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The Prehistoric Role of the Cromwell Gorge, New Zealand

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ABSTRACT

The prehistoric role of the Cromwell Gorge is examined in the light of evidence uncovered from three recent mitigation excavations, occasioned by the construction of the Clyde Power Project on the Clutha River. Following an outline of the environment of the gorge, the results of the excavations at the Italian Creek (S133/258), Rockfall I (S133/121) and Rockfall II (S133/169) shelters are reviewed. The chronology of the sites and the sources of the lithic materials therein are discussed. Site distribution in the area is also considered. It is concluded that the Cromwell Gorge served as an important thoroughfare into Central Otago throughout the prehistoric period. The possibility that it served as a moa-hunting focus is also examined.

Keywords: MURIHIKU PREHISTORY, SUBSISTENCE ECONOMICS, MOA EXPLOITATION, TRANSIENT CAMP SITES.

INTRODUCTION

The Cromwell Gorge is situated in Central Otago, the arid interior of the Province of Otago in southern New Zealand. This paper examines the prehistoric role of the gorge in the light of evidence uncovered recently from three mitigation excavations occasioned by the construction of the Clyde Power Project at the lower end of the gorge. The hydro dam will impond the Clutha River which flows through the gorge into a reservoir which will completely flood the 17-kilometre-long river valley. The three reviewed sites, along with forty historic shelters dating from the nineteenth century goldrush in the gorge, will be inundated in 1987 when the reservoir is filled. The aim of the excavations was to examine the role of the shelters within wider Polynesian subsistence strategies in Murihiku (southern New Zealand), particularly with regard to the chronology of exploitation of interior resources.

The gorge is an antecedent-river valley through which the Clutha River flows eastwards between the Upper Clutha and the Manuherikia basins. To the north the gorge is bounded by the Dunstan Range, whilst the Cairnmuir Range forms the slopes on the south side.

Apart from small terraces on either side of the river, the gorge is narrow and bounded by steep rocky slopes up to a height of 150-250 metres. Above this height gentler slopes ascend to the flat topped block-fault mountain tops. The width of the smaller terraces within the valley is largely dependent on the river's meandering within its rocky confines. Loess deposits mantle many of the terraces, fans and lower slopes, in many places forming an admixture with colluvium and slopewash.

Several small water courses dissect both sides of the gorge and drain into the Clutha River. The creeks, which often dry up for several months of the year, wind down between the massive, craggy schist outcrops of which the ranges are composed. The schist is friable, often resulting in the lower slopes and terraces becoming littered with detritus.

The vegetation of the Cromwell Gorge and wider environs at the beginning of European settlement has been described by Buchanan (1868), Petrie (1912), and Bathgate (1922). The valley floor contained several species characteristic of low

altitude fescue tussock grassland adapted to dry conditions. These were specifically documented by Buchanan and Bathgate who were first hand observers in the 1860s. They noted that hard tussock *(Festuca novae-zelandiae)*, silver tussock *(Poa laevis)* and bluegrass *(Agropyron scabrum)* flourished on the gently sloping land.

Scattered scrub, predominantly manuka *(Leptospermum scoparium)*, kanuka *(Leptospermum ericoides)* and *Hebe* sp. grew abundantly on steeper slopes. The most prevalent native shrub was matagouri *(Discaria toumatou)* which flourished on the stony, sandy soils and served as a valuable source of firewood. It is still widespread today, but no longer grows in the dense thickets which impeded the settlers' progress in the nineteenth century.

By about 1910 excessive and ill managed burning-off and the spread of rabbits had almost denuded large areas of the lower country and up the slopes of the Cairnmuir and Dunstan Ranges. *Leptospermum* stands had been largely cut out during the nineteenth century goldrush, the wood being used primarily for firewood. Today, the *Leptospermum* stands in the gorge, unhindered by man, are regenerating rapidly. There are no records of forest cover in the Cromwell Gorge.

The main changes to have occurred since European settlement are the modification of large areas of low altitude fescue-tussock grassland to a semi-desert vegetation typified by scabweed and thyme, removal or diminution in importance of woody and scrubby species and the introduction and rapid spread of the introduced sweet briar *(Rosa rubiginosa)*.

The Cromwell Gorge climate is typical of the Central Otago semi-arid climatic zone, where the micro-climate has led to the development of the brown-grey earths (Hewitt 1978:11). Relatively extensive areas of anthropic soils have been formed on the valley floor. These are of two forms: alluvial mining detritus and tailings and soils disturbed by road or railway construction. Traces of prehistoric occupation still evident on the riverside terraces at the time of first European settlement are likely to have been sluiced away during the gold rushes which followed.

THE ITALIAN CREEK SITE (S133/258)

The excavation of the Italian Creek shelter was undertaken in February 1978. It is described in detail elsewhere (Ritchie n.d.). The site is located under a rock overhang in the mouth of a rocky gully. Here Italian Creek emerges to flow 250 metres across a river terrace to join the Clutha River (Fig. 1). The shelter is open to the northwest, the area under the overhang being approximately 12 × 3 metres, grading into a gentle slope down to the creek. The creek is one of the few perennial streams which drain the southern flank of the Dunstan Range (Fig. 2).

SEQUENCE OF OCCUPATION

The stratigraphy of the site was relatively straightforward. Initial occupation occurred on an essentially sterile surface (Layer 2) consisting of a buff coloured soil which becomes increasingly clayey with depth. Into this surface, two small hearths were dug; the associated material consisted of black charcoal-rich soil, fire reddened schist fragments and a considerable quantity of moa eggshell. The hearths were described as Lens 1A and interpreted as shallow scoop cooking hearths (Fig. 3).

The upper part of the deposit (Layer 1) is recent deposition. This was extensively disturbed in some areas by sheep scuffing and rabbit burrowing. The Layer 1-2 interface is interpreted as the effective living surface at the time of Maori usage and bore the majority of the evidence for occupation.

