cleared.

Two photographs of the Bannockburn sluicings. Two major reservoirs (Tippett's and Carrick) are high centre, with lines of distributor races marked by briar rose bushes running along the terrace to the cliff edge on the left. Rivetted pipes would have led

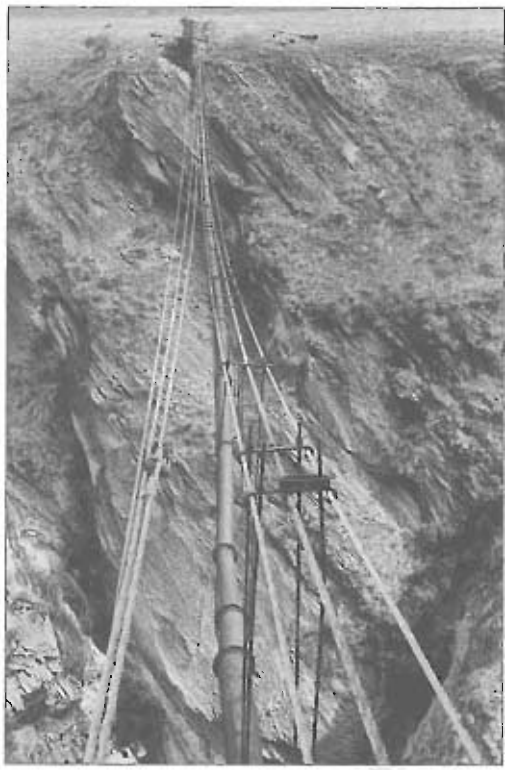
vided individual heading ponds for each miner. At Gabriels Gully these short races are locally referred to as penstocks, a colonial term for a channel leading to a waterwheel (Concise Oxford Dictionary). Besides providing an opportunity to divide and measure water to separate workings, the penstock acted as a stilling pond and prevented air from entering the pressure pipe and diminishing pressure at the nozzle. Where only one miner was working from a large race or reservoir system, only one such penstock was needed, as at Rocklands where the Deep Stream Amalgamated Hydraulic Sluicing Company built a very small rock-and-earth-walled pit on the hillside above the elevator (Hamel 1995a: 16).

from them to each party's hydraulic sluicing nozzle. The sludge channel in Pipeelay Gully runs up from the road to the left of the photograph and right across the background. *Photographs: Kevin Jones, DOC*

The other major sluicing sites where little or no hydraulic elevating was used are in the *Shotover gorges*. Prior to the discovery of the Yukon, Canada, the Shotover was considered by miners to be the richest gold mining river in the world (De La Mare 1993). At the Sandhill Cut, 2.5 km above Skippers Township, hydraulic and ground sluicing was used to create an enormous diversion cut in an effort to reveal the bed of the river. The cut, made between 1926 and 1931, is 580 m long, 60 m deep and with its great sloping batters covers about 16 ha. Even though work continued until 1941, the venture was a financial failure (S123/209). Closer to the township at Skippers Point, Aspinall and Gordon's

Gees Flat, Kawarau Gorge (*right*). A large sluice pit beside the river that is still being used as a demonstration site.

This siphon (*below*) was built in the 1890s by the Davis brothers to carry water across Stoney Creek to their hydraulic sluicings on Davis Terrace. It is probably the only intact siphon in New Zealand.
*Photograph: Peter Bristow*



workings have sluiced most of the point away through tail race tunnels into the river below. The undulating tailings cover about 400 × 300 m and were worked from a large reservoir (45 × 7 m, and 1 m deep) close to the remains of the Otago Hotel. Unlike the Sandhill Cut, this claim was started in 1867, and was worked for 55 years by the Aspinall family and then by W. Gordon until 1937 (S123/164).

Running south from Skippers township, high terraces have been sluiced for more than 2 km, leaving very high faces. The named terraces in order from north to south are Burkes, Londonderry, Pleasant Creek (Johnson's), and Davis (Stoney) Terraces (S123/84–98, 152, 154, 156). These terraces were worked from the 1870s to the 1950s at varying levels of intensity. Most gold was won in the 19th century and a claim on Pleasant Terrace was the site of the famous Eager and Grace litigation in the 1870s. The gravels were being worked by tunnelling and Grace was able to tunnel into Eager's claim for over a year before he was discovered. These claims were extremely rich, and Grace obtained £38,000 worth of gold (equivalent to about $1.25 million today) from the claims in four years.

Though the three sites described above are the largest of the sluicing sites in the river, there are tailings and sluicings, many of them massive, all along the river from the Polnoon and the Floodburn (near the Branches Station) to about the mouth of Long Gully (Peter Bristow pers. comm. 1997), then a gap to the Oxenbridge Tunnel, followed by Big Beach and Tuckers Beach only a few kilometres above the confluence with the Kawarau. The river above Kerrymans Beach was surveyed systematically by Neville Ritchie in 1979 as part of the Clutha Development Project and the material recorded within the Site Recording Scheme. Historic information from Peter Chandler, compiled from local sources in the 1940s and 1950s and included on the forms, links names of miners with given sites, an unusual situation. When the Department of Conservation put forward a case for a Water Conservation Order for the Kawarau and its tributaries, this material was summarised (Hamel 1995b) as supporting evidence for the outstanding historic values of the river.

There were two major settlements in the Shotover at Skippers Point and at Maori Point. The latter has been almost entirely obliterated and the Skippers Point township was modified by the 20th century activities of the Mt Aurum Run farmstead. The cemetery and ruins such as those of the Otago Hotel are the main sites remaining. The school, which became the Mt Aurum woolshed, has been heavily modified by reconstruction. Many miners' cottages were scattered all up and down the valley with the Skippers township as their focal point.

Miners had always been aware that the Shotover River was a giant tail race, and diverting it was a mammoth task. The remnants of several efforts are still visible at the Sandhill Cut (see above), Schooners Beach, Tyrees Cut, Maori Point steel dam and fluming of the 1930s (S123/74), and the Oxenbridge Tunnel. In the Polnoon, a tunnel 820 feet long diverted the whole of the Polnoon Burn into the Sheil Burn. None of these efforts was particularly successful, but dredging and elevating was used effectively. This became apparent when modern miners took to the river with heavy machinery. Between 1980 and 1992, L & M Mining worked about 16 km of river bed from Mt Dewar to Campbells Saddle, obtaining 42,000 ounces of gold. Close to the Moonlight confluence an old slip had covered the river bed and prevented the early miners from working it. When the slip was removed, the gold grade obtained by L & M Mining was about 20 times that in the rest of river, with between 1000-1500 ounces taken in four days (the bucket of the back hoe was visibly yellow). By extrapolation, the other 16 km of river bed may have yielded in the order of 400,000 ounces of gold to the original miners (P. Wopereis, L & M Mining, Nelson pers. comm. 1998).

The Shotover River is unusual in Otago for the density, size, complexity, and wide age-range of sites in the valley, as well as the remoteness and steepness of the terrain. It is also notable for the continuity of some of its mining families, the Smiths having worked in the valley for four generations (C. Smith, Dunedin pers. comm. 1998). This continuity of association of miner families with particular places occurs elsewhere in Central Otago, e.g. the Adies in the Nevis (K. Adie, Lower Nevis pers. comm. 1996) and many families around Bannockburn (C. Spears, Bannockburn pers. comm. 1997). Other features of the Shotover catchment, in particular quartz mining at Bullendale and at the Nugget Battery, and dredging, will be described in the sections below.

Other notable sites where hydraulic sluicing was used to good effect were at the Fatboy and Criffel Diggings at 1350-1250 m a.s.l. on the Pisa Range (Hamel 1991c), the higher workings in Brackens Gully (Hamel 1996b), and on Galvins Terrace behind the Nevis township (Hamel 1994a). Though Gees Flat around the Kawarau Gorge Mining Centre (see Fig. 19) was worked mostly by ground sluicing and tunnelling, it is the only place at present where sluicing by use of a hydraulic nozzle can be seen in action (Smith, P. 1990).

A spectacular failure is apparent at the Pactolus Claim in the upper Nevis where in 1892 the Pactolus Company built a large

Beside the Oxenbridge Tunnel this stationary steam engine ran a pump which was used to lift seepage water out of the bed of the Shotover River, once the main flow had been diverted through the tunnel. The engineering was effective, but there was hardly any gold in the river bed.
*Photograph: Peter Bristow*

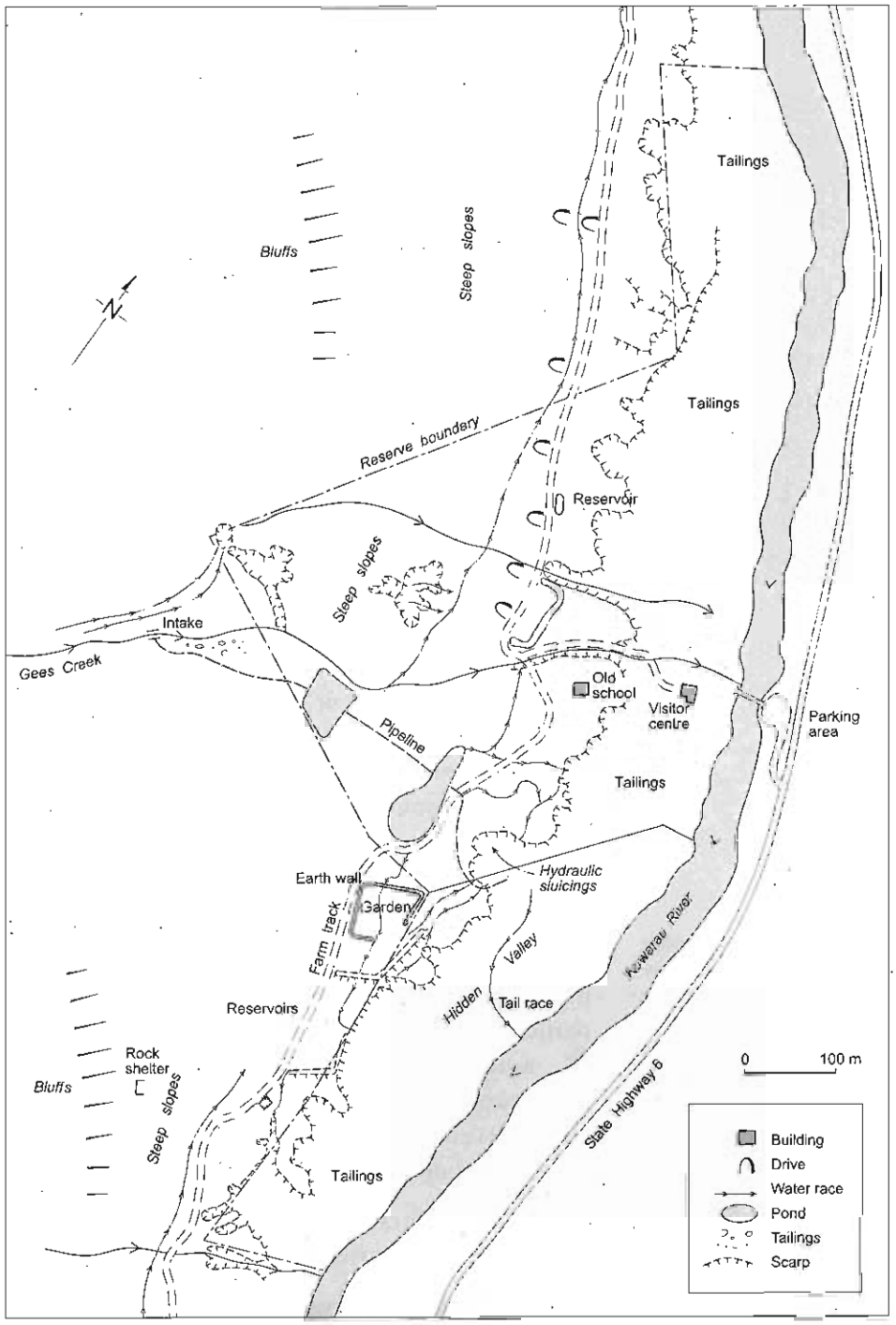
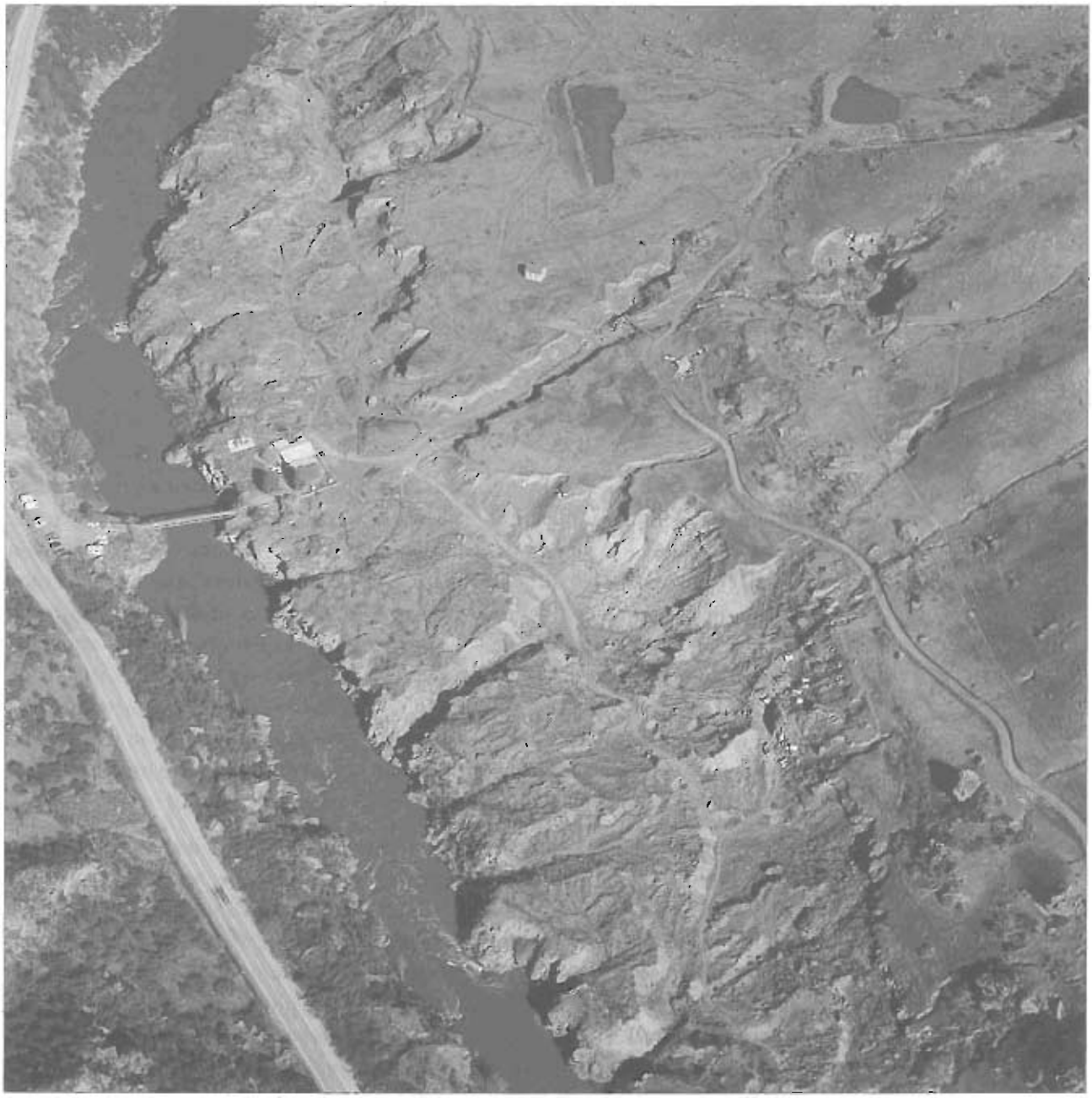



Figure 19. River edge alluvial workings at Gees Flat, Kawarau Gorge. The cemented gravels have been tunnelled with drives.

race for about 60 heads of water out of the Nevis River itself and brought it in at only 70 feet above the workings, in the belief that volume would compensate for lack of height (Hamel 1989a: 7, 15). Such low pressure even with so much water does not produce the pressure at the nozzle that say 8 heads falling 300 feet does. Hood (1990) compared the amount of work done to build the race and the amount of dirt it could shift per year, and found it would have taken 134 years to break even. The Golden Lion race to Nokomai by comparison would have broken even in 2 years. The Pactolus Company switched over to converting flat sheets of iron into cylindrical pipes for the enormous pipelines which about five other sluicing and elevating companies required in the upper Nevis.



River-edge ground sluicing along the Kawarau River, looking east. This type of site is rapidly vanishing.

*Photograph: Kevin Jones, DOC*

## 8.4 HYDRAULIC ELEVATING

Hydraulic elevating required much more complex structures and more capital than hydraulic sluicing. The basic design was invented in California and first used in New Zealand at Gabriels Gully in 1880 by J.R. Perry. He and other Otago miners, such as Smith, modified the Californian system to suit Otago conditions. The key component of the system was a vertical pipe with a U-bend at the bottom, lying in a pool of water and gold-bearing gravel, washed to it along the floor of a sluice pit by a separate system of pipes. Water arrived at one side of the U-bend under high pressure from a penstock and started back up the vertical pipe, passing a hole which allowed the gold-bearing gravel to be sucked in. A

Elevator workings at Baileys Hill, in the upper Nevis.

constriction in the pipe formed a jet and a wider section created a suction effect known as a Venturi tube, so that the water under pressure had to rush up the pipe and not out the hole at the side. The jet *within* the pipe was Perry's main modification, and added direct pressure to the suction effect of the Venturi-tube part of the pipe. For maximum efficiency the diameter of the pipe had to be proportioned to the height of the elevator and to the quantity of water available. At the top of the vertical pipe, the water and gravel was delivered to sorting boxes or tables where the gold was caught and the gravel washed into the nearest creek or tail race. The gold may also have been extracted in the floor of the sluice pit by running the gravel through boxes to the bottom of the elevator whose basic purpose was to remove gravel from the pit.

Such a complex device had to be imported at first until the local foundries were able to build them. It also required greater lengths of pipe, since there were at least three lines across workings which with ground sluicing would have required one, and a long line of high pressure piping from a penstock where ground sluicing needed only ordinary races. A trestle of milled timber was also needed to carry the sluice box over the edge of the pit, but as recompense for all this expense, overburden and gold-bearing gravel could be lifted from 30–100 feet below a surface and shot into a creek lying *above* the gold-bearing layers. To bring up a tail race or sludge channel only 50 feet deep could take a year or

Unusual rectangular ponds left by hydraulic elevating at 800 m a.s.l. in the Lammermoors.

The Blue Lake at St Bathans was formed by linking three hydraulic elevators one above the other, lifting water and gravel a total of 152 feet. *Photograph: Peter Bristow*

even 10 years to construct and could involve acrimony and litigation as happened at Bannockburn (Parcell 1976).