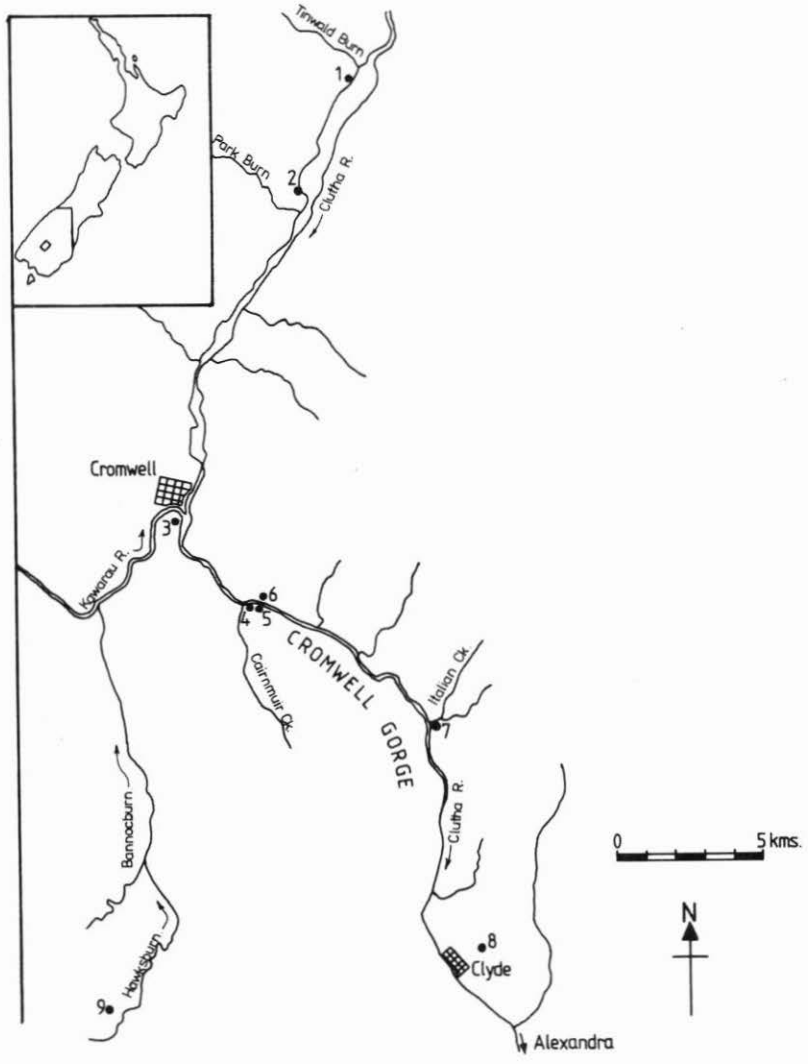

Figure 1: Map of site locations mentioned in the text. 1 Tinwaldburn oven, 2. Parkburn ovens, 3. Cornish Point, 4. Rockfall I, 5. Rockfall II, 6. Caliche shelter, 7. Italian Creek, 8. Clyde Common, 9. Hawksburn.

ARTEFACTS AND FAUNAL REMAINS

The artefactual remains from the site consisted of only two items, a flake of grey silcrete and another of green-black obsidian (length 2-5 cm). Both flakes were found adjacent to the hearth in square A4.

The obsidian flake was subjected to trace element analysis (X.R.F.) at the Institute of Nuclear Sciences, Gracefield, by the late Mr G. McCallum. He stated that

the element configuration was virtually identical to that of sample specimens derived from Mayor Island. The flake's small size and the fact it bears no signs of use suggest it was a discarded chip.

The silcrete flake is likely to have been obtained within a 20 km radius of the site, from one of the recognised sources in the Manuherikia or Ida Valleys. This flake has virtually square sides and also appears to be an unused discard.

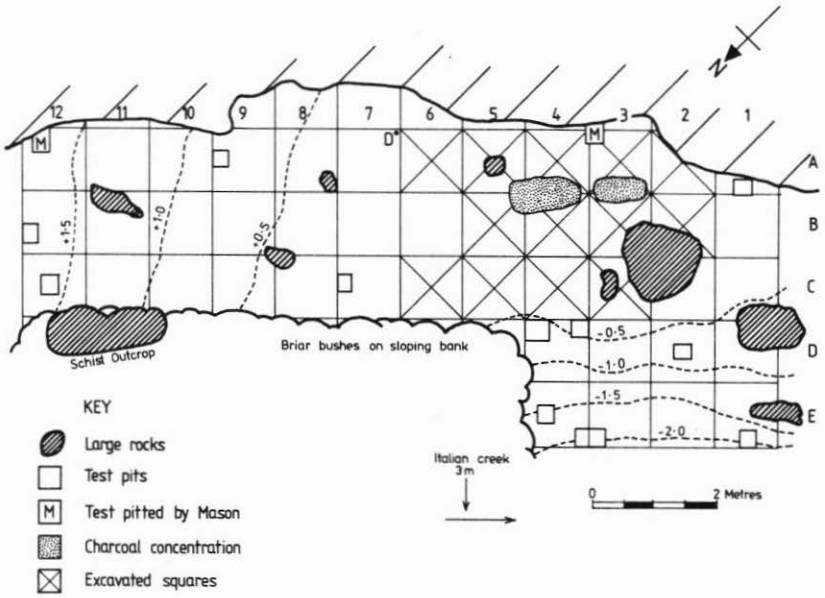

Figure 2: Plan of Italian Creek shelter, S133/258.

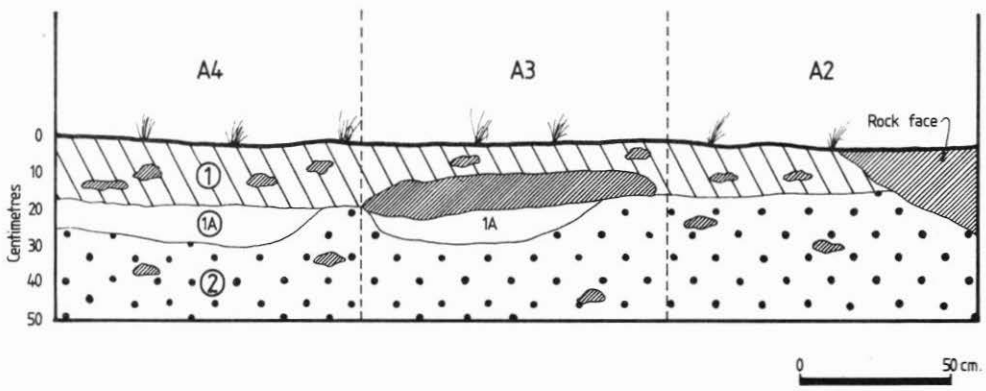

Figure 3: Italian Creek, section, East baulk, squares A2-A4. Layer 1, brown stony loam. Lens 1A, blackened soil (hearth scoops). Layer 2, buff-grey soil.

The site contained few skeletal remains which could be positively identified as prehistoric. The majority of the recovered bones were those of introduced mammals. On the surface of the shelter and within the upper part of Layer 1 the remains of two sheep, a domestic cat, several rabbits, a bellbird *(Anthornis a. melanura)*, an unidentified passerine and the right tibia of a *Rattus* sp. were uncovered. According to R. J. Scarlett (pers. comm.) the rat is possibly *R. exulans* but it is larger than normal for this species.

The hearth debris contained a few small burnt fragments of bone, but these could not be identified. However, two burnt and broken bones were identified as the left and right ulnae of a South Island kaka *(Nestor m. meridionalis)* by Scarlett (pers. comm.). This bird was presumably cooked in the hearth.

Layer 2 was devoid of skeletal material other than concentrations of rabbit bones in former burrows and some rat bones.

Very fragmented remains of about 20 freshwater mussel valves, believed to be of the *Hyridella* genus were recovered (Ritchie n.d.:8). The valves were probably collected within a 10-30 km radius of the site. Recent research in the United States (Parmalee and Klippel 1974) suggests that freshwater mussels may have played a relatively minor part in prehistoric human nutrition. This hypothesis and the occurrence of freshwater mussels in Central Otago are discussed in the Italian Creek site report (Ritchie n.d.).

EVIDENCE FOR THE HUMAN CONSUMPTION OF MOA EGGS AT ITALIAN CREEK

A large number of moa eggshell fragments (1565) but no moa bones, were found within the cultural layers in the site. Burnt and unburnt fragments of shell were particularly concentrated in and around the hearth.

There are four possibilities which could account for the eggshell distribution:

(a) It is a natural distribution.
(b) It is the result of burrowing animals, notably rabbits.
(c) The concentration of eggshell fragments is derived from moas which nested in the shelter, and at a later date a Maori party excavated a scoop hearth on top of the eggshell.
(d) The eggshell fragments reflect either the cooking of eggs in the shell, or the consumption of eggs around the fire by Maoris, the spent shells being thrown into the fire.

These alternatives can be evaluated. Numerous test pits in over 40 shelters in the Cromwell Gorge have clearly indicated that the volume of eggshell fragments found in Italian Creek is far higher than would be expected normally. Over 50 percent of the shelters which have been tested have produced between one and twenty moa eggshell fragments, but not one (with the exception of Caliche shelter, S133/223, where moa skeletal remains were also found) has approached the density or volume of fragments found in the Italian Creek site.

Some redistribution of shell fragments in parts of the site is clearly attributable to rabbit burrowing. There were obvious disturbed areas in the upper part of Layer 1, and this factor accounts for the number of eggshell fragments found in this level. However, the main concentrations of eggshell were located in the vicinity of the hearth where rabbit activity was not evident.

The distribution of eggshell fragments in Layer 1 and Lens 1A could be evidence that moas used the shelter for nesting. Thus, if a Polynesian party subsequently arrived and dug a scoop hearth amongst the eggshell debris on the floor of the shelter, the result would be that the shell which was within or immediately adjacent to the

hearth would be burnt, whilst the shell further from the hearth would remain unburnt. However, the evidence is reasonably suggestive that man and moa were contemporaneous at the site and that the moa eggshell fragments represent instead the remains of moa eggs which were consumed at the site.

Given roughly equal volumes of soil in the three layers, the distribution of fragments as listed in Table 1 is clear evidence that the moa eggshell was intimately associated with the hearth and unlikely to have accumulated by natural deposition processes. In support of this contention is the fact that although the majority of the burnt eggshell fragments were found within the hearth, a considerable number were also scattered nearby, lying in material that bore no sign of burning or firing. Fragments of eggs from at least two species made up the shell remains, judged on differences in colour (green and creamy-white), thickness and texture. However, it is inferred that only the white shelled eggs were consumed. Although there was some intermixing of the green and white shell fragments, the former, which only constitute 5 percent of the total fragment count, bear no sign of burning and were concentrated along the back wall of the shelter. They are probably residual fragments from an earlier nesting phase.

TABLE 1
DISTRIBUTION OF MOA EGGSHELL FRAGMENTS
(in four squares around hearth)

	Burnt shell	Unburnt shell	Total
Layer 1	32	107	139
Lens 1A (hearth)	557	251	808
Layer 2	68	14	82
			1029

Oliver (1949:46) and Simpson (1955:225) have suggested that green eggshell is that of *Megalapteryx didinus* and that the creamy-white shell is that of *Pachyornis elephantopus* or *Euryapteryx gravis*. Hamel (1979:62) has recently outlined evidence suggesting that moas were solitary nesters and that their chicks were nidifugous. Given this adaptation, it seems unlikely that moas of two different species would have been nesting in the same shelter.

How the eggs may have been consumed is not clear from the shell remains as no cutting marks or drill holes were observed in the shell fragments. The eggs could have been cooked whole, or more likely a small hole was made in one end and the raw contents consumed, spent shells subsequently being discarded into the fireplace.

Overall the Italian Creek evidence does not enable a watertight case to be presented to show that moa eggs were definitely consumed at the site, but the possibility cannot be ruled out, and in fact seems the most plausible explanation for the ground evidence. Concomitant with either argument is the contention that some moas were still extant in the vicinity of the site at or about the time of the site's occupation, *c.* A.D. 1450, based on radiocarbon dates on charcoal.

AN EEL NET *(PURANGI)* FROM ITALIAN CREEK

A notable artefact, an eel net *(purangi)*, was found by a surveyor, W. Arthur, in or near the Italian Creek site in 1869 (Ritchie n.d.:12). The net was eventually donated to the Otago Museum (Acc. No. D21.1335).

The net is labelled "Italian Gully, Clyde". Although Arthur does not record finding the net, his field notes and map (Fieldbook 265, p.60, Ap. '69) indicate that he camped at the mouth of Italian Creek (then known as Italian Gully), in April 1869.

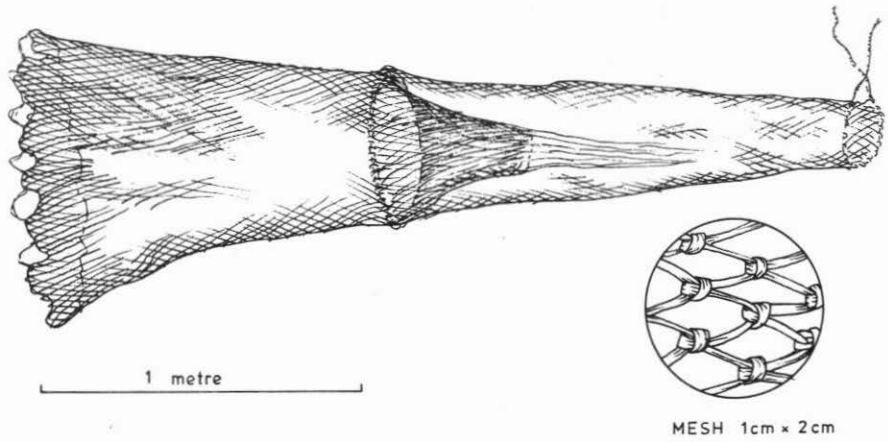

Figure 4: The Italian Gully *purangi.*

It appears that he found the net somewhere near the mouth of the gully. Because it is in reasonably sound condition, it seems likely that it was found under some form of relatively weatherproof shelter. The ground evidence strongly points to the Italian Creek site as the source of the *purangi.* The site is no more than 200 metres distant from Arthur's campsite as marked on his map, and no other prehistoric sites or potential shelters exist in the vicinity.

The Italian Creek *purangi* is made of unscutched knotted flax, woven with a consistent two centimetre spacing. The flax is *Phormium tenax* (judged by its thickness), and was worked green from 3 mm wide strips (J. Cave pers. comm. 1979). The net is made in two parts; the wide-mouthed upstream end being 1.5 metres wide and threaded with a two-ply twisted cord drawstring. This section is 1.2 metres long and is attached to a hoop made of supplejack of 40 cm diameter, to which the downstream end is also attached. The downstream portion of the net is 1.45 m long, tapering to a narrow opening of 15 cm diameter threaded with a two plaited cord. At the central hoop there is a baffle consisting of a small interior netting cone (33 cm long) whose base is unknotted for 59 cm, then braided into a rope 81 cm long which protrudes about 12 cm beyond the small end opening. Generally the *purangi* is in sound condition, although a small portion near the mouth end is fragmentary. The net is now displayed in the Maori gallery of the Otago Museum.

The net (Fig. 4) is similar to an eel net *(purangi)* depicted by Best (1929:113) although the Italian Creek net has an interior baffle which is not described by Best. He states (ibid.:127) that the *purangi* was used with an eelpot, and that the Ngati Porou people used the net in deeper streams. The use of the net as a weir only demanded a swift strong flow of water to prevent the possibility of the eels escaping. One would expect the addition of a baffle would have made the Italian Creek net self-contained and not requiring the addition of a *hinaki* (eelpot) to the downstream end of the net. No evidence of eel consumption was found in the site. However, the *purangi* may have been used (without much success?) in the manner depicted by Best (ibid.:120).

THE ROCKFALL SITES (S133/121 and S133/169)

The two shelters which comprise the Rockfall sites are located within a massive rockfall in the upper part of the Cromwell Gorge, 60 metres from the true right bank of the Clutha River and 400 metres downstream from the mouth of Cairnmuir Creek (Fig. 1). The rockfall is a prominent feature within the gorge. In addition to the prehistoric sites, four historic shelters also exist in the gaps under the jumbled boulders.

Both sites were initially recorded in February 1976 (Higham *et al.* 1976). An excavation of the Rockfall I site (S133/121, then called CG1) was undertaken in February 1977 by members of the Department of Anthropology, University of Otago, under the direction of Graeme Mason. The author, assisted by Ms A. Ross, undertook an analysis of the excavated materials in 1979 (Ritchie and Ross n.d.). The site bears evidence of three phases of use — a transient Maori occupation, a nineteenth century occupation by Chinese miners and a brief usage in the early twentieth century by rabbiters.

The Rockfall II shelter (S133/169) was excavated under the direction of the author in February 1981. The excavation has been briefly reported previously (Ritchie and Harrison 1981:101-102).