Though the first systems came into use in the 1880s, the largest hydraulic elevator systems were built around the turn of the century, as their value for working deep leads was realised. Since the large elevators flourished at the same time as dredging and both leave behind them large holes, it is often difficult to distinguish between the ponds left by elevators and those of paddock dredges.

At *Gabriels Gully* enormous quantities of tailings were produced by hydraulic elevating, filling the valley below Blue Spur and covering the earlier gold-rush workings. A photograph taken about 1906 shows five elevators working in the top of the main valley, with pipelines running down a face into a large hollow now partly filled in (Park 1908).

This system was fed by long races: the Tuapeka, the Waipori, and the Cornishmen's from the headwaters of the Waipori River, and Kitto's and the Perseverance from Bowlers Creek and the Tuapeka River headwaters, respectively (C. Goodlet, Lawrence pers. comm. 1997). The Golden Crescent came in also from Deep Creek in the head of the Waipori River, but may have fed the Waitahuna workings rather than the elevators at Blue Spur. The very early race, the Phoenix, and the Hibernian and Malones also ran to Waitahuna. These race systems are still fairly clearly definable, especially in their upper reaches.

The way in which Gabriels Gully was worked is not easy to discern from the present topography. The dendritic drainage pattern conceals the fact that a low spur within the workings is a watershed between Munros Gully and Gabriels Gully proper. An unnaturally smooth hillside, Pollans Hill, is not a sluiced face, but a slickenside fault formation uncovered by sluicing at a relatively early stage in the workings. Around the turn of the century about five major penstock races and pipe henches had been cut across this face for the hydraulic elevators in the gully below. Their efforts are marked by ordinary sluice faces on the other side of the gully from the slickenside and by rounded ponds. Within the ridge of the watershed there is a most unexpected feature for such a major alluvial site—an adit leading to over a kilometre of tunnels driven through the cemented

Gabriels Gully. The Blue Spur runs from the left foreground to the steep bare slope in the middle background. This slope is a slickenside fault formation uncovered by sluicing. Under the trees at its left-hand end, five large parallel races were dug to act as

conglomerate. The material was brought out to be processed in a battery on the Munros Gully side (P. Mason, Dunedin pers. comm. 1997). Of the living sites, only those associated with the turn-of-the-century workings have survived, and consist of a few standing buildings and many house platforms at Blue Spur township on a ridge to the south of the main workings.

One of the largest and deepest holes dug by hydraulic elevators was at the Blue Lake at *St Bathans*. A goldfields entrepreneur, John Ewing, created a more efficient elevator, which by 1905 could carry gravel up 110 feet, enabling him to start to take out the deep levels in the Blue Lake. Ewing had large workings employing many men at St Bathans, Cambrians, Tinkers, Bald Hill Flat (Fruitlands), and south of Roxburgh. He was influential for about 50 years around the turn of the century, but ran into legal difficulties at St Bathans with the Scandinavian Race Company, who were able to dispossess him from the Kildare Lead under Blue Lake in 1906. The latter company worked down to 152 feet with their elevator, using several lifts and leaving a lake 800 m long and 100 m wide (Salmon 1963).

reservoirs for the pipes to the hydraulic elevators that dug out the valley in the right middle ground. An entrance to a kilometre of tunnels in the cemented conglomerate lies under the trees at the far left. *Photograph: Kevin Jones, DOC*

There has been no integrated survey of the St Bathans workings, nor of similar workings stretching along the eastern flanks of the Dunstans—the Vinegar Hill, Cambrians, Drybread, Tinkers, Matakanui, and Devonshire workings. A 1985 survey of the upper Manuherikia Valley identified the major race systems running to St Bathans. These were the Mountain and Enterprise race system of 12 and 17 heads from Rocks Creek, the Scandinavian of 25 heads from the western branch of the Manuherikia River, and the Otago Company Water race of 12 heads from the eastern branch. John Ewing is shown as a shareholder of the Mountain and Enterprise races in 1872. (His last project was the Teviot-Molyneux Company formed to sluice the Ettrick Flats about 1918 when Ewing was 74 years old.) The Mountain and Enterprise Company was selling water by 1864 and the Scandinavian by 1869. The latter company was one of the most prosperous in Otago, from its work on the Kildare lead in the first decades of the 20th century. These races were more than 15 km long. The Otago Company's race, which had to follow a low and devious route, is about 48 km

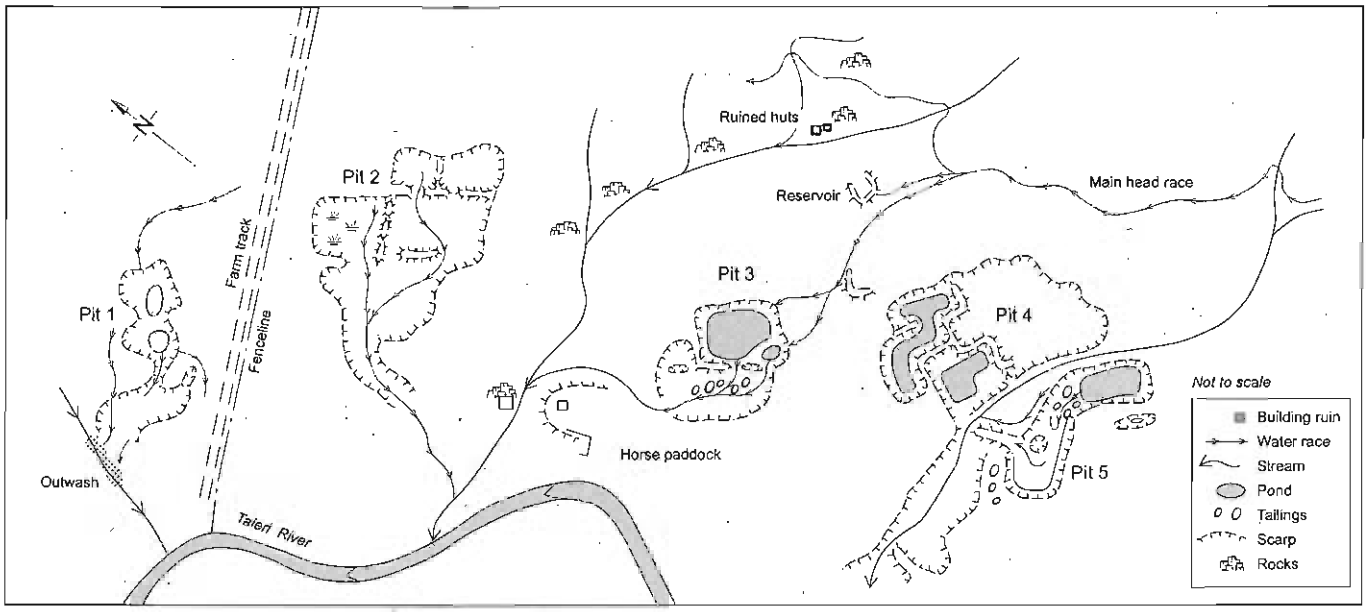



Figure 20. Sketch plan of hydraulic elevator pits at Reid's pits, a remote site on the Lammermoors beside the upper Taieri River (Reproduced from Hamel 1995a).

long. These magnificent race systems were still largely intact in 1985 (Hamel 1985a).

St Bathans township represents goldfield towns within the Otago Goldfields Park. In 1874 the township consisted of two schools, two churches and the Catholic cemetery, a post office, a public hall, a hospital, two banks, five hotels and a billiard room, four stores, a police camp, two butchers, a drapery, a bakery, a blacksmiths, a bootmakers and a carpenters, and an unknown number of dwellings. About 20 buildings remain, including the very fine mud-brick public hall and the Vulcan Hotel in much their original condition (Hamel 1985a). The hall, built about 1869, is remarkable for having foundations of mud-mortared, river-worn cobbles of schist, set very evenly and stacked up to 2 m high at the back of the building to carry the heavy, double-skinned mud-brick walls (Hamel 1993b).

Hydraulic elevating was generally used on dry land, but Alfred Smith developed a system which could be used within the bed of a river. He worked the bed of the Shotover River immediately below Smiths Terrace with it in 1888 (Chandler & Hall 1986). It was used elsewhere in the Shotover and in 1904 on the Arrow Flats (Appendices to the Journal of the House of Representatives 1904, C-3 77), but given the vigorous effects of water within river beds it is unlikely that any field evidence will remain of this technology.

Elevators were set up in some very remote places, such as the top of the *Lammermoors* where Reid developed a site (see Fig. 20) beside the ultimate headwaters of the Taieri River at 800 m a.s.l. in about 1905. Compared to Blue Lake these are shallow, wide workings, spread over several hectares and leaving unusually tidy rectangular pits and ridges of tailings. They were worked by different companies until about 1918 (Hamel 1995a). Prior to Reid starting his elevator, one of the best concealed of the big mining sites of Otago was started at the foot of the Lammermoors near Rocklands Station homestead. This was the Deep Stream Amalgamated Hydraulic Sluicing Company's workings, whose

A piped section of a large race carrying water from the Taieri Falls for hydraulic elevators at Canadian Flat above Paerau in the upper Taieri River.

painfully built 11 miles of race out of Deep Stream included 1000 yards of kauri fluming. This race is still part of the Deep Stream water supply to the City of Dunedin. For 10 years around the turn of the century this was a particularly successful mine, using two elevators and paying £1,500 in dividends up to 1904 (Hamel 1995a). Lying wholly within the bed and lowest river flats of Deep Stream, there are only some anomalous ponds to show where the elevators worked.

Other places where hydraulic elevators worked effectively include the upper and lower Nevis valleys (Hamel 1994a, 1996d), Luggate Creek (Ritchie 1980a: 30), along the edge of the Dunstan Range from Vinegar Hill to Matakanui (P. Mason, Dunedin pers. comm. 1997), and from Island Block to Roxburgh east (Webster 1948). The Island Block hydraulic elevators were worked with water brought across from the Fruidburn on the other side of the Clutha River. Sections of the penstock pipe have not been recycled and are still lying on the ground (P.G. Petchey, Dunedin pers. comm. 1998).

Alluvial gold mining in Otago was vigorously pursued for over 50 years, creating enormous systems of races and earthworks. In the open tussock landscapes of Otago, these sites are the largest and most conspicuous archaeological sites in New Zealand. Though small-scale mining continued throughout, there was a steady progression in the complexity of the technology used. The main power source, however, was water, and every system of races, reservoirs, sluicing, and tail races was controlled by the simple fact that water can only run down hill. As archaeological systems, these 19th to early 20th century sites are relatively easy to interpret, and provide useful systems for exploring the working life of the communities that created them.

## 8.5 DREDGING

Dredging is the most complicated sort of alluvial mining, and requires capital and heavy machinery. The development of efficient dredges led to the last great splurge of 19th century investment in mining in Otago, although the economic benefits to the province came as much from building and working on the dredges as from the gold obtained. Archaeologically, dredging left few traces until the development of the tailings elevator about 1894, which allowed dredges to move out of the rivers and work into the terraces or on to adjacent paddocks. The only traces left of the river dredge workings are T-shaped moorings in gravel banks or iron pins in rocky gorges, anomalies in river bed sediments and the occasional side channel. (The depths to which the river dredges worked are of concern to hydro dam builders, since dredging changed the nature of the river bed sediments.) Of the dredges themselves, the sunken remains and worn out parts, especially buckets and tumblers, still lie along river beaches. The paddock dredges have left some massive remains in the form of

This stone-lined pit, on a hillside above Deep Stream, is the top end of a pressure pipe which once ran down to the hydraulic elevators below, near Rockland Station homestead.

tailings and ponds. The ruined hulks of paddock dredges are more common than those of river dredges. The other significant sites associated with dredging are early hydro-power stations, built to run electric dredges.

Since they were spectacular objects and cost so much, dredges received plenty of attention from newspapers and the Mines Department. The wealth of archival material has led to several major pieces of research, most recently by Caygill (1984), Hearn & Hargreaves (1985), and Chandler & Hall (1986). Hearn & Hargreaves (1985) provide a social history of dredging with a full bibliography, and Caygill (1984) provides a year by year description of the dredging operations, as well as 98 photographs of dredges and an index of dredge names. The Otago Conservancy Office holds useful files of archival material on dredges and a separate volume on the lower Kawarau dredges, compiled by Mark Hangar.

The earliest dredges were giant spoons on the end of a dipping arm, the spoon being made of an iron hoop with a rawhide or canvas bucket to hold the gravel. One of the first was worked between Clyde and Alexandra (see Fig. 21), about 1863. Mounted on pontoons these dredges had to work close to the banks in shallow depths. They were used at Millers Flat, near Clyde, and in the Shotover until ousted by bucket and ladder dredges in the 1870s. One of the last was sunk near Sandy Point, Alexandra, in 1879 (Hearn & Hargreaves 1985).

The first bucket-and-ladder dredges were driven by a pair of water wheels, mounted on each side of the pontoons (Peter Petchey pers. comm. 1998), and were simply turned by the river current, using strong ropes and moorings to hold the dredge in place. They had to operate well out in the river to get the best current and could work down to about 19 feet below water level. By the early 1870s they were beginning to replace the spoon dredges. Current wheelers worked all along the Clutha and up into the Shotover River, one of the largest being the Duke of Sutherland near Clyde.

The obvious solution of driving an endless chain of buckets with a steam engine was proposed in 1873, but it was 1881 before four steam-driven dredges were placed on the Clutha, two of them being the Ino and the Jane near Beaumont. The Dunedin steam dredge above Alexandra was able to work down to 25 feet below water level. These early steam dredges were not very successful and it was not until Choie Sew Hoy put a dredge on to Big Beach in the Shotover in 1888 that the steam-driven, ladder-and-bucket dredge was properly developed (Hearn & Hargreaves 1985). This stimulated a boom, especially for the Dunedin engineering firms who built the dredges, and for the local coal mines that supplied them with fuel.

During the 1890s the Standard or New Zealand dredge was developed and became internationally renowned. These dredges could work to 60 feet below water level with larger buckets. Bucket size had increased from about two cubic feet to six or seven cubic feet. The most significant development of the 1890s

The only archaeological traces of the early river dredges are T-shaped trenches lined with stone to hold the mooring lines. This one was for a punt beside the Clutha River below Albertown, but the same system was used for the dredges.

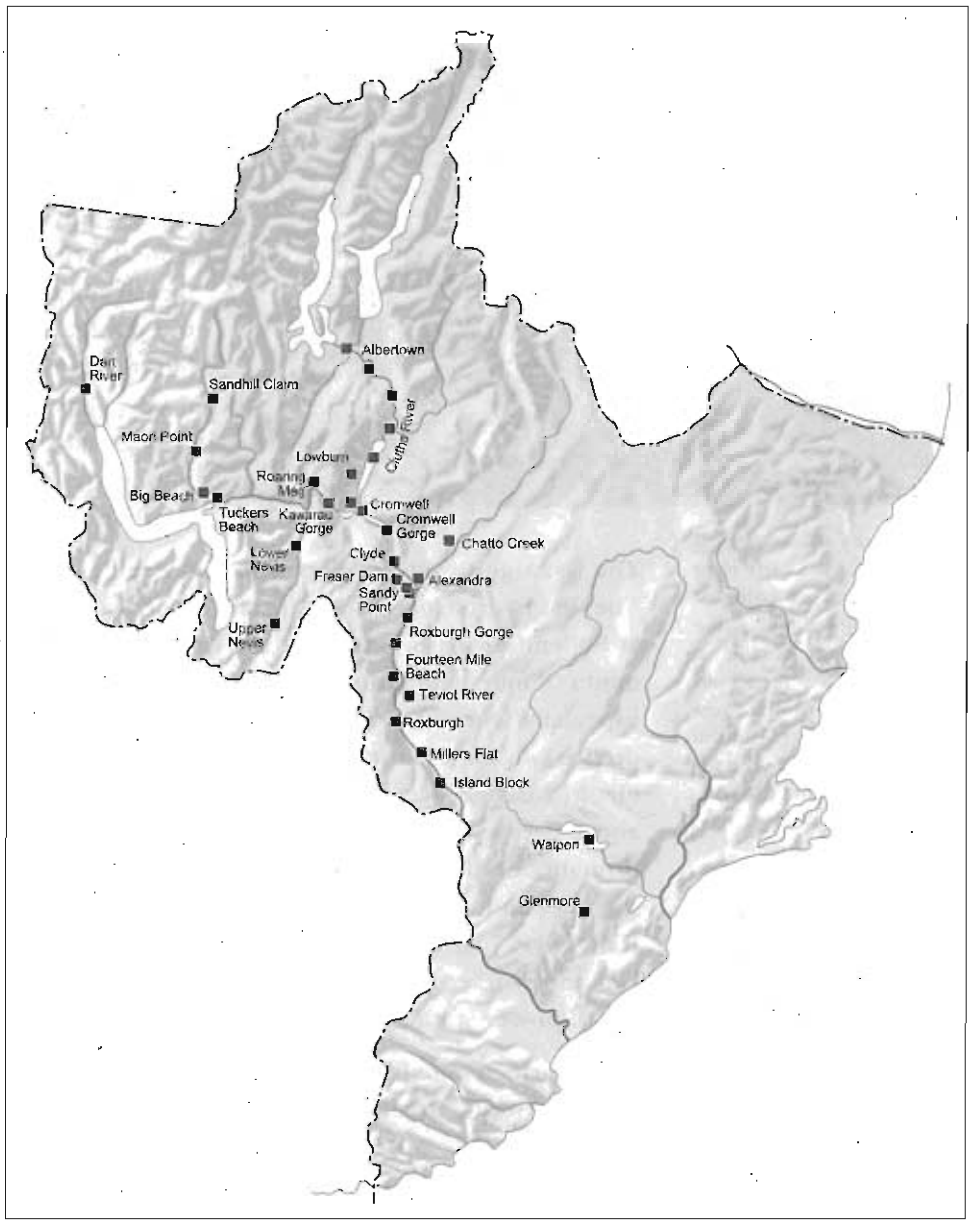
was the invention of the tailings elevator, which is thought to have been first used on the Enterprise near Alexandra in 1894. Tailings could be piled 50 feet high and banks up to 40 feet could be tackled. The dredge moved in its own pond, well away from the river, and was often supplied by a race from a side stream. When the life of the dredge ended, a distinctive pond was left; this is now often the surest sign that a dredge has worked in the vicinity. The tailings have often been levelled, leaving ponds which are all shapes, but can be neatly rectangular.

The last significant development in dredging was the use of hydro-electricity. The first hydro-electric power station and transmission line had been developed at Bullendale in 1886 to drive the crushing machinery of the Bullendale quartz mines. Miners were quick to realise the suitability of hydro power for dredges, especially where it was difficult to get coal to the dredge, and the first electric dredge was built at the Sandhills claim in the upper Shotover in 1891. Two more electtic dredges were put on the Clutha at Fourteen-mile Beach above Roxburgh and at Earnscleugh Flat (Earnscleugh No. 3). For the Sandhills Dredge water was brought out of Stony Creek (a tributary on the true left) to a tank 520 feet above the river and then by pipes to the generator house beside the river (Chandler & Hall 1986: 74). The dredge worked until 1899, when it was moved to Millers Flat and worked by two different companies over the next three years using a hydro-power station on the Minzionburn (Chandler & Hall 1986).