THE ROCKFALL I SITE EXCAVATION AND SEQUENCE OF OCCUPATION

The excavation involved two adjacent areas originally recorded as separate sites — a stone walled rock shelter (S133/37) and a flat open area in front of the shelter which bore visual evidence of prehistoric occupation (S133/121). The excavators treated both areas as one site. The open space forms a courtyard set amongst large rocks which provide shelter on all sides. The whole area of approximately 20 metres × 10 metres was sparsely covered with flakes and hammerstone debris. No structure, or any traces of oven stones or midden were visible on the surface. During the subsequent historic occupation two sections of stone walling were constructed at the entrance to the shelter, presumably to provide protection from the elements for a prolonged occupation (Fig. 5).

Only the front portion of the shelter was excavated. The excavation of the open area was undertaken in a chequer board pattern, the intermediate squares being left unexcavated.

The excavation revealed evidence of two main occupations of the site — a short-term prehistoric occupation (*c.* A.D. 1270 based on the radiocarbon dates), followed by a period of habitation *c.* 1870 by Chinese miners. Particle size analysis of the soil units distinguished during the excavation confirmed that there were three main layers, beginning with a sterile basal layer of fine sand with some coarser material derived from decomposed schist and alluvial deposits. The silty occupation deposit contained a mixed assemblage of prehistoric and historic artefacts, the mixing being attributable to disturbance by livestock. In the southwest corner of the site, a lens of recent slope wash had fanned through a gap between the boulders, burying the occupation layer. This lens was coarser than the occupation deposit and was sterile (Fig. 6).

THE ROCKFALL I SITE PREHISTORIC OCCUPATION

The visual evidence of a prehistoric occupation at Rockfall I was a scatter of flakes exposed on the surface of the open area outside the shelter. During the excavation a small oven pit was also uncovered in the northwest quarter. It is clear from the stratigraphy that the oven usage and the stone working were contemporary and of short duration. The site plan (Fig. 5) shows that the stone working area was centred

near to and east of the oven. The decreasing density of the flake debitage radiating out from this area reflects the typical scattering associated with single point or centralised work areas. Few artefacts were found in or near the entrance to the shelter. However, some flakes and a small silcrete blade were uncovered within the stone wall matrix. It is inferred that soil which contained flake debitage was scooped up and used by the Chinese miners as caulking and fill for the walling which they constructed inside the shelter.

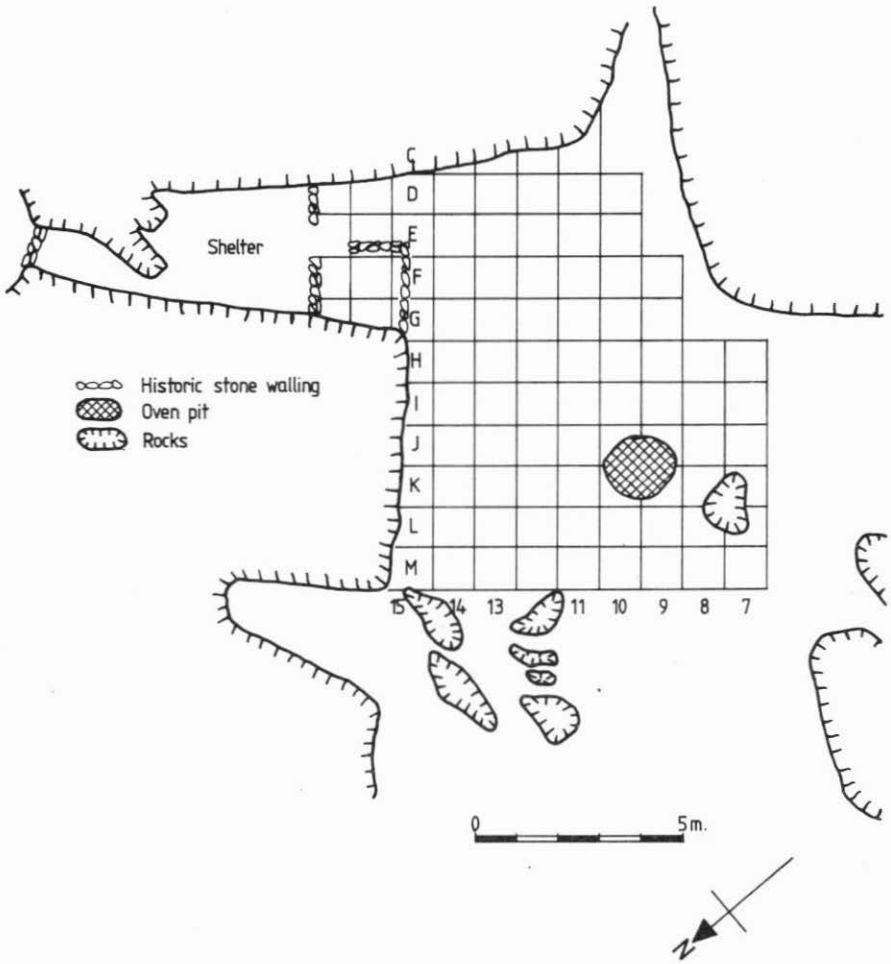

Figure 5: Plan of Rockfall I, S133/121.

Five hundred and fifty-nine flakes were recovered during the Rockfall I excavation, of which 86.8 percent were greywacke. This rock was locally available in the form of river cobbles. The greywacke was primarily in the form of waste flakes, generally measuring less than 2 × 2 cm, or else pieces of unworked stone, apparently carried to the site and never used. Only two pieces bore definite evidence of secondary work-

ing. Two rock types, porcellanite and silcrete, were imported into the site for flaking. Porcellanite, mainly in the form of debitage spawls, made up 6.3 percent of the total, whilst silcrete accounted for 1.4 percent. All the silcrete was debitage, save two pieces which showed signs of having been used. Other lithic material recovered from the site were local river pebbles (2.1 percent).

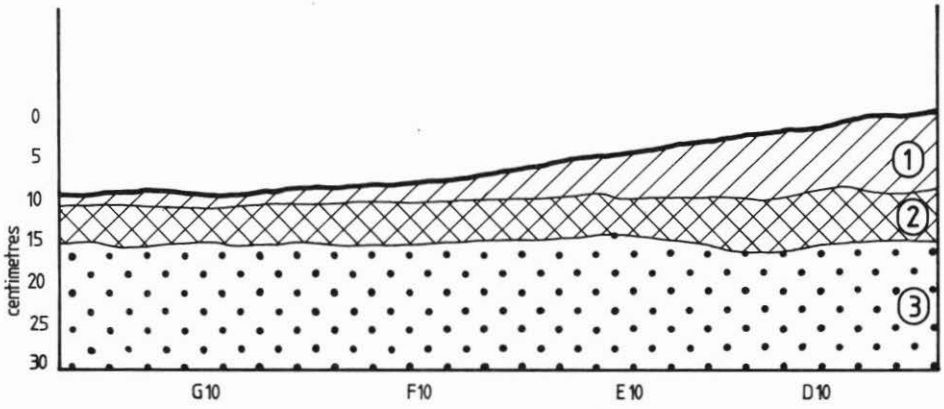

Figure 6: Rockfall I, generalised section through squares D10-G10. Layer 1, recent slope wash. Layer 2, occupation layer, fine sand and fallen rock fragments. Layer 3, basal layer, sterile fine sand, some colluvial detritus.