The Fourteen-mile Beach dredge was installed in 1900, using a hydro-power station on Gorge Creek, and the original Fraser Dam station was built for the Earnscleugh No. 3 dredge. Only the latter was a paddock dredge and left evidence of both tailings and its power station. When the Earnscleugh No. 3 dredge came to the end of its very profitable life in 1926, it was shifted to the Upper Nevis (Fig. 22). The company also shifted two AC generators and the pelton wheel from the Fraser power station, to be set up as one of a series of small independent power stations operating in the Nevis Valley from about 1904 to the present day (Chandler & Hall 1986).

The owners of a remarkable suction dredge at Maori Point on the upper Shotover used the Davis Brothers' old race in 1926 from Stoney Creek to run a power plant beside the river. Although the massive iron superstructure of the dredge is one of the most intact remaining dredges today, it was not a successful venture. The Wye Creek power station was built in the mid 1920s to power the Golden Terrace Extended Dredge at Tuckers Beach on the lower Shotover, but the pattern was beginning to change to publicly owned systems. The first of these in Otago was established in 1924 at Roxburgh, based on a plant installed by an orchardist on the Teviot River. The Roaring Meg and Fraser River stations became part of the Central Otago Power Board system, even though their three largest clients from the 1930s to 1962 were the enormous dredges in and beside the Clutha: the Austral-Malay at Lowburn, the Molyneux in the Cromwell Gorge, and the Clutha near Alexandra (Chandler & Hall 1986). Their drain on the

Figure 21. Dredge sites in Otago.




The massive tailings left by paddock dredges at Earnscleugh, shown here under a heavy hoar frost.

The foundations of a 20th century powerhouse in the Upper Nevis, used to run the old Earnscleugh No.3 dredge.

system was so great that when one of them hit a boulder during the night shift, the lights of Queenstown dipped.

The largest area of surviving dredge tailings lies along both sides of the Clutha River from Alexandra to Clyde. These tailings were once almost continuous, but have been badly damaged by roading, gravel extraction, and levelling for an industrial area adjacent to Alexandra (Petchey 1994f). Dredge tailings are best preserved within the *Earnscleugh Tailings Reserve*, Otago Goldfields Park. The reserve includes small ground sluicings near the McPherson Road gate, some minor amorphous and herringbone tailings near the Marshall Road entrance, long ridges of paddock dredge tailings of the Earnscleugh No. 2, Earnscleugh No. 3, and Alexandra (Clutha) dredges, increasing in height away from the river. There are also miscellaneous iron objects from dredges, of which the most important is the silt wheel from the Earnscleugh No. 3 dredge (S143/8). The site as a whole and its history is described in Smith, P. (1990). Other tailings along this stretch of the river are described in Petchey (1994f). These include not only dredge tailings (S143/10, 13, 18), but also short sections of herringbone tailings. When a survey was carried out in 1977, parts of two dredges were located on this part of the river. One was a kauri deckhead (S143/17) which has since vanished, and the other (S143/12) still lies at the top end of a pond among willows and is known locally as the Muttontown Dredge.

Dredge ponds in the Upper Nevis were left behind by the Earnscleugh No.3 Dredge during its second career.

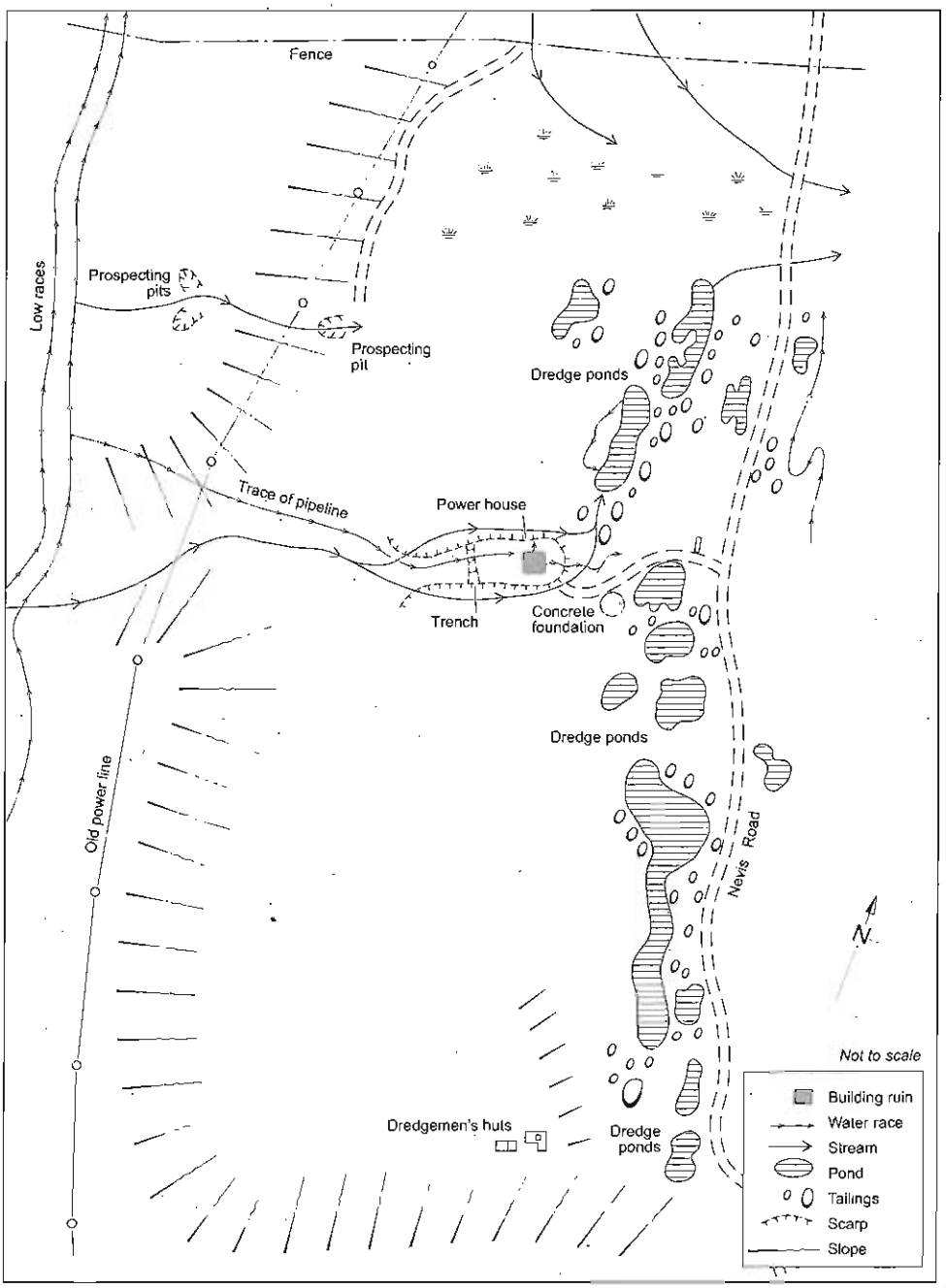



Figure 22. Sketch plan of ponds and tailings left by the Upper Nevis dredge in the 1930s and the foundations of a small power house for the dredge. The latter was run at first as a hydro-electricity station and later on with a diesel generator.

There are numerous references in the 1977 site record forms to dredge buckets and other dredge parts on the beaches which would be covered by the waters of Lake Dunstan. The most notable remains were the Lady Ranfurly dredge (S133/38) lying on the river edge due south of the Ripponvale/Pearson Roads junction and the Electric No. 2 dredge (S133/352) further south near the mouth of the Bannock Burn. Both sets of remains had been stripped of much of their superstructure, and the parts recycled. Some parts have been preserved for their own sakes, such as the boiler of the Lady Ranfurly which is set up on a stand on Domain Road, Bannockburn.

In the Lower Nevis there are a few timbers in the swamps near the mouth of Schoolhouse Creek of the dredge with the longest working life in Otago (and probably New Zealand), run by the Lower Nevis Dredge Company from 1906 to 1940 (Hamel 1994a). In the Upper Nevis, the tailings left by the second working

An angular dredge tumbler, over which the buckets jerked to shed their load. This one was lying on the flats of the Lower Nevis and was probably discarded by the Lower Nevis Dredge.

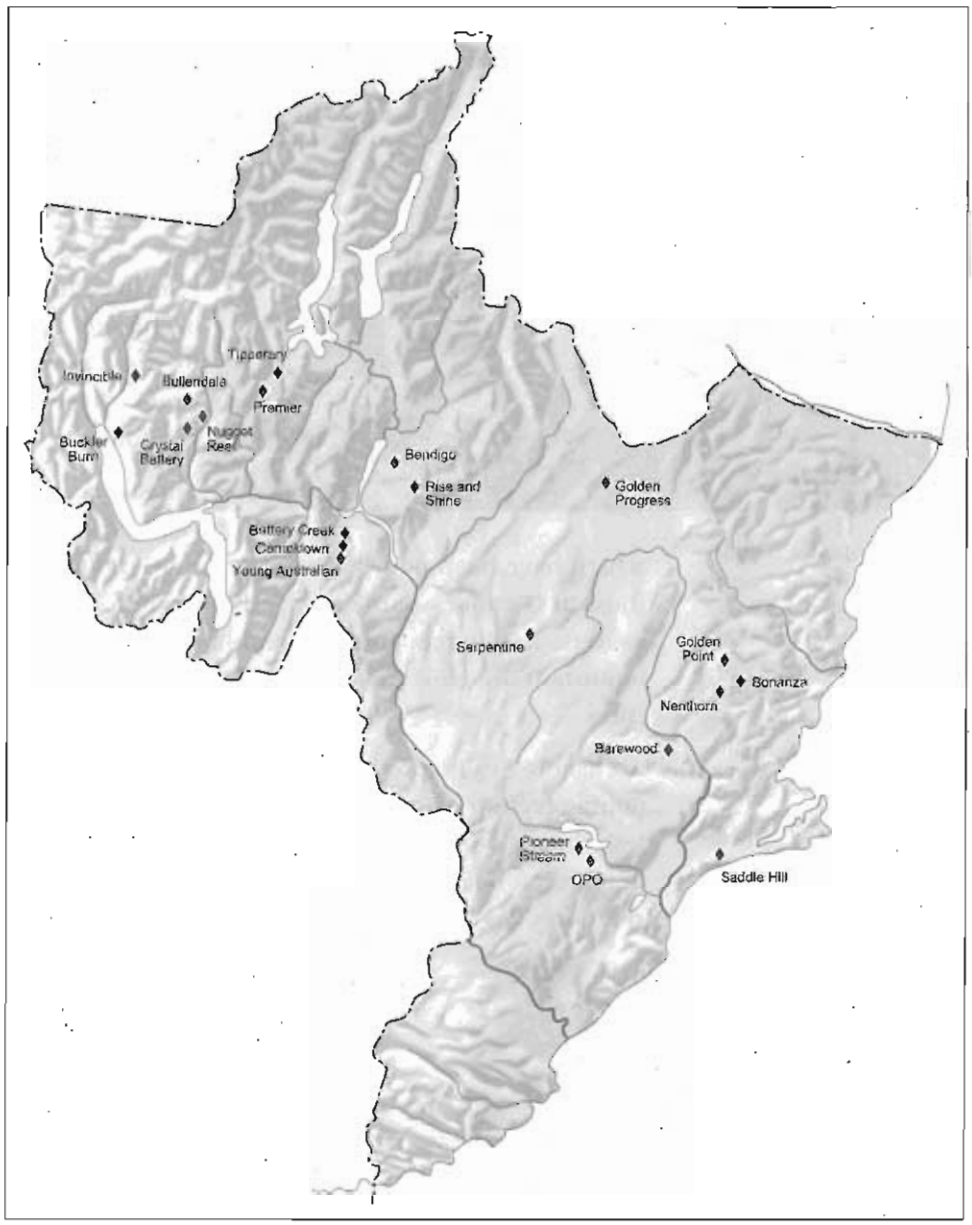
life of the Earnscleugh No. 3 dredge and the foundations of its power house indicate where it worked (from 1927 to 1934) unsuccessfully, before being shifted to the West Coast (Hamel 1996d). One of the more remote sites is that of the Dart River dredge, built about 1900, where the remains of pontoons and a tailings elevator lie beside a hollow at Dredge Flat (Peter Bristow pers. comm. 1998). At Chatto Creek there is a dredge half buried in a paddock.

There are dredge ponds and associated tailings beside many other Otago rivers which have been poorly described or are unknown. The most eastern ones are those at Glenore, south-east of Milton, where the tailings have been so modified as to be hardly recognisable, and have been levelled by modern mining. Other important dredging fields, such as Lowburn and Waipori, are drowned by hydro lakes.

Archaeologically, dredging is the most poorly represented of all the major gold mining technologies in Otago. The hundreds of dredges built are represented by less than a dozen partial hulks and numerous isolated bits of machinery. The tailings left on dry land represent only the paddock dredges, and the work of the river dredges is, of course, wholly unrepresented in the archaeological record.

A silt wheel from the Earnscleugh No. 3 dredge which was used to get rid of fine material.

Figure 23. The quartz mining fields of Otago.



# 9. Quartz mining

The field evidence of quartz mining is often difficult to link into functional systems, compared to alluvial mining. Hard-rock mining was usually underground or from isolated trenches, with often only a faint line of a dray road leading from the mine to a battery site. If an aerial cableway was used, there may be no visible link on the ground. Ore passes which have partially collapsed can be difficult to distinguish from mining adits, and shafts can be not only collapsed, but covered by scrubby vegetation. As some compensation, quartz mines were better documented than alluvial mines, and plans of many underground workings are lodged with the Mines Department. The Government geologists reported on quartz mines in considerable detail in their major surveys (Park 1906, 1908, 1909; Marshall 1918; Williamson 1939).

In setting up batteries, miners made as much use of gravity as possible and usually established the grinding machinery against a slope on a lower level than the mine. This also facilitated running water to the site, either by pipe or race. If cableways and tramlines were used to shift the ore from the mine to the battery, the main source of power was likely to be gravity, assisted by a small engine to manoeuvre the buckets or trucks on a continuous cable. The lower end of the line was often offset from the battery so that an escaping truck could not 'bomb' the battery. Ore passes were frequently used, made up of a vettical shaft down which the ore could be dropped to an adit coming out further down the hillside. From this lower level, the ore could be trucked or barrowed on a gentle gradient either to another ore pass or to the rock breaker above the battery. These methods changed as coal-driven steam engines, internal combustion engines, and later electric motors were brought in to drive the machinery.

Archaeologically an old battery site will consist of at least two platforms, generally cut into rock, often with concrete block foundations set with bolts for the heavy machinery. On a lower level there may be the foundations or remains of cyanide tanks. Along with a race and a reservoir, set slightly above the battery, these are the usual archaeological indications of 19th century quartz mining activity. Some early mines may have no associated battery because the ore was taken by dray to a distant battery, or even shipped to Australia for processing. Early 20th century mines may have a small hydro-electric station nearby.

## 9.1 SHOTOVER

The *Bullendale* mines (see Fig. 23 for location) and associated sites are the most interesting quartz mines in Otago. The reefs were discovered in 1863, and sufficient machinery had been dragged into place to start crushing by 1864. Over 20 km of steep ground between the reef and Skippers Saddle made it the most difficult site in Otago at which to erect a battery. The main battery was the Phoenix, but the large underground mine was known for much of its life as the Achilles mine. Up to 1906 the mine complex had produced 35,029 ounces of gold (Williams 1974: 51). Bullendale is notable at a national level for the first

The Serpentine Battery in its final resting place. It is the only battery in Otago with its driving water-wheel still beside it.

industrial use of electricity, given that a hydro plant was set up to drive its machinery in 1886. Chandler & Hall (1986) provide a full archival description, as well as early photographs and a plan of the underground workings. Peter Chandler also provided comments for the site record forms compiled by Neville Ritchie from a survey in 1977, which along with Peter Petchey's archaeological survey (Petchey 1996i) provides an integrated overview of the whole system.

The sites described in 1977 and checked in 1996 included the foundations of the burnt-out 30-stamp Phoenix battery[11] (S123/140, 141) on the true left of Murdochs Creek. Both a track and a cableway lead to it from the mine openings on the British American Spur (S123/142). Two rotors for a Whitelaw turbine lie in Murdochs Creek, and above the battery sits the Kincaid and McQueen rock crusher installed in 1886. (A Whitelaw turbine was installed at the Phoenix battery in 1867.) The whole battery site has been badly disturbed by flooding. On the opposite side of Murdochs Creek there are the remains of another battery, Southbergs (S123/143), not disturbed by flooding. Further up Murdochs Creek there is the site of the winding house over the main shaft (S123/147), which has the most intact machinery of any Bullendale site. This includes the remains of an early Brush Corporation electric motor and Cornish pump. The motor is a particularly interesting and valuable item. Below the winding house there is a dam in the river (S123/146), and above it on the hillside there are traces of at least 17 hut sites (S123/144, 145). Terraces of another 10 hut sites lie on the slopes nearer the Phoenix battery (Petchey 1996i: fig. 13b). Eleven outlying hut sites were also documented (Petchey 1996i: fig. 13a) and a hotel site, The Reefers Arms, about a kilometre down Skippers Creek (S123/135).

The all-important hydro plant is not even in the same creek as the battery, but is over the Southberg Spur (300 m high) in the Left Branch of Skippers Creek. The transmission line was about 4 km long. The remains of the race, penstocks, and dynamo were still visible in 1996, but a musterer's hut has been built from the corrugated iron of the building that once housed the dynamo (S123/123, 127, 128). In 1983 the site was excavated, the location of the building confirmed, and restoration and interpretation work done on the site in time for the 1986 centennial celebrations (Ritchie 1983a, 1985). The remaining dynamos and shafts have been mounted on a timber structure.[12] About 500 m downstream of

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[11] This was one of Otago's largest batteries. A 32-stamp battery which worked at Saddle Hill near Dunedin for 3 years in the 1880s was probably the largest (though small by North Island standards), but the latter site has been destroyed by the construction of State Highway 1 (Williams 1974: 57).

[12] These two dynamos and the motor on the winding house site are probably the oldest pieces of electrical equipment to survive on site in New Zealand, and may be amongst the oldest on-site systems in the world (P. Petchey pers. comm. 1998).

the dynamo, there is the site of Morgan's sawmill (S123/129), which was run with the waste water from the dynamo.

Bullendale was not the only quartz mining settlement in Skippers. Curries Reef in the Left Branch of Skippers lies about a kilometre upstream from the dynamo site, and in 1977 comprised the remains of a battery and pelton wheel, fluming up to a mine entrance, and three corrugated iron huts (S123/124, 126). This was a 20th century mine worked between the 1930s and 1969, but very similar in form to its 19th century predecessors. Another mine was worked in Copper Creek by the local runholding family, the Macnicols, from 1948 to 1953. The remains in 1977 comprised a habitable hut made from flattened race fluming, a battery, pelton wheel, dam, pipeline, and tailings (S123/133, 134).

The Nugget Reef lies well to the south of the Bullendale lodes and was worked as early as 1866. The remains of the later Nugget Battery (S123/186), often referred to as the Gallant Tipperary in the mines records (Peter Bristow pers. comm. 1998), lies almost in the bed of the Shotover itself, about a kilometre upstream from the Skippers Creek confluence. Habitations and other structures associated with it spread along the true right bank of the Shotover (S123/182, 183, 190, 196). Other named battery sites, probably on the same group of lodes as the Nugget Battery, include: the Crystal Battery (S123/194, 197) on the left bank of Sawyers Creek about 3 km from its confluence, Eureka Battery (S123/102) about 800 m up Jennings Creek, the Leviathan Battery (S123/181, 184) about 1.2 km up Sawyers Creek, and Cotters quartz mine (S123/94) to the east of the Shotover River in Cotters Creek. There is also thought to be a battery and reef in Pleasant Creek (Peter Bristow pers. comm. 1998). Park (1909) provides a geological summary and description of these mines.

## 9.2 ARROW

The large quartz mines at *Macetown* lay along three lodes—the Tipperary and Premier to the west, and the Sunrise outcropping at 1500 m on Advance Peak. The steep topography assisted access to the reef from numerous adits on the hillside. The Tipperary mine is said to have produced 184,000 ounces of gold, making it by far the most productive of the Otago hard-rock mines (compare Achilles 35,029 ounces and Bendigo 28,400 ounces) (Williams 1974: 52). Other research suggests figures of 26,000 ounces from the Premier Mine, only 20,000 ounces from the Tipperary and 5000–10,000 ounces from all the others at Macetown (Department of Lands and Survey 1982).

The main period of active mining on the lodes was from 1876 to about 1886, most of the machinery being hauled in over Big Hill, since the road up the Arrow River was not built until 1884 (Hamel 1996b). About 150–200 people lived in and around Macetown during this period (Smith, P. 1990). Park (1909) describes the major lodes and the mines, as well as the scatter of short lodes to the south in the hills on the true right of the Arrow River, south of the Soho confluence. Material on the names of mines and their production is summarised in Galvin (1887).

Macetown itself is now a grassy flat with stands of introduced trees (poplars, sycamores, elms, willows, hawthorns, old fruit trees), stone ruins and three

Anderson's Battery at Macetown with a berdan to the left.

standing buildings (Veitch 1972). The remains of Andersons battery (1906) stands about 500 m upstream of the township, with adits about 500 m up Scanlans Gully on the south end of the Tipperary Reef where the main workings of the Tipperary Mine were in the 1870s. About a kilometre further up the Richburn, the remains of the Homeward Bound battery are on the site of the main Premier Reef workings. This large 10-stamp battery was the third to be erected to work the reef and came from the OPQ mine at Waipori in 1910. Various other batteries and mining sites lie up the Rich Burn and on Advance Peak, all are undescribed (Smith, P. 1990).

## 9.3 GLENORCHY

The complex of quartz mines in the *Glenorchy* field at the head of Lake Wakatipu are reasonably accessible, compared to Bullendale and Macetown. They extend from the Buckler Burn west of Glenorchy for about 15 km to the Invincible Mine in the Rees Valley and to a smaller mine at Paradise in the Dart Valley. Most of the lodes carry more scheelite than gold, and this has been the most productive scheelite field in New Zealand. The largest and most productive group of scheelite mines are those cut into the Glenorchy-Kelly lodes on Mt Judah, which were worked intermittently from the 1880s until 1977. Bristow (1994b) provides a history of scheelite mining at Glenorchy and an analysis of the sites in the Bucklerburn. Williams (1974) has only a sketch map of some of the underground workings. Many small mines have operated on the lodes, with returns from over 40 mines listed in the Mines Department records up to 1964, but of the 2000 tons of ore produced, only six mines produced more than 50 tons (Jeffrey 1986). The largest mine, the State Mine, still has corrugated iron sheds housing a stone breaker, screen, jig, wilfley table, and roaster, all except the jig powered by pelton wheels. The 10-stamp battery has been removed, but local small-scale miners have continued to use the equipment, the roaster and wilfley table being housed in a new building (Peter Bristow pers. comm. 1998). The associated underground mines have not been destroyed by open cast mining, and are marked on the hillside by numerous spoil heaps. There are numerous small buildings, pieces of machinery, and earthworks extending from the Government Battery at 500 m a.s.l. to mines high on Mt McIntosh and Mt Alaska at about 1500 m a.s.l. (Bristow 1995).

By contrast, the Invincible lode up the Rees Valley was mostly gold bearing, and a mine (S123/253) high on the hillside was successfully worked from 1882 to 1889. During that time the tailings were re-worked by a different company at the foot of the hill using a large buddle as a concentrator (S123/254), until the mining company itself installed a row of seven berdans and worked the tailings themselves (Smith, P. 1990). Altogether about 7,000 ounces of gold was

obtained. The buddle at the bottom of the hill and the berdans, along with the battery, tracks, and other evidence of mining make this a spectacular site within the Otago Goldfields Park.

## 9.4 BENDIGO CREEK

The quartz mines at *Bendigo* lie along three major lodes roughly parallel to Bendigo Creek, with several shorter lodes outcropping on the slopes running down to the creek (Park 1908). The field as a whole began with alluvial mining in the initial gold-rush days from 1862 to 1866. The development of these deep quartz reefs is a story of ordinary miners making a fortune out of the sort of mining that usually needed large amounts of English capital. Instead Thomas Logan, Brian Hebden (a charcoal burner), and William Garrett managed to raise enough capital from an ex-Californian hotel keeper, George Wellington Goodger, to set up the Solway battery at the foot of the hill in 1868. When they sold out in about 1875, Logan and his partners had obtained half a million

Bendigo. Roofless stone huts at Welshtown lie close to lines of deep trenches dug down onto the main reef. *Photograph: Kevin Jones, DOC*

pounds worth of gold (Hamel 1993a). Though the reef continued to be worked and the 20-stamp Matilda battery was set up directly over the lode, no more fortunes were made and the battery was dismantled about 1905. There are about five other battery sites on the field, though only two or three operated at any one time. The Come-In-Time battery still stands *in situ* though it has lost its power source, presumably a waterwheel. The area has deep shafts and adits, numerous tracks and very fine stonework in causeways, bridges, and hut ruins.

The original 162 ha Bendigo site within the Otago Goldfields Park (Smith, P. 1990) covered the area around the Cromwell Reef and Logantown, but not the old Bendigo township itself. The protected area has been enlarged recently by the addition of about 300 ha, covering alluvial workings in Clearwater Creek and the upper parts of Bendigo Creek, as well as a covenant which maintains the historic sites on 540 ha in the upper part of Rise and Shine Creek. The additional areas have been surveyed in a way that links the sites into functional systems (Hamel 1993a), but the old reserve has not. A survey carried out in 1980 described over 100 sites within the old protected area, but other than those with distinctive names such as the huts in Logantown (S124/276-280), it is now very difficult to link record forms to given sites. The way in which the area was mined, other than around the large Matilda Battery, cannot be determined from these site record forms, nor from a subsequent mapping exercise by Hellebrekers (Otago Conservancy archives).

## 9.5 MACRAES

> 'This is one of the most important lode-mining areas in Otago, and one in which mining activities lingered well into the 20th century owing to the presence of scheelite' (Williams 1974: 55).

This prophetic statement of Williams about Macraes was half right, but it has been gold which has allowed the development of open-cast mining at Round Hill on a large scale in the 20th century. In its 10 years of production (1989-1999), Macraes Mining Company (now Gold and Resource Developments NL) has produced over a million ounces of gold at an ever increasing annual rate, making it Otago's most productive gold mine ever. The richest 19th century Otago gold mine was Tipperary at Macetown, said to have produced 184,000 ounces,[13] but the largest mine on a national scale, the Martha Mine, at Waihi had produced 35.5 million ounces by 1955 and an average of 75,000 ounces per annum from 1988 to 1996. Golden Point produced only 13,000 ounces of gold, and the 800 tons of scheelite were a much more important part of its operations (Hamel 1992e).

Quartz mining had begun near Macraes by May 1866 when several shafts were sunk on the Eclipse lode in Tipperary Gully, 10 tons of stone being shipped to Melbourne for crushing. By 1868 this mine became known as the Duke of Edinburgh (Petchey 1996b), the mine itself comprising cuttings and shafts

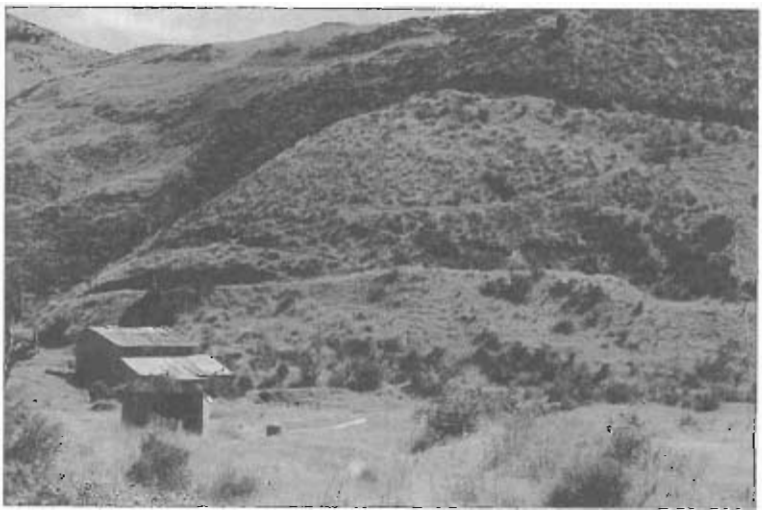
[13] It is not possible to tally New Zealand's or Otago's total gold production, because the amounts of alluvial and dredged gold exported were not fully listed until 1919, though qnartz gold was listed from 1866 (Guerin 1988).

extending along the reef for 12–15 chains and no deeper than 40 feet. A great deal of mercury was lost from the gold-saving tables, and such inefficiencies plus the cost of coal would have been factors in the mine's closure in 1872.

The remains of the Duke of Edinburgh mine have been badly damaged by ploughing and roading and been used as a rubbish dump (I42/78, GR126355). There is no trace left of the battery and mine buildings. The reservoir is relatively intact, and the remains of a stone house (I42/79, GR128355) associated with the mine are still visible along with sod walled enclosures (Petchey 1996b: 5, 19).

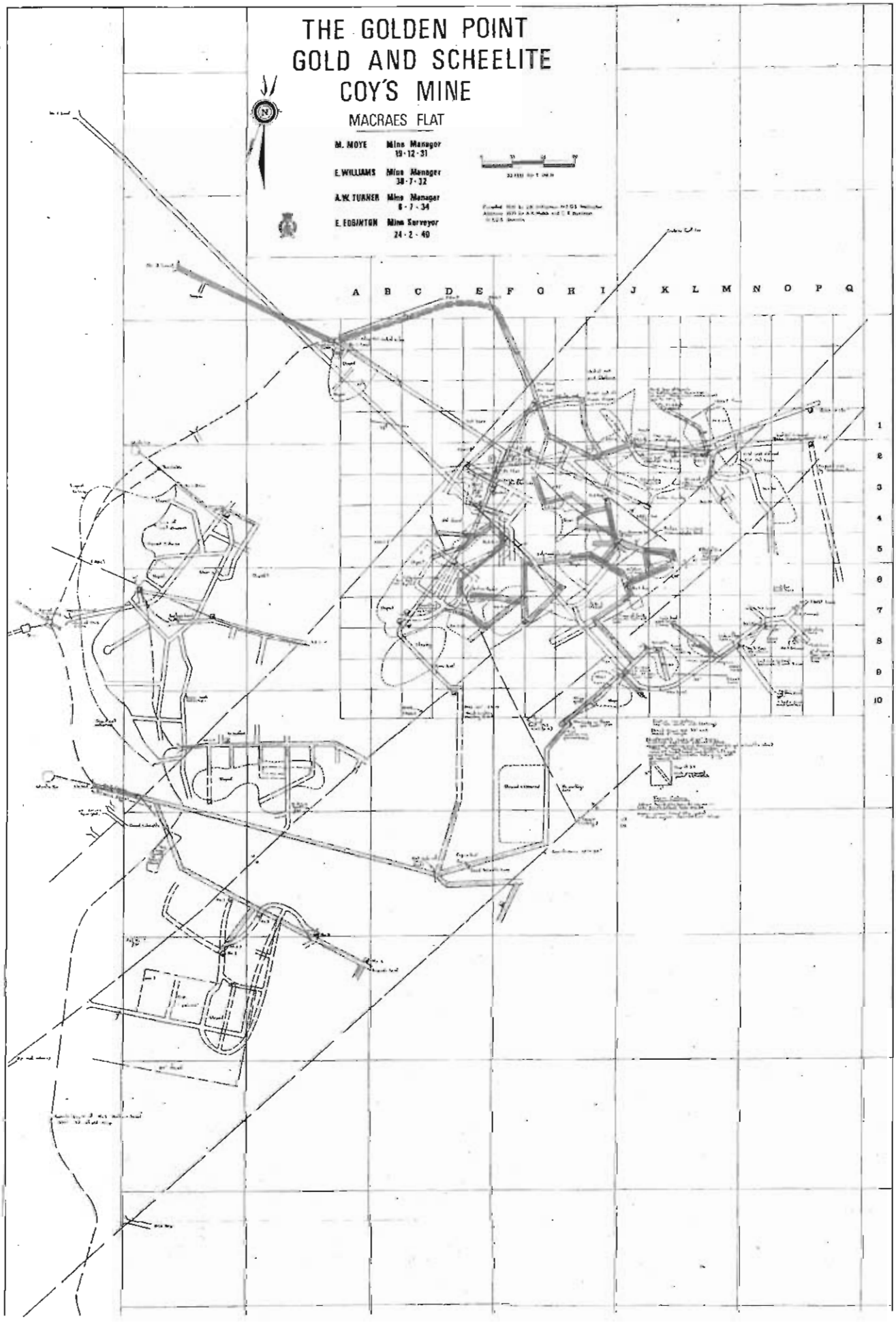
From west to east on the Macraes lodes, Williamson (1939: 88) lists: Bruhns, Mt Highlay, New Zealand Gold and Tungsten, Nunns, Coronation, Golden Bell, Deepdell, Maritana, Golden Point, Round Hill, Innes, Mills, Tates, Duke of Edinburgh and Golden Ridge. The Ounce and Golden Bar, and other small early 1900 mines along Stoneburn Road have been documented by Petchey (1994c-d, 1995a, 1997a). Virtually all the mines between and including Golden Bell and Golden Bar have either been or are being destroyed by open cast mining by Gold and Resource Developments. They are described in reports commissioned by the mining company, e.g. Hamel 1991b, 1992e, 1994d; Petchey 1994a-e, 1995a-d, 1996 a-g, 1997a-b.

The distinctive landscape features being produced by the modern open-cast mine—waste stacks and effluent ponds—stand in great contrast to the small-scale historic mining alongside at *Golden Point Reserve*. This Otago Goldfields Park site contains the only working and *in situ* battery (Callery's), complete with its building, power source (a kerosene engine), and Wilfley table, in the South Island. (The Government Battery at Coromandel is complete and in running order. The Willis Battery near Coromandel is also complete, but not in running order; Neville Ritchie pers. comm. 1997.) Callery's Battery was used as much for



The Callery Battery at Golden Point (*above*), the only battery in Otago to retain its original shed. The dray tracks from the Maritana Mine which used the battery at the turn of the century run around the hill to the far left. *Photograph: Peter Bristow*

The face of the large underground gold and scheelite mine at Golden Point (*right*), with numerous mullock heaps at the mouths of adits which ran deep into the hillside. This face has been destroyed by modern mining.


THE GOLDEN POINT
GOLD AND SCHEELITE
COY'S MINE
MACRAES FLAT
M. MOYE Mine Manager 19-12-31
E. WILLIAMS Mine Manager 30-7-32
A.W. TURNER Mine Manager 8-7-34
E. EGGINTON Mine Surveyor 24-2-40
A B C D E F G H I J K L M N O P Q
1 2 3 4 5 6 7 8 9 10

Golden Point Reserve. This is a complex site, with early mound and pothole tailings, ground sluicing, tunnelling in cemented gravels, and early 20th century hardrock mining. *Photograph: Kevin Jones, DOC*

A corrugated iron and a mud-brick hut at Golden Point, two of the many small huts occupied by the local miners. *Photograph: Peter Bristow*

scheelite processing as for gold, but both were produced from the very large underground mine system at Golden Point.

Mining began at Golden Point with some potholing in the bed of Deep Dell (I42/19), but it was not until 1890 that Donaldsons started operating a battery to crush cemented gravels lying on a high terrace. About 1904 they opened adits into the hard-rock reefs in the hillside, and operated the mine successfully for 20 years, taking out both gold and scheelite (I42/18). In the first decade of this century Donaldsons were the only exporters of scheelite in New Zealand, selling directly to Hamburg. They used a very primitive cyanide process to extract the gold in an ordinary reservoir instead of a concrete or metal tank (I42/52). About 1912 the battery was shifted by new owners to a site just downstream, and operated subsequently by various owners (including the Golden Point Gold and Scheelite Company) until 1944, extending the mine ever further into the hill. Only the foundations of the Golden Point Company battery remain, but their underground mine (on three levels) explored about two million cubic metres of rock. It was probably the largest underground gold and scheelite mine in Otago, and only the remote Tipperary Mine at Macetown and the Achilles at Bullendale may be similar in size and complexity (Hamel 1992e).

West of Callery's Battery, the simple tunnels of the Maritana Mine with inbuilt ore passes run into the hill (I42/17). Ore from this mine was originally processed at the turn of the century at a battery just downstream of Callery's and housed in a much larger building than the present one.[14] There was a complex history of removal and rebuilding of two batteries around the Maritana and Callery's sites, with finally the present battery being left in position (Hamel 1991b; Smith, P. 1990). In the 1930s the three Callery brothers used the battery to process ore from the Round Hill mines, which were a group of short tunnels to the east of Golden Point, but now destroyed by the modern mine. The parts of a Huntingdon mill from the Bonanza mine lies beside Callery's battery. This mill is similar to one used by the Donaldsons at one their other sites, and there are plans to restore it within the Reserve (P. Bristow pers. comm. 2000).

None of the other mines in the Macraes field are anywhere near the size of the Golden Point mines, but some have interesting features. Three medium-sized concrete tanks of a cyanide processing plant at Horse Flat (I42/14) were erected by the Deepdell Mining Company (1912–1924), probably to process ore from other mines in the district (Hamel 1994d). At Nenthorn, there are the remains of a bleak township of a few stone buildings and many sod foundations with numerous adits and shafts and an unusual battery site on a steep bank of Deighton Creek (Jacomb & Easdale n.d.). Mining here was brief (1888–1899).