The charred bone fragments found in the oven matrix were negligible in quantity and unable to be identified. Soil samples taken from the oven returned a low pH value (a mean of 6.7 over 6 readings). As both decayed bone and charcoal increase the pH of a soil (W. Blair pers. comm.), it seems unlikely that substantial quantities of faunal material were being cooked in the oven. Only two pieces of bone were recovered which could be prehistoric — the right humerus of a tuatara *(Sphenodon punctatus)* and a piece of fossilised moa bone (R. Scarlett pers. comm.). The latter was very weathered and bore no indication of industrial usage.

The site was a transient camp site. Manufacturing or maintenance knapping appear to be the primary activities performed at the site. The uniformity of the artefact forms, the presence of a single small oven showing no evidence of clearing or re-use and the limited faunal remains are all indications of a brief temporary occupation.

THE ROCKFALL II SITE (S133/169)

The Rockfall II site is located under a massive boulder at the eastern end of the same rockfall within which the Rockfall I site is located. The shelter measures approximately 8 × 8 metres (Fig. 7).

Only one occupation layer (Layer 2) was discernible within the Rockfall II shelter. This was a 4-6 cm deep layer of grey silt within which the bulk of the artefacts, dispersed charcoal and faunal remains were recovered. The occupation layer overlay a sterile base layer (Layer 3) composed of buff coloured silt and pea-sized gravel. Above the occupation layer (see Fig. 8) two units were defined, a 3-5 cm deep layer of grey gravel, on top of which was a thin layer of silt with sparse grass growth. Both

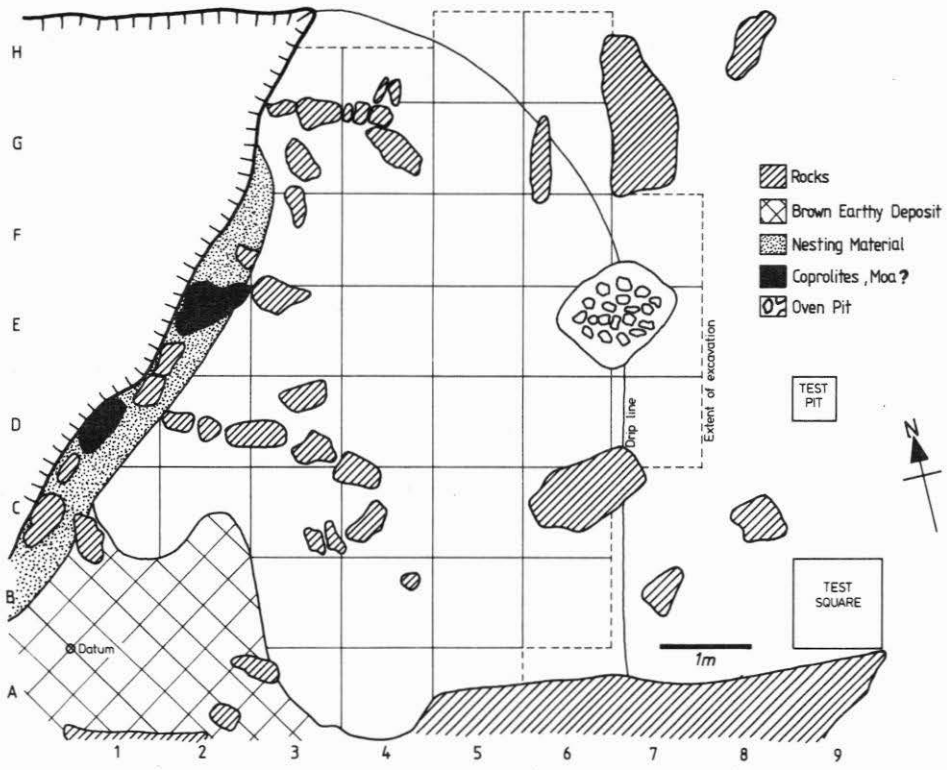

Figure 7: Plan of Rockfall II, S133/169.

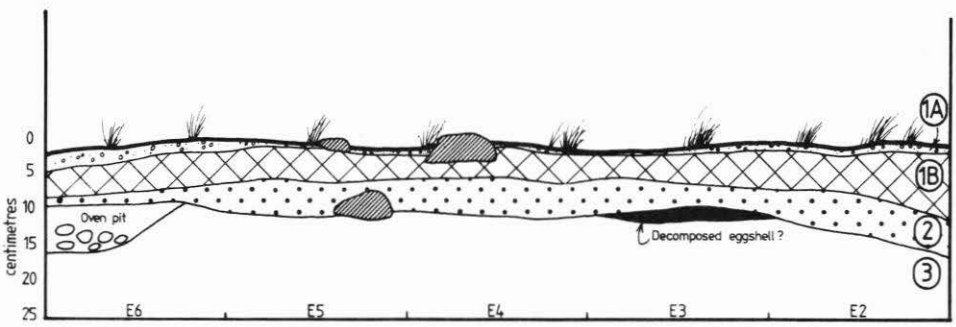

Figure 8: Rockfall II, simplified section through squares E2-E6. Layer 1A, silt, sparse grass growth. Layer 1B, grey pea gravel and silt, generally sterile. Layer 2, occupation layer, grey silt. Layer 3, basal layer, sterile buff coloured pea gravel.

lateral and vertical redeposition within the shelter were clearly attributable to stock (and human?) scuffage and rabbit burrowing.

Along the west wall of the shelter, an area of *c.* 5 square metres of brown fibrous matter was encountered, within which there were concentrations of fibrous coprolites. This material, which is believed to be approximately contemporary with the occupation, would seem to be the residue from nesting moas. Its significance is discussed later. In a central position at the front of the shelter, a small oven pit was uncovered. It had been excavated into the Layer 3 basal gravels. Evidence of the oven's role is outlined in the faunal analysis section.

Before the excavation two single stone alignments, retaining 10 cm-high platforms, were evident within the shelter (Fig. 7). These features primarily served to level the floor of the shelter, but they may also have acted as "activity dividers". It was concluded that they date from the historic era because there is little correlation between their placement and the distribution of the prehistoric material, and one alignment also overlay the moa nesting remains. As at the Rockfall I shelter, artefacts such as bottle glass, tin cans and butchered sheep and cattle bones attest to a brief historic occupation. No definite historic fireplace was located, but small concentrations of charcoal near the upper stone alignment may reflect the position of a hearth.

ROCKFALL II ARTEFACTS

The lithic assemblage from the Rockfall II site, excluding oven stone material, consisted of 151 units (129 excavated, 22 surface collected). The majority of these were unmodified discard flakes of silcrete and porcellanite (Table 2).

TABLE 2
ROCKFALL II LITHIC MATERIAL

Rock Type	Unmodified flakes	Modified flakes	Tools/ Cores	Polished chips	Surface Collected	Total
Grey Porcellanite	55	2	1c		5	63
Brown Porcellanite	10	1b			3	14
Grey Silcrete	2				2	4
Buff Silcrete	11	1	1d			13
Dark Green Argillite	8		1e	15	1	25
Light Green Argillite				10	3	13
Greywacke	1		(1?)		7	9
Greenschist	4				1	5
Quartz	1a					1
Haematite (ochre)	4					4
TOTALS	96	4	4	25	22	151

a: natural spall, b: bifacially retouched, c: core, d: cutter, e: roughout.

Grey porcellanite flakes constituted the dominant rock type recovered at the site. The small size, form, unmodified nature, and relative concentration of the flakes suggests that they were discard flakes from the production of tools (probably blades or scrapers for cutting moa flesh). Two flakes bore evidence of re-use in the form of secondary flaking, whilst one blocky piece appears to be a small discarded core. Fourteen flakes of a dark brown porcellanite, one bifacially worked, were also recovered.

A large shaped blade of yellow-buff silcrete, together with eleven unmodified

flakes and another bearing evidence of re-use, were recovered inside the shelter. The shape of the blade and its proximity to moa remains suggest a possible usage, for scraping or dismembering moa bones. Four unmodified flakes of grey silcrete were also found.