[14] Unfortunately both the Golden Point and Maritana mines have been, or will be, almost entirely destroyed by modern open-cast mining.

Nenthorn. The rectangular banks are the outlines of yards or garden walls at the eastern end of the short-lived village.
*Photograph: Kevin Jones, DOC*

Though the town was short-lived, somebody at Nenthorn built this stone house (*right*) with great care and small stones. It was close to the school and may have been for the schoolmaster.

The ruins (*below*) of the St Bathans Hotel at Nenthorn.
*Photograph: Peter Bristow*

The geology of the field is best described by Williamson (1934, 1939). A brief archaeological survey identified sites on an aerial photograph, some of which were field checked (Jacomb & Easdale n.d.). The township is relatively undisturbed; since occupation was brief, the site would be a valuable source of comparative material for archaeological/historical research. Bonanza (Williamson 1939), an isolated lode west of Nenthorn, had a Huntingdon mill and other machinery which has been salvaged under threat of destruction and taken to Golden Point. It has a relatively deep mine with long tunnels, compared to similar mines east of Macraes, such as The Ounce and Golden Bar which were shallow and spread out laterally (P. Mason, Dunedin pers. comm. 1998). The latter are the best preserved of the smaller quartz mining complexes along the Macraes lode, being worked for about 30 years around the turn of the century (Petchey 1995a). Golden Bar is a particularly compact quartz mining system, with unusually clear surface evidence, including adits, dray tracks, races, dams, battery foundations, and hut sites. It is relatively undisturbed and, unlike The Ounce, easily accessible to the public. Both are under threat from modern mining.

## 9.6 OTHER FIELDS

The *Carrick* field runs up a broad spur from about 600 m to about 1060 m a.s.l. The lodes and their history since 1870 are complex. Smith, P. (1990) provides a summary of the mining history and describes some of the batteries. Quartzville at the foot of the main spur was a packers' town where loads were transferred from drays to pack horses for the steeper pull up to the mines. Like the similar township on the flats at Bendigo, little remains of Quartzville, and the house ruins are mostly higher on the spur or scattered through the gullies, along with

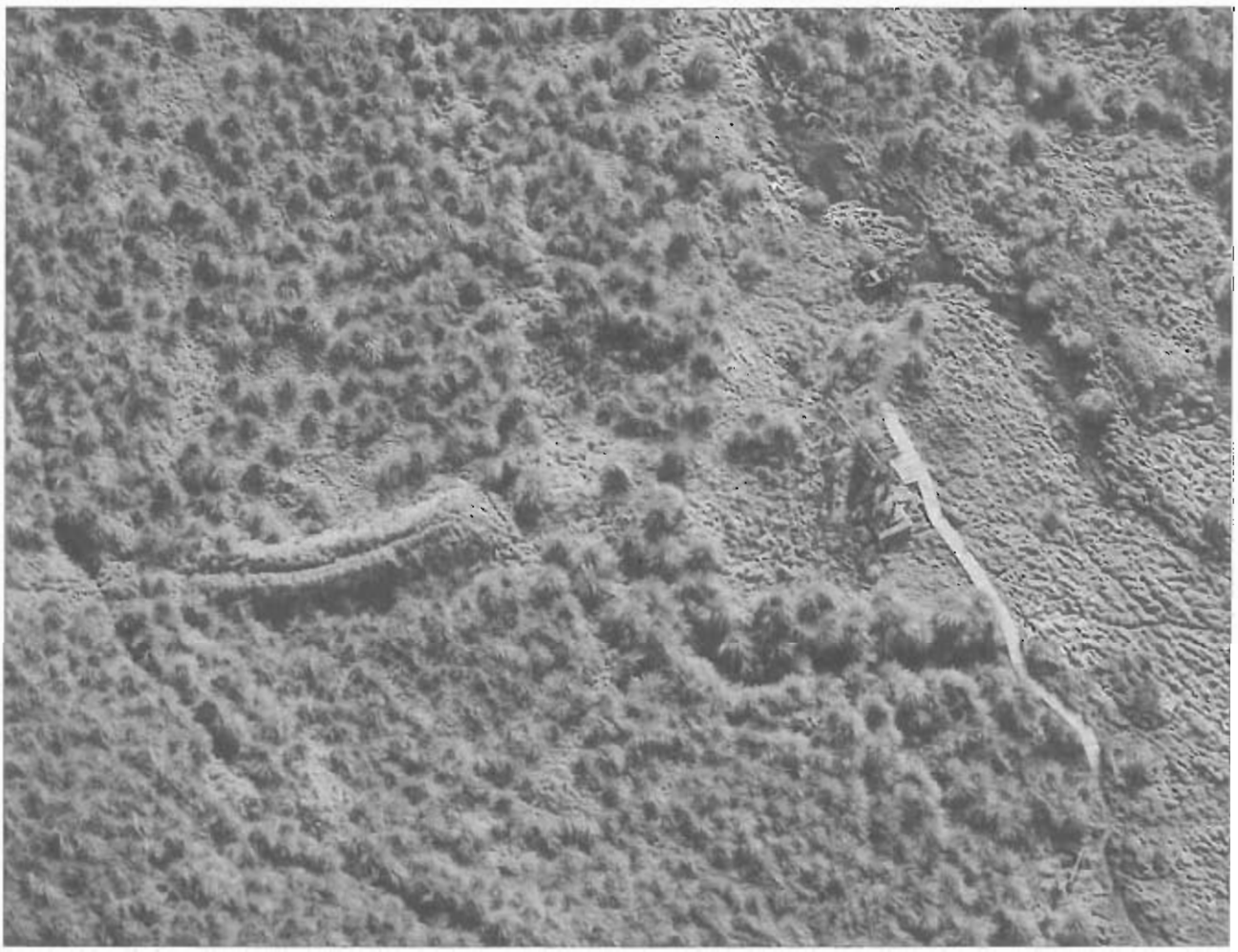
A massive collapsed adit of the Caledonian Mine, running under the Carricktown Road (*right*). The mullock heap from it lies high-right in the photograph of Battery Creek, on the left. *Photograph: DOC files, Dunedin*

The Carrick field (*above*) was long lived. This view from the west looks up Battery Creek towards the Carricktown Road. The mullock heaps are probably those of the Caledonian Mine at the top, and possibly the New Royal Sovereign, lower down. *Photograph: Peter Bristow*

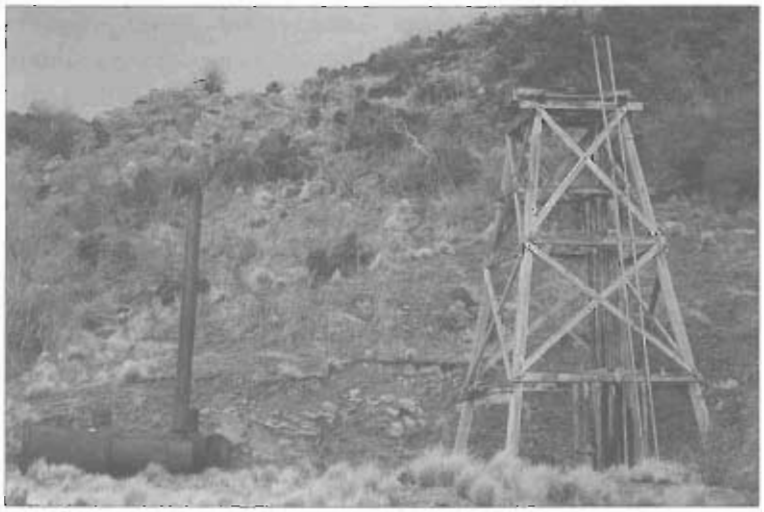
Large stone dams with carefully constructed outlets were built in Battery Creek as part of the water-control systems for the Carricktown batteries.

numerous adits, spoil heaps, battery platforms, and remains of machinery (Smith, P. 1990). Near the top of the range in the head of Adams Gully, a very large iron waterwheel, the Young Australian, is still standing, but separated from its battery, the ruins of which are on the opposite hillside. The very large and still functional Carrick water race (see above), built to provide water to Bannockburn and, in passing, to the waterwheel, runs along the boundary of the Otago Goldfields Park site which encloses the wheel and battery.

Other quartz mining areas which have been brought into the Otago Goldfields Park are the Golden Progress mine on the Oturehua lodes, and Pioneer Stream and OPQ on the Waipori lodes. The *Golden Progress* mine is notable for its intact wooden poppet head, a common feature of quartz mines which has rarely survived. This one was erected in 1928. The lignite-fired boilers and steam-



Canton Battery is set in swampy ground and a boardwalk has been constructed to it. A race runs round the hillside above it (left of photo) and a tram track runs from centre left towards the battery. The wheel for running a pump lies beside the creek beyond the battery. *Photograph: Kevin Jones, DOC*



The poppet head and two boilers at Golden Progress Mine near Oturehua. The boilers are probably lying in the position in which they worked to power a steam engine for running the winding gear on the poppet head.
*Photograph: Peter Bristow*

driven pump remains, but the 10-stamp battery was shifted to the Rise and Shine Creek near Bendigo in 1936. (The latter was dismantled in 1970, moved twice (Smith, P. 1990: 120), and is now in storage awaiting restoration.) The remains of the miners' houses and gardens surround the mine. The history and mining of the lodes is described in detail in Williamson (1939). Although the ore was relatively rich, the mines here were small.

The *Waipori* field is a large and complex one, with sites in the head of the Waitahuna River, in a broad band around Lake Mahinerangi west from Post Office Creek, and north into Lammerlaw Stream, Devils Creek, Stoney Stream, and the Waipori River (Site Record File maps). A major survey by Vincent (1978, 1979) of all the sites on the old Waipori Station (15,560 ha) when it was about to be subdivided into freehold farms, identified over 900 separate sites, mostly connected with alluvial mining in the hills around the main field, now hidden under Lake Mahinerangi. Quartz mines for gold and scheelite occur on lodes, grouped into four main areas: Pioneer Stream, Lammerlaw Stream, Stoney Stream, and Devils Creek.

The Shetland Reef, the OPQ mine, and its associated sites in Pioneer Stream, are important as the earliest quartz mines in Otago, the reef having been discovered in March 1862 and mining begun by early 1863 (Easdale & Jacomb n.d.). OPQ is also the largest Waipori quartz mine, worked to a depth of 280 feet (Williams 1974) and was operated intermittently until 1901. Little above-ground evidence remains at OPQ mine itself, but, within the OPQ reserve on the Canton Reef there is a battery and a waterwheel used for pumping. Other remains include the Victory waterwheel lying on its side in a bog at the lower end of the OPQ reef. The larger reserve in the head of Pioneer Stream and in Pipeclay Gully (Mitchells Flat) includes a complex race, dam and reservoir system, large areas of ground sluicing, and numerous hut sites, prospecting holes, and tracks. There is a historic record of hydraulic elevating at Mitchells Flat, but no field evidence of this technique was identified. Easdale & Jacomb (n.d.) provide an effective integrated sketch map of the workings, which includes those of Vincent's (1979) sites which could be relocated.

Though not well known, *Barewood* (south of Middlemarch) produced about 15,000 ounces of gold between 1890 and 1911 from a lode running for about 13 km parallel to the Taieri River (Williams 1974: 57). Ingram (1980) provides maps of claims, photographs of the main battery, poppet head, and some of the ground evidence surviving in 1980. The success of the field was due in part to the opening in 1890 of the Central Otago railway through the Taieri Gorge nearby, which provided easy transport to and from Dunedin. Ore was crushed at first at the big battery at Saddle Hill, which was later shifted to Flat Stream at the south end of the field. The entrances to the shafts are inconspicuous in rolling farmland, and the miners' houses merge with those of the farming community of the time. The foundations of three batteries are dispersed along

Barewood quartz mine, showing trenches and shafts aligned along the reefs. *Photograph: Kevin Jones, DOC*

the line of the reef, as well as the remains of the mine manager's house and some small houses, but there are no major industrial structures left (Hamel 2000c). In terms of invisibility, this successful mining operation is comparable to the large hydraulic elevating system of Deep Stream Amalgamated near Rocklands homestead (see section 8.4 above).

Quartz mining in Otago has left a wide range of sites from the remote locations of the Skippers and Dart Valleys to the rolling farmlands of eastern Otago. Several are of national importance, for both technological (e.g. Bullendale), and anthropological reasons (e.g. the relatively intact Golden Bar system). Active quartz mining in Otago covers more than a century from 1863 to the present day, providing much useful comparative material on social and industrial development in 19th and 20th century Otago communities.

# 10. Twentieth-century gold mining

By the beginning of the 20th century, the 19th century techniques of alluvial gold mining were becoming 'old-fashioned' by comparison with dredging and quartz mining. With capital being poured into new dredges and bigger batteries, there were some alluvial miners who quietly went on using the old work-intensive techniques of the 19th century. Since these alluvial sites were formed after 1900, they are not protected as archaeological sites under the Historic Places Act 1993. Some are sites which have been worked off and on by the same extended family for over 100 years. There are also sites which were the result of

Earnsclengh Flat Dredge tailings. The broad pale bands are the tracks of the Clutha Dredge formed in the middle of the 20th century. The dredge entered from the river just right of centre of the photograph. The darker ground between the pale bands and the river are the tailings left by two or three smaller dredges at the beginning of the century. *Photograph: Kevin Jones, DOC*

Doctors Point (*right*) in the Roxburgh Gorge. Machinery from 1930s mining includes this winch with a double-action pelton wheel.

Baileys Hill (*below*), Upper Nevis, and a 20th century building belonging to the McLean family, who have mined in the valley for several generations.

government-subsidised mining during the 1930s depression. Often these workings are difficult to distinguish from 19th century workings in the same field, and local information is often the only guide as to when they were formed.

A good example is at *Doctors Point* in the Roxburgh Gorge (Hamel 1992d). The workings lie in rough alluvium of an old slump, about 500 m long and 50 m high, poised above the river (S143/56, 79–84, 87–89, 92, 95–106, 108–111). Using small races from Shanty Creek, the material was sluiced out in wide pits, those at the northern end in the 1880s and in a high pit at the southern end by Jack Clark in the 1930s. Clark was on a steeper hillside than the earlier miners, and used a winch driven by a reversible pelton wheel to pull a hopper along a wire cable in order to dump spoil down slope out of the sluice pit. The winch and pelton wheel are still in place. Salmon (1963) provides a summary of many other interesting schemes, proposed and actual, which operated in the 1930s in Otago.

A holiday crib(?) built from, and hidden in the tail race of massive tailings in Drummonds Creek, Upper Nevis.

An example of a long-lived mining family is the Smiths. In the upper Shotover, the first Alfred Smith sluiced above the township and developed a river elevator, which the second Alfred Smith worked at Maori Point in the 1920s after the suction dredge there failed. His sons, Lawrence and Roland, sluiced until the Second World War, when Lawrence was 'man-powered' by the government to work in the scheelite mines at Glenorchy; Roland went into the army, only to be killed in New Guinea. There is a family tradition that Lawrence and Roland had found a rich seam in the upper Shotover before the war, but Lawrence could not find it afterwards (C. Smith, Dunedin pers. comm. 1998). A cousin, Jim, worked in the Arrow in the 1930s and carried a piano into the top of Hayes Creek (J. Reid, Arrowtown pers. comm. 1996). Though they improved their equipment, all three generations used the same basic techniques.

The 20th century miners in the Upper Nevis were particularly inventive in their use of 'home-made' electricity. This tractor (*right*) was used to run a generator to supply electricity at Baileys Hill.

A generator shed (*below*) and transformer of a minute hydro-electricity station above the Pactolus claim in the Upper Nevis.

The Adies near the Upper Nevis township have followed a pattern similar to that of the Smiths, and a family member still uses a house at the township as a holiday home. At Baileys Hill in the upper Nevis, a network of three family groups worked the complex alluvial faces—the Ellis family, who were Southland sheep farmers, and the Jones and McLean families. Two generations of McLeans worked from 1930 to 1991, improvising simple electric power systems which had been traditional in the valley since 1904 and using the 19th century water races. The McLeans still maintain holiday homes in this very remote valley (Hamel 1996d). Similar family patterns occur on nearly every major field.

Mining traditions were still sufficiently alive in the 1930s for the government to consider gold mining a suitable activity for the unemployed. The men were provided with a small wage (30 shillings a week for married men and 15 for single), which ceased once they had found the equivalent value in gold (Salmon 1963). About six to eight camps for men only were set up throughout Otago, partly as an effort to get unemployed and dissident men out of the towns (Olssen 1984). There were meant to be sufficient experienced miners among them to lead small parties out into the creeks prospecting, partly in hope of finding new fields.

The position of one such campsite has been identified from an old photograph, as lying in the gorge of the Lindis Valley above Faithfull's Bridge. When surveyed in 1990 only heaps of stone from chimneys and uneven ground marked the site on a terrace beside the river (Hamel 1990a). There was also a camp in the Lower Nevis, and most work was down on the western terraces. The men here seem to have been particularly inexperienced, judging by a quixotic effort to mine in the gorge below the Nevis Crossing (Hamel 1994a). A. and R. Brown used a small and novel hydro-electricity plant to carry out subsidised mining at Tuapeka Mouth in 1932 and 1933 (Hamel 1995e). There

were 714 men working around Clyde, Blackmans, and Conroys Gullies in 1933 and 622 in 1934, but the numbers dropped sharply after that.

There was some small-scale quartz mining carried on into the 20th century. The Unemployment Board in the 1930s subsidised some quartz mining, such as that at Conroys Reef, where a ball mill was brought in to crush quartz for about a year in 1936 (Hamel 1994c). The Rise and Shine lodes at Bendigo were worked on Government subsidy in the 1930s by two second-generation miners, Cameron and Logan (Hamel 1993a). Miners in ones and twos continued into the 1950s to mine scheelite at Glenorchy, using the State Battery, and at Golden Point using Callery's Battery. The Ounce and Golden Bar mines (Macraes) worked until 1937 and 1928, respectively (P. Petchey pers. comm. 1997).

These 20th century sites should not be disregarded. They have considerable historic value, because they show a continuity of tradition of mining life, often within the same extended family, and they are usually well-preserved. They pre-date the use of the bulldozer and backhoe, and can provide clear demonstrations of how the old water-powered, hand-tool methods were used.

# 11. The Chinese in Otago

In 1865 Otago storekeepers, and Dunedin businessmen generally, were disconcerted by the flight of their customers, the gold-rush miners, to the West Coast. The gold was there and there should be miners to mine it and buy their goods. The Dunedin Chamber of Commerce decided to encourage Chinese miners from Victoria to come to Otago where anti-Chinese feeling was less violent, though still present. By 1871 there were 2641 Chinese in Otago, virtually all gold mining, or providing services to their miners. Anti-Chinese feeling was sufficiently strong that they moved in groups and tended to live in separate 'camps'. By 1870 there were 100-300 Chinese in each of the townships of Arrowtown, Naseby, Macraes, Lawrence, Waipori, Nevis, Bannockburn, and Lawrence (Ritchie 1986: 17).

Some of their small townships, such as the one south of Lawrence, were established in the 1860s, with comfortable dwellings arranged along a street, with a cook shop, stores, and a gaming house. Unfortunately for the European shopkeepers, the Chinese were astute enough to set up importing businesses which brought in the foods, drink, and other materials from China that the miners were accustomed to. They did buy European goods as well, but their own familiar Chinese dried vegetables and rice whisky were very popular. By 1871 there was considerable opposition to the Chinese, but a Select Committee reported to the house that the Chinese miners were generally law-abiding, industrious, frugal, clean, of no special risk to morality of the community, and as a rule worked ground which 'would not pay the European miner' (Ritchie 1986: 21). Around the turn of the century, Reverend Alexander Don recorded his mission visits to the Chinese

The ruins of Chinese huts in Potters No 1 Creek running down into the Nevis. This field was worked during the gold rushes, but these huts belong the later period of settled mining.

of Otago and frequently had himself photographed with them in front of their dwellings.

The archaeological implications of these social processes were that:

- Chinese sites tend to be readily identifiable by Chinese ceramics.
- They are often grouped into camps and townships, though lone hut sites do occur.
- They often reworked tailings where they could get a small, but certain return, and are not generally associated with capital-intensive elevating and dredging, with the exception of Choie Sew Hoy and his associated workers.
- There is a good record of the numbers and whereabouts of Chinese, as well as photographs, during the 1880–1902 period, an unusual record for small-scale miners. Ng (1993) has not only analysed Don's records, but brought together other material in a detailed analysis of the Chinese in Otago.

Choie Sew Hoy was the exception to nearly every rule about the Chinese in Otago. He brought in capital, achieved success in the European world while maintaining his Chinese roots and traditions, was a dominant figure in dredging in the 1890s, and founded a family in Otago. He had interests in at least six mining properties, even before he and his son initiated a dredging boom in the 1890s with the innovative use of a steam dredge at Big Beach, below Arthurs Point on the Shotover (Ng 1993). Around 1895 the Sew Hoys shifted their activities to Nokomai, beginning by building the Roaring Lion race, which carried water out of Otago into Southland (Hamel 1991a) to the very large hydraulic sluicing claims in the Nokomai Valley. (The latter were to continue on a large scale into the 1930s, but they are part of the archaeology of the Southland Conservancy.)

Ritchie (1986) provides a detailed analysis of the archaeology of Chinese goldminers in Otago, along with descriptions of excavations of about 19 hut sites and rock shelters, as well as of two settlements at Arrowtown (Ritchie 1984) and Cromwell. Many of these have been flooded by hydro-electric development, but the Arrowtown settlement has been partially restored as an Otago Goldfields Park site. Ritchie (1986) provides meticulous information and illustrations of the artefacts from his excavations, which included many Chinese ceramics as well as European ceramics and bottles, metal match boxes, and domestic hardware.

A rock shelter turned into a small stone hut in Conroy's Gully. This one was occupied by Chinese and used for the film 'Illustrious Energy'. *Photograph: Peter Bristow*

Out of this work on Chinese sites, chronological markers have been developed for liquor bottles (Ritchie & Bedford 1983) and tin match boxes (Anson 1983; Bedford 1985). Ritchie showed that the Chinese were using European cutlery and utensils, as well as Chinese cleavers and woks, and that they were eating mutton, as well as the more traditional beef, pork, and poultry. There was a trend over time for more sheep meat to be eaten than pork, probably because of expense. Many European-packaged foods as well as potatoes were eaten, indications of some dietary

Ah Lum's store at Arrowtown. Ah Lum's is the only Chinese store left in Otago. *Photograph: Peter Bristow*

changes. From cut marks on the bones, it was apparent though that Chinese often followed their traditional cooking methods of chopping poultry and other bones up with a cleaver for stewing (Ritchie 1986: 635; Ritchie & McGovern-Wilson 1986). A useful comparison with the butchery methods of European miners was made by Hurley (1994), through an analysis of bone material from German Hill, Ida Valley. The other common markers of Chinese sites were game pieces, such as dominoes and counters, and opium pipes and smoking apparatus.

Ritchie (1986) endeavoured to discover whether or not there were distinctive features about the foundations of Chinese huts and the nature of the tailings left from their mining. He considered that there were some repetitive traits, such as the door being in a short end wall rather than in the middle of a long wall. Bristow (1994a) added to the sample size of identified Chinese huts and showed there was no significant correlation of door placement with markers such as Chinese ceramics. He concluded that lone Chinese men, working far from home, did not express their ethnicity through their hut designs, nor could he associate Chinese with any archaeologically distinctive technology, such as wing dams or tailings pattern. Hut design and use of wing dams were controlled far more by terrain and the amount of capital available than by ethnicity (Bristow 1994a: 109). An analysis of buttons and textiles from Ritchie's sites, along with photographic records, showed that the Chinese miners had also widely adopted European working clothes (Cameron 1985).

The archaeology of Chinese gold mining in Otago is a particularly interesting facet of historic archaeology, providing as it does information which is much less biased than contemporary written records were. Chinese are noted for their ability to retain their culture as a minority group in a foreign community. Their flexibility in conspicuous matters, such as hut styles, clothing and purchases of food, which show up in the archaeological record, but not in the archival writings, may provide useful clues as to how they achieve such integrity.

This mud brick house at Macraes was built by Gay Tan, a Chinese miner married to a European woman. The plaster over the mud bricks has been decorated around the front door.
*Photograph: Peter Bristow*

# 12. A new way of life

A system of sluice faces, the remains of a battery, and an early woolshed share one great advantage over the written word: they are not an interpretation of the action of a community now defunct, they were produced by that community. Their truths are of a different order from those of a contemporary newspaper reporter or of a later historian. This is why the archaeologist looks at the remains of 19th century mining with such respect, and takes the word of the sluice face over that of the goldfields' warden. Admittedly, the difficulties of interpretation can limit understanding—old stone fence posts left standing after the removal of the wires can baffle an outsider.

Gold and wool made Otago in the 19th century. Little recording has been done of the agricultural sites of Old New Zealand. The farmsteads of the big pastoral leases have been partly recorded and preserved, but the coastal and earliest farmsteads are poorly documented, other than some of the buildings. Early coal mines were numerous, but have been poorly recorded. The study of standing historic industrial buildings is not seen as the traditional field of the archaeologist in this country. Gold mining sites have been described in terms of location and technology used, but except for the close analysis of dwellings by Ritchie (1986), there has been little analysis of the way the sites were worked. The value of doing so is evident from Hood's (1990) analysis of the Pactolus Race and Petchey's (1996h) analysis of the Serpentine wheel and battery. In general, historic archaeology in New Zealand has been largely descriptive and locational, with little attention to syntheses, with the major exception of Ritchie's study of the Chinese in Otago. As Smith points out we need to look 'beyond the superficial familiarity of the sites and artefacts ... towards broader questions such as the diversity or lack of it within our society and the processes by which it has changed' (Smith, I. 1990: 101).

The recorders of European life in the 19th century not only interpreted what they saw according to their own viewpoint, they also omitted to describe much of community life. Domestic life was almost wholly ignored, though the paraphernalia of the colonial kitchen and bedroom fill every small-town museum. The small alluvial miner, lacking in capital, but washing thousands of cubic metres of the countryside into the river and sifting for himself an independence from the gravels, was rarely commented on. The logistics of farming life on the big runs was rarely mentioned, nor the management of the large farmsteads employing perhaps 100 people. The patterns of the 19th century farmsteads and the designs of the buildings provide useful evidence of a way of life that is very much changed. The Chinese were nearly invisible, except to be vilified by the local bigots. The remains of their dwellings and workings are a major source of our knowledge about them. Yet the ordinary miners, making up the bulk of the Otago population, were the people who were crafting a new way of living. In Belich's (1996) terms, it was the decent poor and middle-class respectables, rather than the gentry, who made up the bulk of the gold-mining population. Most were there for one reason—to make sufficient money to gain independence through buying their own land, house, or business.

In the process they also wanted to 'get on'. Belich (1996) points out some surprising developments in this process of upward mobility, which were

distinctly subversive of the old class system. Some decent poor simply wanted to enhance their familiar manner of living—more bread, more beer, and a larger hovel. Some adopted the good things of middle class life without leaving their own way of life as decent poor. Using their gold they built bigger houses on their small farms, owned horses, ate large quantities of meat, and dressed their women-folk in the latest fashions (especially hats) from Europe. It was also startling how many customs were shed in this process of re-defining the classes, e.g. domestic servants and tipping for minor services (Belich 1996: 329). They were not establishing 'an England writ small', or 'an Ireland across the sea', or even a blend of these social structures—they were establishing a new way of living. The process was greatly accelerated in Otago by the development of the goldfields, which transformed a beautiful wilderness, in which few human beings could make a living, into a series of lively communities, functioning in a rather less beautiful, but more complex, landscape. The big farmsteads encapsulated a way of life which to some degree looked back to the old kinship-based structures of feudal England. It was in the new townships and in Dunedin that a greater diversity of living could be explored and a new pattern established. The European archaeology of Otago has much to tell us about this process.

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# Appendix 1

## SELECTED NON-ARCHAEOLOGICAL RADIOCARBON DATES ON CHARCOAL FROM FOREST FIRES

| SITE | LAB. NO. | CONVEN -TIONAL AGE BP | CALIBRATED AGE 1 SIGMA (probability) | COMMENTS |
|---|---|---|---|---|
| Pisa Range | A428 | 810 ± 50 | 1231-1288 (1.0) | *Podocarpus hallii* Molloy et al. 1963 |
| Pisa Range | NZ~99 | 781 ± 49 | 1242-1300 (1.0) | *Podocarpus hallii* Grant-Taylor & Rafter 19~1 |
| Nevis Valley | NZ47 | 660 ± 60 | 1306-1365 (0.~3)<br>1375-1397 (0.27) | *Podocarpus totara* Molloy et al. 1963 |
| Silver Peaks | NZ89 | 650 ± 60 | 1306-1363 (0.70)<br>1376-1401 (0.30) | *Podocarpus totara* Molloy et al. 1963 |
| Maungatua Range | NZ48 | 620 ± 60 | 1309-135~ (0.58)<br>1382-1418 (0.42) | *Dacrydium biforme* Molloy et al. 1963 |

Calibrated according to Stuiver & Pearson (1993) with 40 year southern hemispheric offset.

# Appendix 2

## SELECTED RADIOCARBON DATES ON CHARCOAL FROM ARCHAEOLOGICAL SITES

Includes only dates from short-lived species and twigs.

| SITE | LAB. NO. | CONVEN -TIONAL AGE BP | CALIBRATED AGE 1 SIGMA (probability) | COMMENTS |
|---|---|---|---|---|
| Waitaki Mouth | NZ4636 | 620 ± 33 | 1326–1352 (0.50)<br>1361–1367 (0.07)<br>1389–1413 (0.43) | Anderson & McGovern-Wilson 1990 |
| Shag Mouth | NZ7734 | 781 ± 37 | 1226–1226 (0.01)<br>1244–1246 (0.02)<br>1257–1296 (0.97) | Anderson et al. 1996 |
| Shag Mouth | NZ7755 | 646 ± 47 | 1305–1307 (0.03)<br>1316–1371 (0.71)<br>1386–1406 (0.25) | Anderson et al. 1996 |
| Shag Mouth | NZ7756 | 670 ± 47 | 1300–1330 (0.40)<br>1347–1375 (0.38)<br>1375–1393 (0.22) | Anderson et al. 1996 |
| Shag Mouth | NZ7757 | 537 ± 44 | 1405–1447 (1.0) | Anderson et al. 1996 |
| Shag Mouth | NZ7758 | 580 ± 47 | 1330–1346 (0.23)<br>1393–1435 (0.77) | Anderson et al. 1996 |
| Shag Mouth | NZ7759 | 627 ± 40 | 1323–1354 (0.49)<br>1356–1368 (0.15)<br>1387–1412 (0.36) | Anderson et al. 1996 |
| Shag Mouth | NZ7760 | 582 ± 47 | 1330–1346 (0.25)<br>1393–1435 (0.75) | Anderson et al. 1996 |
| Shag Mouth | NZ7761 | 600 ± 50 | 1326–1352 (0.37)<br>1362–1366 (0.05)<br>1389–1429 (0.58) | Anderson et al. 1996 |
| Shag Mouth | NZ7762 | 647 ± 47 | 1305–1308 (0.05)<br>1316–1335 (0.24)<br>1335–1371 (0.46)<br>1386–1405 (0.25) | Anderson et al. 1996 |
| Shag Mouth | NZ7763 | 592 ± 48 | 1327–1350 (0.33)<br>1390–1433 (0.67) | Anderson et al. 1996 |
| Shag Mouth | NZ7771 | 660 ± 46 | 1302–1332 (0.39)<br>1342–1373 (0.42)<br>1380–1395 (0.19) | Anderson et al. 1996 |
| Shag Mouth | NZA887 | 626 ± 95 | 1301–1374 (0.63)<br>1378–1420 (0.37) | Anderson et al. 1996 |
| Shag Mouth | NZA888 | 585 ± 93 | 1303–1372 (0.50)<br>1383–1442 (0.50) | Anderson et al. 1996 |
| Shag Mouth | WK2589 | 630 ± 35 | 1324–1354 (0.51)<br>1357–1368 (0.13)<br>1388–1410 (0.36) | Anderson et al. 1996 |
| Hawksburn | NZ5044 | 692 ± 33 | 1295–1325 (0.52)<br>1353–1360 (0.09)<br>1367–1388 (0.38) | Anderson 1981a |
| Hawksburn | NZ5045 | 709 ± 33 | 1289–1322 (0.62)<br>1355–1356 (0.01)<br>1368–1387 (0.37) | Anderson 1981a |
| Hawksburn | NZ5046 | 714 ± 33 | 1287–1321 (0.65)<br>1369–1387 (.35) | Anderson 1981a |

| SITE | LAB. NO. | CONVEN -TIONAL AGE BP | CALIBRATED AGE 1 SIGMA (probability) | COMMENTS |
|---|---|---|---|---|
| Hawksburn | NZ5047 | 611 ± 33 | 1327-1351 (.46)<br>1364-1365 (.01)<br>1390-1417 (.52) | Anderson 1981a |
| Hawksburn | NZ5048 | 691 ± 33 | 1295-1326 (.51)<br>1353-1360 (.11)<br>1367-1388 (.38) | Anderson 1981a |
| Hawksburn | NZ5049 | 652 ± 33 | 1305-1312 (0.10)<br>1316-1333 (0.26)<br>1339-1371 (0.46)<br>1385-1398 (0.18) | Anderson 1981a |
| Hawksburn | NZ5050 | 720 ± 33 | 1285-1319 (0.66)<br>1370-1386 (0.34) | Anderson 1981a |
| Hawksburn | NZ5051 | 668 ± 33 | 1302-1329 (0.42)<br>1347-1373 (0.40)<br>1379-1392 (0.18) | Anderson 1981a |
| Hawksburn | NZ5052 | 663 ± 28 | 1303-1330 (0.41)<br>1346-1372 (0.44)<br>1382-1393 (0.15) | Anderson 1981a |
| Rockfall I | NZ4972 | 674 ± 59 | 1297-1330 (0.42)<br>1346-1393 (0.58) | Ritchie 1982a |
| Coal Creek | NZ6855 | 655 ± 40 | 1304-1333 (0.38)<br>1340-1372 (0.42)<br>1383-1397 (0.18) | Anderson 1991a |
| Dart Bridge | NZ5324 | 587 ± 56 | 1327-1351 (0.32)<br>1364-1365 (0.01)<br>1390-1436 (0.67) | Anderson & Ritchie 1986 |
| Dart Bridge | NZ5325 | 723 ± 57 | 1281-1326 (0.59)<br>1352-1362 (0.11)<br>1366-1389 (0.30) | Anderson & Ritchie 1986 |
| Long Beach | NZ4702 | 305 ± 82 | 1493-1603 (0.46)<br>1612-1679 (0.31)<br>1763-1805 (0.17) | Hamel & Leach 1979 |
| Long Beach | NZ4704 | 476 ± 56 | 1423-1500 (0.82)<br>1511-1516 (0.04)<br>1599-1618 (0.14) | Hamel & Leach 1979 |
| Long Beach | NZ4701 | 710 ± 57 | 1286-1327 (0.54)<br>1351-1364 (0.14)<br>1365-1390 (0.32) | Hamel & Leach 1979 |
| Pounawea | NZ5031 | 582 ± 70 | 1324-1354 (0.31)<br>1357-1368 (0.08)<br>1388-1440 (0.62) | Anderson 1991a |
| Pounawea | NZ5032 | 816 ± 77 | 1161-1172 (0.05)<br>1189-1298 (0.95) | Anderson 1991a |
| Papatowai | NZA1415 | 577 ± 57 | 1327-1350 (0.28)<br>1390-1439 (0.72) | Anderson & Smith 1992 |
| Papatowai | WK1761 | 650 ± 45 | 1305-1314 (0.12)<br>1316-1334 (0.24)<br>1338-1371 (0.44)<br>1385-1401 (0.21) | Anderson & Smith 1992 |
| Papatowai | WK1762 | 640 ± 45 | 1317-1370 (0.71)<br>1386-1408 (0.29) | Anderson & Smith 1992 |

Calibrated according to Stuiver & Becker (1993) with 40-year southern hemispheric offset (Vogel et al. 1993)

# Appendix 3

## RECORDS OF EARLY SITES WITH MOA BONE OR EGG SHELL

See Anderson (1989: appendix D) for identified remains of moas. Sites which have probably been destroyed are marked D.