Thirty-seven flakes of argillite were recovered, 76 percent bearing at least one polished surface. The argillites break down into two colour groupings — dark green (25 units) and light green (13 units). One unit of the dark green stone appears to be a small adze roughout, but overall the small size and distribution of the flakes suggests that they are the result of maintenance knapping on damaged, polished argillite adzes or chisels.

The rest of the Rockfall II lithic assemblage was composed of fragments of greywacke, greenschist and quartz. The greywacke and greenschist fragments appear to be chips or spalls of stones which were collected locally for oven or hammer stones. The single flake-like piece of quartz probably fell from one of the quartz veins within the schist boulders which form the shelters. Four small pieces of haematite (red ochre) were also found in the shelter. The oven stones were primarily fragmented schist amongst which there were a few quartz and greywacke cobbles.

ROCKFALL II FAUNAL ANALYSIS

Historic and prehistoric materials were liberally intermixed in many of the excavated squares in the Rockfall II site, because of scuffage and rabbit burrowing. Despite the disturbances, some patterns are evident.

The faunal material was studied by R. Scarlett. He concluded that the moa remains represent one specimen each of two different moa species, namely *Euryapteryx gravis* and a *Dinornis* sp.

The moa bone was very comminuted, and primarily consisted of burnt and unburnt fragments of tibiae scattered around the inward side of the oven pit. The distribution coincides with that of the flake debitage. Pieces of metatarsi, a femur and pelvic fragments were also present. There was a notable absence of phalanges or claws, although the skeletal remains included 17 *E. gravis* tracheal rings found in a "U" shaped formation as well as five articulated vertebrae (which Scarlett believes are either *Euryapteryx* or *Pachyornis*). Within the oven, the only identifiable bone material was a rib which Scarlett identified as that of a *Dinornis* sp. but again, suggested the possibility that it may be that of a large *Pachyornis*.

Burnt fragmented moa bones have been found in several Central Otago sites, including Hawksburn, Owens Ferry and Dart Bridge. Two explanations are offered, which are not necessarily mutually exclusive. Either refuse bone and meat scraps were thrown into the still burning fire pits to dispose of them, or moa fat and sinew, often still attached to bones, was used to some extent as fuel in cooking pits, resulting in large volumes of burnt comminuted bone. The Rockfall II cooking pit was of small capacity and not used for prolonged or repeated cooking. Possibly pieces of moa flesh were cooked by placing them on heated rocks with little or no vegetation or earth covering.

At the rear of the shelter, the space between the overhanging boulder and the floor is generally less than one metre high. Here, about five square metres of brown earth and fibrous matter were uncovered, within which there were two concentrations of coprolites and dispersed fragments of white moa eggshell. There were also areas of developed microstratigraphy within the fibrous brown layer, including woody material, brown compacted lenses, and flakey white matter. The fibrous and woody material is believed to be the remains of a moa nest(s), whilst the microstratigraphy

is interpreted as compacted excreta and other nest residues, including eggshell decomposition.

The fibrous-brown earth material did not form obvious discrete nests, but rather a concentration along the back wall of the shelter. At the southwest and innermost corner of the shelter, this material was 10-15 cm thick. R. Scarlett has examined the moa remains and samples of the fibrous material and coprolites. He also concluded that the residues were from moa nesting and mentioned that they were similar to those excavated at Shepherd's Creek in the Waitaki Valley (Scarlett pers. comm.). He also identified the eggshell fragments as those of *Euryapteryx gravis* on the basis of their texture.

From analysis of the stratigraphy and the distribution of the artefacts and butchered moa bone, it is inferred that a Polynesian group slaughtered and butchered a moa of the *Euryapteryx gravis* species which was nesting in the shelter. Despite some disturbance of the stratigraphy along the critical interface, it was discerned that a thin deposit of the grey silt and pea gravel (i.e. the occupation layer, Layer 2) abutted and overlay the fibrous brown layer within which the coprolites were located. As the low ceiling of the shelter over the nest area would have precluded easy human movement, it is assumed that the Layer 2 deposit was dispersed over the nesting materials by natural processes and animal disturbances.

In addition to the moa remains, a cranium of the introduced skylark *(Alauda a. arvensis)*, the left metatarsus of a bellbird *(Anthornis m. melanura)* and a humerus of a tuatara *(Sphenodon punctatus)* were recovered. The latter was found below the fibrous nesting layer. There is no clear evidence of its consumption, but its presence, along with a tuatara humerus uncovered in the nearby Rockfall I site and bones of the same species uncovered in a natural deposit excavated from a cleft near Cromwell (Ritchie 1982), attest to the existence of the species in the Cromwell area within the past thousand years. The remains of tuataras also probably reflect the former proximity of forest cover.

In addition to these remains, a one-centimetre-long sliver of unidentifiable burnt bird bone was recovered which had been worked (Scarlett pers. comm.).

RADIOCARBON DATES AND CHARCOAL SAMPLE IDENTIFICATION

Charcoal samples from the three sites were submitted to the Radiocarbon Laboratory, Institute of Nuclear Sciences.

Three samples were submitted from Italian Creek. Two of the samples, NZ 4714 and NZ 4715 were derived from within a metre of each other from opposite sides of the same scoop hearth in square A2.

	Old T 1/2	New T 1/2	Secular Corrected
NZ 4714	410 ± 90 B.P.	420 ± 90 B.P.	470 ± 90 B.P.
NZ 4715	320 ± 80 B.P.	320 ± 90 B.P.	400 ± 90 B.P.

The third sample, NZ 4716, was collected from a discrete charcoal concentration in square A4. It produced a date some 200 years earlier:

NZ 4716	582 ± 96 B.P.	599 ± 99 B.P.	607 ± 99 B.P.

Despite the differences between the dates, they overlap within two standard deviations and in conjunction with the stratigraphic evidence indicate a single occupation of the shelter.

Botanical analyses of the three samples undertaken by Dr B. P. J. Molloy revealed the following composition of the samples.

NZ 4714	*Hebe* sp.	84%
	Discaria toumatou	16%

All material small stems of short life span, hard and brittle.

NZ 4715	*Hebe* sp.	50%
	Discaria toumatou	50%

All material of short life span, softer than those in NZ 4714.

NZ 4716	*Hebe* sp.	34%
	Discaria toumatou	66%

The wood identifications are well in line with the species that might be expected in the vicinity of the site. Historical records indicate that matagouri flourished abundantly in the area and was used extensively in the historic era as a fuel. Bathgate (1922:282) noted that "Hebe cupressoides was one element of the scrub in the riverbed", but the charcoal could have been derived from other scrubby Hebe species that grew in the gorge.

Three charcoal samples from the Rockfall I oven pit were submitted for dating. They produced dates of:

	Old T 1/2	New T 1/2	Secular Corrected	
NZ 4972	674 ± 60 B.P.	693 ± 62 B.P.	683 ± 62 B.P.	*Pittosporum* sp. dominant
NZ 4973	949 ± 59 B.P.	976 ± 60 B.P.	929 ± 60 B.P.	*L. ericoides* dominant
NZ 5067	992 ± 59 B.P.	1020 ± 65 B.P.	967 ± 65 B.P.	*L. ericoides* dominant

In addition, Dr B. P. J. Molloy identified *Discaria toumatou* and *Hebe* sp. as being minor components in samples NZ 4972 and NZ 5067.

The 674 B.P. date has been adopted as indicative of the occupation of the site. The two earlier dates are possibly the result of the utilisation of *Leptospermum* wood of some longevity (i.e. *c.* 200 years).