| SITE RECORD | NAME | EVIDENCE | REFERENCE |
|---|---|---|---|
| E40/2 | Dart Bridge | Bones, ovens, etc. | Anderson & Ritchie 1986 |
| E41/6 | Wyuna Koch | Ovens, flakes | Record form |
| F41/1, 66 | Owens Ferry | Bones, ovens, greenstone | Kooyman 1984 |
| F42/4 | Glenaray | Bones, hearths | Anderson 1980a |
| F42/7 | Nevis D | Bones, ovens | George 1937 |
| G39/2 | Dingleburn D | Ovens and adzes | Record form |
| G41/1 | Parkburn D | Charcoal and eggshell | Record form. |
| G41/368 | Cornish Point D | Oven, silcrete blades | Record form |
| G41/453 | Rockfall I/II D | Bones, ovens, etc. | Ritchie 1982a |
| G42/2 | Fruitlands D? | Bones, large number of flakes | Record form |
| G42/13 | Hawksburn | Bones, ovens, huts,etc. | Anderson 1989 |
| G42/183 | Italian Creek D | Eggshell, hearths, etc. | Ritchie 1982a |
| G43/51 | Coal Creek | Bones, ovens, flakes | Anderson & Ritchie 1984 |
| G43/105 | Minzionburn spur | Bones, ovens, flakes | Record form |
| G43/120 | Minzionburn | Bones, ovens, artefacts | Record form |
| G44/1 | Beaumont | Bones, ovens, artefacrs | Record form |
| G44/10 | Millers Flat | Bones, ovens, artefacts | Record form |
| G47/50 | Papatowai | Bone, ovens, flakes | Anderson & Smith 1992 |
| G47/51 | Kings Rock | Bone, shell, flakes | Hamel 1977a |
| G47/52 | Tautuku Peninsula | Bone, ovens, flakes | Lockerbie 1959 |
| G47/64 | Tautuku Point | Bone, shell, flakes | Hamel 1977a |
| G47/65 | Tautuku North | Bone,shell, charcoal | Hamel 1977a |
| G47/71 | Waitangi Stream | Bone, shell, ovens | Hamel 1977a. |
| G47/73 | Long Point | Bone,charcoal, shells | Hamel 1977a |
| G47/83 | Waipati Beach | Bone, shell | Hamel 1977a |
| H41/3 | Hills Creek D? | Bones, ovens, flakes | Reeord form |
| H41/7 | Oturehua flats | Ovens, silcrete blades | Record form |
| H42/4 | Ida Valley Station D | Bones, flakes | Record form |
| H42/3 | Puketoi D | Ovens, bones | Record form, Murison 1872 |
| H42/7 | Oliverburn D | Silcrete blades, charcoal | Record form |
| H42/8 | Pigeon Rock D | Silcrete blades | Reeord form |
| H43/1 | German Jaeks D | Ovens, bones, silcrete blades | Record form |
| H43/9 | Rocklands | Bones, ovens, artefacts | Record form . |
| H43/14, 16, 18 | Paerau | Bones, artefacts | Record forms |
| H43/40 | Matarae | Bones, artefacts, shelter | Record form. |
| H44/8 | Deep Stream | Bones, ovens, artefacts | Record form |
| H46/2 | Nugget Point | Bones, shell | Hamel 1977a |
| H46/3 | Clutha Mouth | Bones, charcoal | Hamel 1977a |
| H46/10 | Kaka Point | Boncs, shell | Searlett 1974; Hamel 1977a |
| H46/28 | Cannibal Bay | Bones, eggshell, flakes | Hamel 1977a |
| H46/- | Toko Mouth | ? | Anderson 1989: 142 |
| H47/1 | Pounawea D | Bone, ovens, flakes | Hamel 1980 |
| H47/2 | Hinahina | Bone, shells, etc. | Hamel 1977a |
| H47/6 | False Island | Bone, shell. flakes | Hamel 1977a, Scarlett 1974 |
| I40/8 | East Takiroa | Bone, eggshell,artefacts | Record form |
| I40/9 | Takiroa shelter | Bone, rock art | Record forms, Peterson 1962 |

| SITE RECORD | NAME | EVIDENCE | REFERENCE |
|---|---|---|---|
| I40/18 | Maerewhenua | ?Bone | Peterson 1962 |
| I40/42 | Otekaieke | Ovens, bones | Record form |
| I41/5 | Kyeburn | Ovens, bones, tools | Record form |
| I41/29 | Awamoko Stream | Moa bone, eggshell | Record form |
| I43/4 | Seacliff | Bones, ovens, shell | Blake-Palmer 1956 |
| I43/22 | Ross's Rocks | Tracheal ring, charcoal, shell | Record form |
| I43/59 | Puketiraki | Bones, shell, tools | Record form |
| I43/60 | Puketiraki | Bones, shell | Record form |
| I43/51 | Nenthorn | Bones, shell, flakes | Easdale & Jacomb 1986 |
| I44/1 | Omimi | Bones, charcoal. | Record forms, Hamel 1977b |
| I44/5 | Orokia Mouth | Bones, adze preforms | Record form, von Haast 1879 |
| I44/10 | Kaikorai Mouth | Bones, shells, oven | Harding 1957 |
| I44/13 | Hoopers Inlet | Bones, flakes | Record form, Worthy 1999 |
| I44/20 | Murdering Beach | Bones, ovens, flakes | Record forms |
| I44/21 | Purakanui | Bones, fish, flakes | Anderson 1981b |
| I44/23 | Long Beach | Bones, ovens, flakes | Leach & Hamel 1981 |
| I44/76 | Harwood | Bones, ovens | Record forms |
| I44/68 | Sandfly Bay | Bone, ovens, flakes | Record form |
| I44/121 | St Clair | Bones, charcoal | Teviotdale 1932: 101 |
| I44/127 | Kaikai Beach | Bones, ovens | Lockerbie 1959; Scarlett 1974 |
| I44/172 | Andersons Bay | Bone, shell, adzes | Teviotdale 1932; Scarlett 1974 |
| I44/177 | Warrington | Bones, ovens, flakes | Record forms |
| I44/182 | Doctors Point | Bone, shell, flakes | Record form |
| I44/- | Waitati Mouth | | Anderson 1989: 142 |
| I44/- | Te Waiparapara | | Anderson 1989: 142 |
| I45/14 | Teviotdales Cave | Bone, eggshell | Teviotdale 1931 |
| I45/11 | Taieri Mouth | Bones, adzes, shell | Record form |
| J41/3 | Awamoa | Bone, ovens, artefacts | Mantell 1853, record forms |
| J41/9 | Whitstone shelter | Bones, rock art, artefacts. | Record form |
| J41/56 | Waitaki Mouth | Bones, ovens, artefacts | Anderson 1989: 131 |
| J41/71 | Beach Road | Bone, oven, shell | Record form |
| J41/75 | Cape Wanbrow | Bones, ovens, charcoal | Record form |
| J42/1 | Tai Rua | Bones. ovens, artefacts | Trotter 1967b, 1979 |
| J42/2 | Ototara | Bones, artefacts | Trotter 1965, 1967b |
| J42/3 | Kakanui Road | Bone, ovens, shell | Record forms |
| J42/4 | Kakanui nth bank | Bone, shell, artefacts | Weisler et al. 1996 |
| J42/18 | Waimataitai Sth | Bone, ovens, shell | Trotter 1965 |
| J42/22 | Waianakarua Sth | Bone, ovens, artefacts | Record forms |
| J42/23 | Bow Alley Creek | Bone, ovens, aretfacts | Record forms |
| J42/26 | Trotters Creek | Bones, ovens, shell artefacts | Record form |
| J42/28 | Waianakarua Bluff | Bone, shell, artefacts | Record forms |
| J42/31 | Hampden | Bone, shell, artefacts | Record forms, Trotter 1967b |
| J42/35 | Waiwherowhero | Bone, ovens, shell. | Record form |
| J42/38 | Waimataitai Nth | Bone, shell, artefacts | Record form, Trotter 1967b |
| J42/63 | Katiki Beach | Bone, shell | Anderson 1989: 142 |
| J43/1 | Pleasant River | Bones, ovens, flakes | Smith 1999 |
| J43/2 | Shag Mouth | Bone, shell, everything | Anderson et al. 1996 |
| J43/3 | Stoney Creek lagoon | Shell, ovens | Record form |
| J43/4 | Tumai | Bones, shell, flakes | Allingham pers. comm. |
| J43/- | Glenpark | Bones, ovens | Anderson 1989: 142 |
| J44/1. | Little Papanui | Bones, ovens, flakes | Teviotdale 1932 |
| J44/2 | Pipikaretu | Bone, ovens, artefaets | Record form, McLaurin ms |
| J44/8 | Little Papanui nth | Bone, charcoal | Record form |
| J44/42 | Papanui north | Bones, sbell | Record form |
| J44/47 | Papanui Inlet | Bones, artefacts | Record form |
| J44/82 | Cecily Beach | Bones, shells, oven | Record form |
| J44/- | McKays Beach | ? | Anderson 1989: 142 |

# Appendix 4

## ARCHAEOLOGICAL SITES CONTAINING IDENTIFIED SMALL-BIRD BONES

Most of the information is from McGovern-Wilson 1986. D marks sites which have been destroyed.

| SITE RECORD | NAME | OTHER EVIDENCE | OTHER REFERENCES |
|---|---|---|---|
| F41/66 | Owens Ferry | Moa bones, ovens, greenstone | Kooyman 1984 |
| G41/453 | Rockfall II D | Moa bones, ovens, etc. | Ritchie 1982a |
| G42/13 | Hawksburn | Moa bones, ovens, huts, etc. | Anderson 1989 |
| G42/183 | Italian Creek D | Moa eggshell, hearths, etc. | Ritchie 1982a |
| G43/51 | Coal Creek | Bones, ovens, flakes | Anderson & Ritchie 1984 |
| G47/50 | Papatowai | Moa bone, ovens, flakes | Anderson & Smith 1992 |
| G47/51 | Kings Rock | Moa bone, shell, flakes | Hamel 1977a |
| G47/64 | Tautuku Point | Moa bone, shell, flakes | Hamel 1977a |
| H42/3 | Puketoi D | Ovens, moa bones | Record form, natural also |
| H46/28 | Cannibal Bay | Moa bones, eggshell, flakes | Hamel 1977a |
| H47/1 | Pounawea D | Moa bone, ovens, flakes | Hamel 1980 |
| I40/8 | Near Takiroa | Moa bones, artefacts | Record form, weka only |
| I43/1 | Huriawa | Pa, terraces, etc. | Leach 1969 |
| I43/4 | Seacliff | Moa bones, ovens, shell. | Blake-Palmer 1956 |
| I43/22 | Ross's Rocks | Moa tracheal rings, charcoal, shell | Record form |
| I44/1 | Omimi | Moa bones, charcoal | Record forms, Hamel 1977b |
| I44/17 | Mapoutahi | Pa, artefacts | Anderson & Sutton 1973 |
| I44/20 | Murdering Beach | Moa bones, ovens, flakes | Record forms |
| I44/21 | Purakanui | Moa bones, fish, flakes | Anderson 1981b |
| I44/23 | Long Beach | Moa bones, ovens, flakes | Leach & Hamel 1981 |
| I44/177 | Warrington | Moa bones, ovens, flakes | Record forms |
| J41/3 | Awamoa | Moa bones, ovens, artefacts | Trotter 1980, Record forms |
| J41/9 | Whitstone shelter | Moa bones, art, artefacts. | Record form |
| J41/56 | Waitaki Mouth | Moa bones, ovens, artefacts | Anderson 1989 |
| J42/1 | Tai Rua | Moa bones, ovens, artefacts | Trotter 1979 |
| J42/2 | Ototara | Moa bones, artefacts | Trotter 1965 |
| J42/18 | Waimataitai Sth | Moa bone, ovens, shell | Trotter 1965 |
| J42/20 | Katiki Point | Terraces, dog and seal bone | Trotter 1967a |
| J43/1 | Pleasant River | Moa bones, ovens, flakes | Smith 1999 |
| J43/2 | Shag River Mouth | Moa bone, shell, everything | Anderson et al. 1996 |
| J43/4 | Tumai | Moa bone, seal, flakes | Allingham pers. comm. |
| J44/1 | Little Papanui | Moa bones, ovens, flakes | Teviotdale 1932 |
| J44/4 | Taiaroa Head | Pa, fish, etc. | Leach & Hamel 1978 |
| J44/47 | Papanui Inlet | Bones, artefacts | Record form |
| J44/117 | Papanui Beach | Midden, artefacts, etc. | Davies 1980 |

# Appendix 5

## ARCHAEOLOGICAL SITES CONTAINING IDENTIFIED MARINE MAMMAL BONE

(from Smith 1985)

| SITE RECORD | NAME | FUR SEAL | SEA LION | ELEPHANT | LEOPARD SEAL | CETACEAN SEAL |
|---|---|---|---|---|---|---|
| **North Otago** | | | | | | |
| J41/3 | Awamoa | x | | | | |
| J41/7 | Kaiararo Stream | x | | | | |
| J41/56 | Waitaki River Mth | x | | x | | |
| J41/75 | Bushey Beach | x | | | | |
| J42/1 | Tai Rua | x | | | | x |
| J42/2 | Ototara Glen | x | | | | |
| J42/19 | Katiki Point | x | | | | |
| J42/20 | Katiki Point | x | | | | |
| J42/21 | Tawhiroko Midden | x | | | | |
| J42/17 | Waianakarua | x | | | | |
| J42/29 | Lookout Bluff | x | | | x | |
| J42/30 | Boat Harbour Bay | x | | | | |
| J42/33 | Moeraki Point | x | | | | |
| J42/38 | Waimataitai | x | | | | |
| J43/1 | Pleasant River Mouth | x | x | x | | x |
| J43/2 | Shag River Mouth | x | x | | | |
| J43/4 | Tumai | x | | | | x |
| J43/8 | Pleasant River West | x | | | | |
| **East Otago** | | | | | | |
| I43/1 | Huriawa | x | | | | |
| I43/4 | Seacliff | x | | | | |
| I43/13 | Waikouaiti golf course | x | | | | |
| I43/22 | Ross's Rocks | x | | | | x |
| I44/1 | Omimi | | | | x | |
| I44/5 | Otokia Mouth | x | x | x | | x |
| I45/6 | Reid Strm bridge | x | | | | |
| I44/13 | Hoopers Inlet | x | x | x | | |
| I44/17 | Mapoutahi | x | | | | |
| I44/21 | Purakanui | x | | x | | |
| I44/1?? | Warrington | x | x | | | |
| I44/23 | Long Beach | x | x | x | x | |
| I44/172 | Andersons Bay | x | | | | x |
| J44/1 | Little Papanui | x | | | | x |
| J44/8 | Papanui Beach | x | x | | | |
| J44/3 | Tarewai Point | x | | | | |
| J44/?? | Pukekura Pa | x | | | | |
| J44/?9 | Mt Charles | x | | | | |
| J44/ | Cape Saunders | x | | | | |

*Continued next page >*

| SITE RECORD | NAME | FUR SEAL | SEA LION | ELEPHANT | LEOPARD SEAL | CETACEAN SEAL |
|---|---|---|---|---|---|---|
| South Otago | | | | | | |
| G47/38 | Waipati Estuary | x | | | | |
| G47/50 | Papatowai | x | x | x | x | |
| G47/51 | Kings Rock | x | | | x | |
| G47/64 | Tautuku Pt | x | x | | | |
| G47/65 | Tautuku Beach Nth | x | | | | |
| G47/72 | Waitangi Stream east | x | | | | |
| G47/73 | Long Point | x | | | | |
| H46/3 | Kaka Point | x | | | | |
| H46/18 | Nugget Point | x | | | | |
| H46/28 | Cannibal Bay | x | x | | | |
| H47/1 | Pounawea | x | x | x | | |

# Appendix 6

## ARCHAEOLOGICAL SITES CONTAINING FRESHWATER MUSSELS

| SITE RECORD | NAME | TYPE | REFERENCE |
|---|---|---|---|
| E40/10 | Diamond Lake | Midden | Record form |
| G42/183 | Italian Creek | Rockshelter | Ritchie 1982a |
| G43/47 | Lake Onslow | Midden? | Record form |
| G43/115 | Oven Hill, Millers Flat | Ovens, midden and in Minzion Creek | Record form |
| H42/3 | Puketoi | Ovens, middens | Record form |
| H43/5 | Middlemarch | Near cache | Record form |
| I40/35 | Duntroon | Rock shelter | Record form |
| I41/16 | Duntroon | Rock art | Record form |
| I41/17 | Duntroon | Rock art | Record form |
| I41/28 | Awamoko | Rock art, artefacts, moa bone | Record form |
| I41/29 | Duntroon | Moa bone | Record form |
| I41/30 | Duntroon | Rock shelter | Record form |
| I41/31 | Duntroon | Rock shelter | Record form |
| I41/34 | Duntroon | Rock shelter | Record form |
| I41/35 | Duntroon | Rock shelter | Record form |
| I41/37 | Duntroon | Rock shelter | Record form |
| I41/72 | Duntroon | Midden | Record form |
| I41/63 | Duntroon | Rock art | Record form |
| I44/17 | Mapoutahi | Pa | Anderson & Sutton 1973 |
| J41/43 | Duntroon | Rock shelter | Record form |
| J42/1 | Tai Rua | Moa hunter site | Trotter 1979 |
| J42/2 | Ototara | Moa bones | Record form |

# Appendix 7

## ARCHAEOLOGICAL SITES CONTAINING IDENTIFIED KIORE AND KURI BONES

| SITE RECORD | KIORE | KURI | NAME OR LOCATION OF SITE | REFERENCE |
|---|---|---|---|---|
| G42/13 | x | x | Hawksburn | Anderson 1989 |
| G42/183 | x | | Italian Creek | Ritchie 1982a |
| I43/1 | | x | Huriawa | Leach 1969 |
| I43/4 | | x | Seacliff moa site | Blake-Palmer 1956 |
| I43/22 | x | | Ross's Rocks | Till 1984 |
| I43/63 | | x | Brions Point | Record form |
| J41/9 | x | x | Whitstone shelter | Record form |
| J41/66 | x | | Oamaru south | Record form |
| J42/1 | x | x | Tai Rua | Trotter 1979 |
| J42/2 | | x | Ototara | Trotter 1965 |
| J42/4 | | x | Kakanui | Weisler & Somerville-Ryan 1996 |
| J42/18 | | x | Waimataitai lagoon | Trotter 1965 |
| J42/19 | | x | Katiki Point nth of reserve | Record form |
| J42/20 | | x | Katiki Point pa site | Record form |
| J42/21 | | x | Tawhiroko | Record form |
| J42/31 | | x | Big Kuri Creek | Record form |
| J42/52 | | x | Moeraki Contact period site | Record form |
| J43/1 | x | x | Pleasant River | Smith 1999 |
| J43/4 | x | x | Tumai | Allingham pers. comm. |
| **Catlins Coast** | | | | |
| G47/50 | x | x | Papatowai Point | Hamel 1977a |
| G47/51 | | x | Kings Rock | Hamel 1977a |
| G47/52 | x | | Tautuku Peninsula | Hamel 1977a |
| G47/64 | x | | Tautuku Point | Hamel 1977a |
| G47/73 | | x | Long Point | Hamel 1977a |
| H46/18 | x | | Tirohanga | Record form |
| H47/1 | x | x | Pounawea | Hamel 1980 |
| H46/28 | x | x | Cannibal Bay | Hamel 1977a |

# Appendix 8

## SELECTED DATES FROM UMU-TI

(after Fankhauser 1992)

| SITE ID | SITE RECORD | N.Z. NO. | CONVENTIONAL $C^{14}$ AGE | CALIBRATED AGE 1 SIGMA (probability) |
|---|---|---|---|---|
| BB423 | S127/141 | NZ6209 | 675 ± 30 | 1301-1327 (0.43) |
| | | | | 1350-1374 (0.38) |
| | | | | 1377-1390 (0.19) |
| MP1 | S127/138 | NZ6210 | 609 ± 34 | 1327-1351 (0.45) |
| | | | | 1365-1365 (0.01) |
| | | | | 1390-1419 (0.54) |
| MP2 | S127/139 | NZ6409 | 718 ± 34 | 1285-1321 (0.66) |
| | | | | 1369-1387 (0.34) |
| TTHO | S101/65 | NZ6364 | 657 ± 29 | 1304-1332 (0.40) |
| | | | | 1342-1371 (0.45) |
| | | | | 1384-1395 (0.15) |
| UHTO | S128/6 | NZ6208 | 560 ± 29 | 1409-1435 (1.0) |
| WO5 | S127/147 | NZ6212 | 392 ± 29 | 1494-1527 (0.32) |
| | | | | 1560-1605 (0.45) |
| | | | | 1607-1630 (0.23) |
| WO6 | S127/147 | NZ6393 | 588 ± 34 | 1332-1343 (0.25) |
| | | | | 1394-1428 (0.75) |
| WO7/1 | S127/142 | NZ6171 | 509 ± 46 | 1413-1453 (0.79) |
| | | | | 1459-1476 (0.21) |
| WO7/2 | S127/142 | NZ6211 | 589 ± 34 | 1331-1344 (0.25) |
| | | | | 1394-1427 (0.75) |
| R2D2 | S101/64 | NZ629? | 647 ± 30 | 1318-1334 (0.25) |
| | | | | 1337-1370 (0.50) |
| | | | | 1386-1404 (0.25) |
| GSDO | S127/159 | NZ6300 | <250 | <AD 1660 |
| HVA | S127/162 | NZ6166 | <250 | <AD 1660 |
| HVB | S127/162 | NZ6411 | <250 | <AD 1660 |
| SDO | S127/159 | NZ6170 | <250 | <AD 1660 |

Calibrated according to Stuiver & Becker (1993) with 40-year southern hemispheric offset.

| THERMO-LUMINESCENCE DATES | | CONVENTIONAL $C^{14}$ AGE | CALIBRATED AGE (1 SD) |
|---|---|---|---|
| ASO | S118/9 | 625 ± 112 | 625 (737-513) |
| DLO | S118/15 | 671 ± 71 | 671 (742-600) |
| TO | S118/10 | 586 ± 88 | 586 (674-498) |
| LHO-2 | S127/160 | 373 ± 100 | 373 (472-273) |
| WO5 | S127/147 | 432 ± 67 | 432 (499-465) |
| SDO | S127/159 | 225 ± 31 | 225 (256-206) |

# Appendix 9

## SITES OF ROCK SOURCES AND FLAKING FLOORS

| SITE RECORD | NAME | MATERIAL | REFERENCE |
|---|---|---|---|
| E40/2 | Slip Stream | Greenstone quarry | Beck 1984 |
| E40/5 | Routeburn | Greenstone boulders | Beck 1984 |
| G42/2 | Courthill | Porcellanite flaking | Record form |
| G42/4 | Crawford Hill | Silcretc outcrop and flakes | Record form |
| G42/5 | Crawford Hill | Silcrete outcrop | Record form |
| G42/23 | Olrig | Silcrcre slabs and flaking floor | Record form |
| G43/4 | Coal Creek | Working floor, porcellanite | Record form |
| G43/30 | Coal Creek | Porcellanite quarry | Record form |
| H40/2 | Bremner Creek | Porcellanire | Record form |
| H41/5 | Oturehua | Silcrete quarries and flaking floors | Leaeh 1984 |
| H41/9 | Rockyside | Silcrete outcrop and flaking floor | Record form |
| H42/1 | Waipati | Silcretc and flakes | Record form |
| H42/3 | Puketoi | Silcrete boulders? | Record form |
| H42/8 | Oliverburn | Silcrcte flakes/occupation | Record form |
| H42/9 | Oliverburn | Silcrete outcrop and flakes | Record form |
| H42/10 | Oliverburn | Slabs of silcrete aud flakes | Record form |
| H42/11 | Oliverburn | Silcrete outcrop and flakes | Record form |
| H42/16 | Hogburn | 'Chalcedonic chert'? | Record form |
| H44/3 | Lee Stream | Adze workshop? | Record form |
| I40/39 | Otekaike | Silcrcte boulders and flakes | Record form |
| I40/40 | Otekaike | Silcrete boulders and flakes | Record form |
| I40/41 | Otekaike | Silcrete boulders worked | Record form |
| I40/58 | Otekaike | Silcrete boulders and flakes | Record form |
| I42/2 | Taieriside | Silcrete boulders and flakes | Record form |
| I43/23 | Nenthorn | Silcrete quarry and flaking | Record form |
| I43/68 | Ainges Road | Silcrere quarry and flaking floor | Record form |
| I44/5 | Brighton Is. | Basalr flaking floor | Record form, von Haast 1879 |
| I44/198 | Waitati | Phonolite quarry | Record form |
| J41/29 | Enfield | Flakes and cores-silcrete | Record form |
| J42/4 | Kakanui | Basalt outcrop and flakes | Weislcr & Somerville-Ryan 1996 |
| J42/5 | All Day Bay | Flaking floor and adzes? | Record form |
| J42/25 | Pukcmata | Chalcedony source | Record form |
| J42/43 | Black Sandy Bay | Chalcedony source | Record form |
| J43/2 | Shag River Mth | Basalt working | Anderson et al. 1996 |

# Appendix 10

## CLASSIC AND PROTOHISTORIC SITES IN OTAGO

| SITE RECORD | NAME | ARCHAEOLOGICAL MATERIAL | ETHNOGRAPHIC MATERIAL | SOURCE |
|---|---|---|---|---|
| **Coastal settlements** | | | | |
| | Otiake | | x | Anderson 1980b |
| | Tamahaerewhenua | | x | Anderson 1980b |
| | Tekorotuaheka | | x | Anderson 1980b |
| | Te Punaamaru | | x | Shortland 1951, record form |
| | Papakaio | | x | Anderson 1980b |
| | Moeraki Kaik | | x | Anderson 1980b |
| J42/20 | Katiki Point | x | | Trotter 1967a |
| | Kakaunui | | x | Anderson 1980b |
| I43/1 | Huriawa | x | | Leach 1969 |
| | Waikouaiti | | x | Anderson 1980b |
| I44/177 | Warrington | x | x | I.W.G. Smith pers. comm. |
| I44/17 | Mapoutahi | x | | Anderson & Sutton 1973 |
| I44/21 | Purakanui | | x | Shortland 1951 |
| I44/23 | Long Beach | x | x | Leach & Hamel 1981 |
| J44/20 | Murdering Beach | x | x | Skinner 1959; Bell 1956 |
| | Te Waiparapara | | x | Neill 1901 |
| J44/77 | Pukekura | x | | Leach & Hamel 1978 |
| J44/44 | Pukekura | x | | Hamel 1992 |
| J44/3 | Tarewai Point | x | | Teviotdale 1939a |
| | Te Rauone | | x | Barnicoat n.d. |
| | Otakou | | x | Barnicoat n.d. |
| | Ruatitoko | | x | Griffiths & Goodall 1980 |
| | Tahakopa | | x | Griffiths & Goodall 1980 |
| | Omate | | x | Griffiths & Goodall 1980 |
| | Te Waipekapeka | | x | Griffiths & Goodall 1980 |
| | Otiheti | | x | Neill 1901 |
| | Koputai | | x | Griffiths & Goodall 1980 |
| | Otepopo | | x | Anderson 1982 |
| | Maitapapa (Henley) | | x | Shortland 1851 |
| H45/5 | Ram Island | x | | Record form |
| | Taivaamu | | x | McNab 1907 |
| H47/3 | False Island | x | | Lockerbie 1959 |
| G47/51 | Kings Rock | x | | Lockerbie 1959 |

*Continued next page >*

| AREA | NAME | ARCHAEO-LOGICAL MATERIAL | ETHNO-GRAPHIC MATERIAL* |
|---|---|---|---|
| **Inland settlements*** | | | |
| Hawea | Upoko tauia | | x |
| | O tu purupuru | | x |
| | Turihuka | | x |
| | Te taumanu o taki | | x |
| | Pakituhi | | x |
| | Te tawaha o hawea | | x |
| | Manuhaea | | x |
| Wanaka | Paekai | | x |
| | Nehenehe | | x |
| | Parakarehu | | x |
| | Mouwaho | | x |
| | Takikarara | | x |
| Clutha-Wakatipu | Wairere | | x |
| | Oteroto | | x |
| | Tititea | | x |
| | Te kirikiri | | x |
| | Paharaki | | x |
| | Tahuna | | x |
| | Puia | | x |
| | Takerehaka | | x |

* Source for all these entries: Anderson (1982b)

# Appendix 11

## INVENTORY OF FARMSTEADS FOR WHICH SKETCH PLANS ARE AVAILABLE

**Coastal Otago**

Matanaka, Waikouaiti (Knight & Coutts 1975)

Miram's and Percy's farms, Double Hill, Waitati (Hamel 1982)

Landels and Beggs farms, Tuakitoto (Hamel 1984)

**Central Otago**

Kawarau and Carrick farmsteads, Bannockburn (Hamel 1988a)

Butlers, Fruitlands (Hamel 1988)

Glenaray (Hamel & Gordon 1989)

Morven Hills, Lindis (Hamel 1990a)

Lauder, Maunuherikia (Hamel 1990b)

Mt Pisa and Queensberry Hotel (Hamel 1990d)

Nokomai (Hamel 1991a)

Blackstone Hill, Manuherikia (Hamel 1992b)

Ben Nevis, Craigroy and Masters homestead (Hamel 1994a)

Moncrieff and Warbrick crofts, Gibbston (Hamel 1996e)

Longlands, Deepdell, Shag Valley, Taieri Lake, Gladbrook, Cottesbrook, Garthmyl, Mt Ross, Attadale, Mt Stoker/Lindores, Deepdell (Hamel 2000c)

**Southland**

Drake, Waghorn and Grange farms, Waituna (Hamel 1985a)

# Glossary

(1) indicates that the term is used in Part 1, and (2) that it is used in Part 2.

Adit (2) A mining term, referring to a tunnel dng in from the surfacc to a mineral-bearing section of tock. Compare to a 'drive'.

Adze (1) A stone tool with a beveled cutting edge, created by flaking, hammering and/or grinding rock to a desired shape. The edge is not straight like an axe when viewed from the side but slightly curved. The edge is usnally set with the cutting edge at right angles to the handle so that it can be nsed more like the Enropean plane that like an axe. If the final shape is long and narrow withonly a small cntting edge, the tool tends to be called a chisel.

Archaic (1) In New Zealand this term has been nsed to describe the assemblage of artefacts used by the first Polynesians to arrive here, partieularly those who hunted moas. It is less often used to describe the culture and lifestyle generally of early people.

BP (1) Stands for years 'before present' but in fact means before 1950, which approximates to the start of atomic bomb explosions. It is used by many scientists as a way of making a general statement based on radiocarbon dating, rather than usiug calendar years AD and BC.

Berdan (2) This is a large, cast-iron pan built like a washing machine, with a revolving arm and ball inside it, used for crushing ore to a very fine state, often after the ote has been already crushed in a battery.

Blade (1) In the production of stone tools, this is a long narrow flake struck off a core which may be used as at cutting or scraping tool without further modification, or it may be trimmed and beveled to form an adze.

Buddle (2) A large cone-shaped table, raised in the centre, over which water and finely ground ore is poured to separate the heavier gold from the lighter seduuents.

Classic (1) This term is used to describe an assemblage of artefacts developed in New Zealand by Maori in the latter half of the Prehistoric period. It includes a more limited set of adze shapes than those in the Archaic assemblage, more complex two-piece bait hook points, distinctive ornaments and greater use of nephrite objects made by sawing rather than flaking.

Drive (2) A mining term, referrmg to a tunnel dug along the line of a mineral-bearing section of rock underground.

Extinction (1) Indicates that a species has disappeared completely from all parts of its rauge.

Extirpation (1) Iudicates that a species has disappeared from a part of its range.

Flake (1) Iu the production of stone tools, this is a piece of any shape deliberately struck off a lump of rock. It may have a sufficiently sharp edge and desirable shape to be used as a cutter or scraper without further modification, or it may be further modified by trimming smaller flakes off it. Large numbers of flakes are produced as waste in shaping rock to form a desired tool such as an adze.

Hei-tiki (1) A greenstone pendant in the form of human shape with the legs tucked up. The eyes are large and often inset with paua shell. It is a characteristic ornamenr of the Classic assemblages.

Historic (2) The period in Otago after the arrival of Europeans about 1848, when there are sufficient written records to describe the way of life.

Kaik or kaika (1) A hamlet or small village of a more or less permanent nature, with predominantly Maori inhahitants.

Kokowai (1) The red mineral haematite, produced by volcanic action which, when suffieiently weathered can be used as a pigment.

Mahinga kai (1) A place where food, flax or stone resources could be gathered by a designated group of people.

Manawhenua (1) Customary authority exercised by an iwi or hapu in au identified area.

Mere (1) A thiu oval club usually made of nephrite.

Nephrite (1) (2) Commonly called greenstone, this is an unusual rock with twisted and tangled microcrystals of the minerals tremolite-actinolite with a measure of hardness of 6.5. Because of its structure, it is very tough and less likely to shatter than any other rock type used by Maori.

Pa (1) Used in an archaeological sense, a pa is a living site which has been chosen beeause it can be defended by trenehes and especially by fencing with closely set poles or palisades. Steep slopes, cliffs, spurs and swamps were chosen as natural defences for pa sites.

Pataka (1) A store house set on high foundations for storing food and precious objects and often highly dccorated.

Patu (1) A thin oval club which could be made from whale bone or various types of stone.

Porcellanite (1) A mudstone which has been baked to a natural ceramic by underlying coal seams having undergone natural combustion.

Protohistoric (1) The period in Otago when there were some written records but they were insufficient to document the way of life of the inhabitants, roughly from AD 1770 to the 1840s.

Rakatira (1) A Maori of chiefly status.

Rohe (1) Boundary of a tribal area.

Silcrete (1) Geologically, silcrete was "formed as a hard duricrust (Measure of hardness 6.5–7.0) of siliceously cemeuted quartz sands and gravels of freshwater origin. It is widespread in parts of the Maniototo. but good quality flakeable material occurs in only small outcrops.

Tangatawhenua (1) The iwi or hapu that holds mana whenua in a particular area.

Wakawaka (1) A relatively small area of land over whicb a hapu has rights of gathering and which will contain mahinga kai.

Whata (1) A platform set on high posts for storing food and clothing vulnerable to rats and dogs.

# Scientific names of small-bird species

(after Heather & Robertson 1996, and Millener 1990)

### *Extinct species*

| | |
|---|---|
| New Zealand swan | *Cygnus sumnerensis* |
| Flightless goose | *Cnemiornis calcitrans* |
| Finscb's duck | *Euryanas finschi* |
| Goshawk | *Circus eylesi* |
| Extinct eagle | *Harpagornis moorei* |
| New Zealand quail | *Coturnix novaezelandiae* |
| Hodgen's rail | *Gallinula hodgenorum* |
| Extinet giant rail | *Aptornis defossor* |
| Extinct coot | *Fulica prisca* |
| Snipe, mainland variety of sub-antarctic sp | *Coenocorypha aucklandica* |
| Laughing owl | *Sceloglaux albifacies* |
| Owlet-nightjar | *Aegotheles novaezealandiae* |
| Piopio | *Turnagra capensis* |
| Extinct crow | *Corvus moriorum* |

### *Modern species*

| | |
|---|---|
| Little spotted kiwi | *Apteryx owenii* |
| Large spotted kiwi | *Apertyx haastii* |
| South Island brown kiwi | *Apteryx australis* |
| Crested grebe | *Podiceps cristatus* |
| Royal albatross | *Diomedea epomophora* |
| Shy mollymawk | *Diomedea cauta* |
| Bullers mollymawk | *Diomedea bulleri* |
| Sooty shearwater | *Puffinus griseus* |
| Short-tailed shearwarer | *Puffinus tenuirostris* |
| Fluttering shearwater | *Puffinus gavia* |
| Little shearwater | *Puffinus assimilis* |
| Diving petrel | *Pelecanoides urinatrix* |
| Giant petrel | *Macronectes giganteus* |
| Fairy prion | *Pachyptila turtur* |
| Broad-billed prion | *Pachyptila vittata* |

| | |
|---|---|
| Cook's petrel | *Pterodroma cookii* |
| Mottled petrel | *Pterodroma inexpectata* |
| White-faced storm petrel | *Pelagodroma marina* |
| Yellow-eyed penguin | *Megadyptes antipodes* |
| Blue penguin | *Eudyptula minor* |
| Fiordland crested penguin | *Eudyptes pachyrhynchus* |
| Snares crested penguin | *Eudyptes robustus* |
| Erect-crested penguin | *Eudyptes sclateri* |
| Pied shag | *Phalacrocorax varius* |
| Little shag | *Phalacrocorax melanoleucos* |
| Stewart Island shag | *Leucocarbo chalconotus* |
| Spotted shag | *Stictocarbo punctatus* |
| White heron | *Egretta alba* |
| Reef heron | *Egretta sacra* |
| Australasian bittern | *Botaurus poiciloptilus* |
| Royal spoonbill | *Platalea regia* |
| Paradise duck | *Tadorna variegata* |
| Blue duck | *Hymenolaimus malacorhynchos* |
| Grey duck | *Anas gracilis* |
| Brown teal | *Anas aucklandicus* |
| New Zealand shoveler | *Anas rhynchotis* |
| New Zealand scaup | *Aythya novaeseelandiae* |
| Australasian harrier | *Circus approximans* |
| New Zealand falcon | *Falco novaeseelandiae* |
| Banded rail | *Rallus philippensis* |
| Weka | *Gallirallus australis* |
| Takahe | *Porphyrio mantelli* |
| Oystercatcher species | *Haematopus* sp. |
| Stilt species | *Himantopus* sp. |
| Banded dotterel | *Charadrius bicinctus* |
| Wrybill | *Anarhynchus frontalis* |
| Large wader, cf curlew | *Numenius* sp. |
| Southern black-backed gull | *Larus dominicanus* |
| Red-billed gull | *Larus novaehollandiae* |
| Black-fronted tern | *Sterna albostriata* |
| Caspian tern | *Sterna caspia* |
| White-fronted tern | *Sterna striata* |
| New Zealand pigeon | *Hemiphaga novaeseelandiae* |
| Kakapo | *Strigops habroptilus* |
| Kaka | *Nestor meridionalis* |
| Kea | *Nestor notabilis* |
| Red-crowned parakeet | *Cyanoramphus novaezelandiae* |
| Yellow-crowned parakeet | *Cyanoramphus auriceps* |
| Morepork | *Ninox novaeseelandiae* |
| Rifleman | *Acanthisitta chloris* |
| Pipit | *Anthus novaeseelandiae* |
| Yellowhead | *Mohoua ochrocephala* |
| Brown creeper | *Mohoua novaeseelandiae* |
| New Zealand Robin | *Petroica australis* |
| Bellbird | *Anthornis melanura* |
| Tui | *Prosthemadera novaeseelandiae* |
| Kokako | *Callaeas cinerea* |
| Saddleback | *Philesturnus carunculatus* |

# Index

Bold figures indicate a photograph and possibly a text reference as well.