Ten samples of wood and vegetation found within the shelter were submitted to Dr R. N. Patel, DSIR Botany Division, for identification. The wood specimens were largely derived from within the "L" shaped stone walling at the entrance of the shelter. This area was dubbed "the bedroom" by the excavators because the vegetative matter was believed to be bedding debris. The identifications (Appendix 1) show a predominance of native species including *Nothofagus* and *Podocarpus* which are not found in the gorge today.

Two samples of charcoal from the Rockfall II oven pit were submitted for dating. They produced dates of:

	Old T 1/2	New T 1/2	Secular Corrected	
NZ 5340	632 ± 46 B.P.	650 ± 48 B.P.	655 ± 48 B.P.	*Discaria* dominant
NZ 5341	377 ± 40 B.P.	388 ± 41 B.P.	446 ± 41 B.P.	*Discaria* dominant

The discrepancy between these dates is puzzling and not accountable in terms of the minor components in the samples. In each instance, the minor components were made up of *Hebe, Sophora, Coprosma* and *Leptospermum ericoides* species, all in the form of small stem fragments. Further samples have been submitted to obtain a better resolution of the date of occupation of the shelter.

The radiocarbon dates indicate that the Italian Creek site was occupied about A.D. 1400 and Rockfall I about A.D. 1270. Unfortunately, the two dates from Rockfall II are conflicting, but they do suggest it was occupied more recently than the other two sites.

SOURCES OF THE LITHIC MATERIALS IN THE ROCKFALL SITES

In the absence of definitive source characterisation studies on all the rock types recovered in the Rockfall sites, ascriptions to particular sources can only be based on present knowledge of potential sources and the hand specimen characteristics of the stone from each. The recovered lithic materials were obtained from both local and distant sources.

The dominant rock type found in the Rockfall I site was a green coloured greywacke. This was collected in the form of cobbles from the nearby riverbank and used for preforming adzes or chisels. The small size of the flakes, the absence of polished surfaces and the lack of pieces bearing cortex suggests that initial shaping had been undertaken elsewhere, the recovered flakes reflecting the refinement of basic tool shapes.

The silcrete and most of the porcellanite in both sites are likely to have been collected from some of the known sources in the Manuherikia and Ida Valleys, a distance of 20-50 kilometres. (Stone from these sources is widespread in Central Otago sites.) Pieces were probably carried or collected for specialised cutting purposes, such as moa butchering. Although porcellanite sources typically exhibit a range of colour variations, in the author's experience, a dark brown colour is not common in the Ida-Manuherikia Valley sources, whereas it is common in the Mataura Valley sources. Since the Rockfall II assemblage also contains argillites of suspected Foveaux Strait origin, it is a reasonable possibility that some Mataura Valley porcellanite was collected en route.

Like the porcellanites, the most likely sources of the silcretes are some of the outcrops in the Ida and Manuherikia Valleys. Silcrete, however, seems to be more colour specific to particular sources. Thus the two colours evident in the silcretes may reflect obtainment from two discrete sources.

The argillite in Rockfall II can be reasonably confidently ascribed to the Bluff Harbour (dark green) and Riverton (light green) sources, reflecting a specific penetration of the Central Otago basins by a group from the Foveaux Strait coast. The other rock types in the sites, predominantly schist and occasional cobbles of local metasediments and greywacke, were collected locally and used as oven stones.

DISCUSSION AND CONCLUSIONS

This section briefly considers activities within the individual sites, and their selection as shelters. Evidence from the three sites is then reviewed in an attempt to elucidate their role within the wider exploitation strategies of which they are surviving components.

The cultural significance of intra-site activity locations, within and adjacent to the gorge rock shelters, is difficult to evaluate, given the small sample, and really beyond the scope of this paper. However, some comments are offered which may assist future research.

Three major factors determine the location of various activities in a site — cultural or individual preference and the physical limitations imposed by convenience and site topography. These features can be evaluated to some extent although very little emphasis has been placed on this aspect in earlier shelter excavation reports, which have tended to concentrate primarily on vertical distribution of materials rather than the horizontal variations within a site.

Insights into locational behaviour are evident from even a brief perusal of the literature. For example, Best (1974:239) states the Maoris preferred to sleep under light structures or in the open air, only resorting to their poorly ventilated whares in

winter, or to building temporary shelters when travelling if the weather was bad. Similarly, they preferred eating outdoors. Best (1974:101) records that they had strong prejudices against partaking of food in a dwelling-hut and that cooking was usually done out of doors, or under crude shelters on wet days (1974:104).

Although Best's comments refer specifically to the permanent village situation, such cultural traits are also likely to have had some bearing on the location of activities within the rigid confines of a rockshelter.

Certain activities clearly have some degree of mutual incompatibility, e.g. cooking, food refuse dumping and sleeping areas. The reasons for locating these features away from each other are readily apparent. However, activities such as stone-working are clearly "mobile choices". In the Rockfall sites, the stone-working areas in each instance were sited on the inward side of the oven pits, but in Rockfall II the flake scatter was actually inside the shelter, possibly reflecting inclement weather at the time of the site's occupancy. The sample is too small to determine if these facts have any cultural significance. However, a specific study of intra-site activity patterning from a good cross-section of shelter sites may prove fruitful.

Ethnographic evidence (e.g. Best 1974:231, 234 observation) that Polynesian travellers only sought shelter when in transit if the weather was particularly inclement, may explain why only a relatively small number of the gorge rockshelters contain evidence of Polynesian occupation, but it cannot explain why particular shelters were used.

The main attraction of the Italian Creek site was probably the presence of the creek itself, which is one of the few perennial streams in the gorge. Although the Clutha River flows through the centre of the gorge, relatively steep banks preclude easy access in many locations, including in the vicinity of Italian Creek.

On the other hand, the Rockfall sites are located only 80 metres from the Clutha River, and access is not difficult. The rockfall is a prominent feature and the jumbled boulders would afford a degree of protection from the elements which make the location stand out as an "obvious shelter spot" within the gorge. A recognition of the rockfall for the provision of human shelter is borne out not only by the two prehistoric occupations, but also the four longer term occupations by the Chinese miners in the nineteenth century.

Inference from the present state of knowledge of the prehistory of Central Otago and the analyses of materials from the three reviewed sites indicate that they represent hinterland or peripheral units in extensive exploitation systems centred on essentially permanent base camps at favoured locations along the south and east coasts of Murihiku.

Transient or short-term occupation of the three shelters is evidenced not only by the sparseness of the faunal remains, but also by the layout and size of the sites, the small hearths or oven pits showing no evidence of re-use, and the general paucity and nature of the artefactual remains. Despite their small size, each excavation produced different insights into the Polynesian subsistence and collection strategies in inland Murihiku.

Four main exploitation emphases are discernible from the field evidence: moa hunting and egg gathering, hunting and gathering within the immediate environment, the conveyance of food products such as freshwater mussels, and eeling, presumably from short-term camps, such as Parkburn (S124/4) and Tinwaldburn (S124/16) (Ritchie and Harrison 1981:100).

The arguments in support of moa egg consumption and the hunting of moas during their nesting season have been outlined in detail in the Italian Creek and Rockfall II site descriptions.

The degree of difficulty Polynesian hunters encountered in stalking and killing moas in various terrains is a subject upon which it is easy to surmise but difficult to demonstrate. However, it seems a reasonable probability that during periods of enforced sedentism, such as when moas were nesting, they were extremely vulnerable to hunters, who through observation and discussion of experiences are likely to have learned quickly the main patterns of the life cycle of their quarry. It has been suggested (Hamel 1979:62) that the numerous overhangs within the craggy rock formations of the Central Otago river gorges may have been favoured moa nesting locations. Such locations abound in the Cromwell Gorge and eggshell fragments found in many shelters confirm their usage (Ritchie 1982). If the early Polynesian hunters recognised such a regularity in moa ecology, it seems likely that they would undertake seasonal or regular raids on nesting areas.

If the exploitation of breeding areas involved the killing of adult moas and chicks and the collection of their eggs for food or industrial purposes, then it follows that such hunting pressures would lead to declining moa populations. Ultimately, as populations decreased, hunting pressures on surviving pockets would have increased relatively and resulted in their eventual demise in Central Otago, if not elsewhere (cf. Ambrose 1970:435).

It seems logical that hunting parties coming from coastal locations would require inland base camps from which they would range on hunting-gathering forays. In the Cromwell area, the Hawksburn site (S133/5) is likely to have served such a purpose (Hamel 1978, Anderson 1979). The Hawksburn site was presumably established in an area of high moa density and used as a base camp for hunting in the vicinity and possibly for occasional forays to other recognised productive hunting areas. The ground evidence indicates that the Cromwell Gorge may have been one such location, perhaps with the added incentive of easily caught nesting moas and egg collection. Temporary camps and butchering sites are likely to be a remnant of such activities.

Organised hunting expeditions aside, it is unlikely that a hunting party whilst in transit would forgo the opportunity to make a "spontaneous kill" if they happened upon a hapless moa in circumstances where it could be easily despatched.

Discounting the moa remains, the physical evidence of the procurement of foodstuffs in the vicinity of the sites in question is sparse. It consists of only the cooked remains of a kaka at Italian Creek and the likelihood based on pH tests that the Rockfall oven was used for cooking vegetable matter.

The presence of tuataras in both Rockfall sites and the oven-charcoal identifications indicate that stands of shrubland existed at no great distance from the shelters at the time of their occupation. In addition, species such as weka and pigeon are likely to have been locally abundant, the native quail formerly thrived in the shrubland vegetation, whilst various duck species were likely to have nested on the open river flats beyond the gorge (Ritchie 1982).

The freshwater mussels at the Italian Creek site must have been conveyed there from a location beyond the gorge. The shellfish prefer slow moving water such as in lakes and river backwaters, where they lie in the mud on the bottom. Presumably Italian Creek mussels were collected at no great distance, probably within a 30 km radius of the site. The nearest colony that exists today is in a backwater on the Clutha River between Alexandra and Clyde. Other possible sources were cited in the Italian Creek report (Ritchie n.d.:9).

Despite the lack of ground evidence, ethnographic accounts indicate that eeling was a major economic pursuit in many parts of prehistoric New Zealand. The backwaters of the Clutha River and its tributaries would have afforded many suitable

habitats for eeling, as typified by the locations and inferred roles of the Parkburn and Tinwaldburn sites near Lowburn in the Upper Clutha Valley (Ritchie and Harrison 1981:100). However, it seems inconceivable that the *purangi* fishing net found at Italian Creek would have been used successfully in the fast flowing and entrenched Clutha River in the vicinity of the site, or at many other locations in the gorge. The net may have been abandoned in transit, or left with the expectation of returning for it.

The lithic assemblages from the three sites were not substantial (totalling 712 units), but they are large and varied enough to reveal some patterns. Both the ovens and the lithic distribution in the Rockfall sites, i.e. one-use ovens surrounded by a scatter of flakes, suggest single phase occupations. Imported artefacts and rock types such as the obsidian in the Italian Creek site and the argillite adzes or chisels, evidenced by the recovery of polished chips at Rockfall II, must have been carried at the time of the site's occupation. These rock types are specific evidence of coastal contacts. The argillites can be reasonably confidently ascribed to the recognised Foveaux Strait sources, whilst the obsidian was derived initially from Mayor Island. Post-encampment collection of the silcrete and porcellanite is conceivable, especially if it was wanted for a specific purpose such as butchering a moa. However, it is likely that small pieces of stone for making cutting tools were regularly carried on long expeditions.

The Rockfall sites, despite their close proximity, revealed interesting inversions in the rock types present at each. In Rockfall I, flakes of locally procured greywacke dominate the artefactual assemblage with porcellanite and silcrete forming only a minor component (7 percent). The form of the greywacke flake debris in Rockfall I indicates that adze preforming and maintenance were the main activities being performed, whereas in Rockfall II the greywacke is unflaked spalls off oven and hammer stones.

In Rockfall II, porcellanite and silcrete, imported from sources at least 20 km distant, are the main lithic types. Significantly, there is also a high correlation between the flake distribution and the scatter of butchered moa remains. Although few of the recovered flakes bear obvious signs of use, it is highly probable that the main activities, i.e. blade or cutter production, and the moa butchering and cooking were functionally related.

Economic activities aside, the gorge shelters obviously served to some extent as short-term camps or links within chains or groups of inland resource obtainment locations utilised by various Maori groups.

Hamel (1978:119) suggested that a route up the Fraser River, via the major moa hunting site at Hawksburn (S133/5, Anderson 1979), and then on to the Kawarau could be seen as a logical route, bypassing the difficult Cromwell Gorge. Despite the difficulties that may have been encountered in traversing the gorge, the known site distribution clearly favours the gorge itself as the main thoroughfare between the Alexandra Basin and the Wakatipu and Upper Clutha districts.

Beginning at the eastern end of the gorge there are the tantalising references by Gilkison (1978:4) to the existence of Maori sites between Clyde and Alexandra. He wrote "Halfway between Clyde and Alexandra there used to be fairly extensive middens containing ashes, flints and bones; and under a large rock near Clyde [S133/599] there used to be ashes and remains of freshwater mussel shells . . . . At Muttontown Gully [near] Clyde there was found a slab of flint from which about one dozen flakes lying beside it had been chipped." Field surveys undertaken by the author have failed to find any trace of the sites described by Gilkison. However, it is reasonable to assume that Gilkison, a former solicitor resident in Clyde from 1887 to

1903, was referring to positively observed evidence of prehistoric human activity, the traces of which have been obliterated by gold dredging and pastoral development.

The Otago Museum holds two collections of lithic material from unrecorded sites in the Clyde Common-Alexandra Flat areas. These are the R. E. Berry collection (Acc. No. D53.247), consisting of 207 flakes of silcrete, grey porcellanite and greywacke and some ovenstones. A further collection of six silcrete blades (D21. 1065-1071) is labelled "Clyde Common". These areas at the eastern end of the gorge have also been surveyed recently, but again no trace of prehistoric occupation has been located.

Within the gorge itself, the three described excavations have produced varied evidences of Polynesian subsistence and lithic resource collection strategies. Transient usage of the many potential shelters in the gorge is also attested by the recovery of a porcellanite flake near a shelter (S133/35) in the mouth of Cairnmuir Creek, whilst four small siliceous flakes were found outside Caliche shelter (S133/223) during the excavation of a Chinese miners' camp there in February 1979.

At the western end of the gorge, evidence of a working floor and ovens (S133/16) was ploughed up at Cornish Point during the establishment of an orchard in the 1930s. No midden was noticed at the time, but the silcrete and porcellanite flakes included fragments of blades. The site referred to by Taylor (1952:143) as "the old time pa on the site occupied by Cromwell was Wairere" is conceivably the Cornish Point site.

Immediately beyond Cromwell on the Lowburn-Pisa flats, several oven sites have been recorded near Lowburn township (S133/3, S124/3), on the north bank of the Locharburn (S124/15), near the mouth of the Tinwaldburn (S124/16) and near Lindis Crossing (S124/28). Notable artefacts found in this area include a *patu onewa* at Kidd's Creek (S124/11) and a greenstone adze (S133/8) at Lowburn. The Parkburn and Tinwaldburn sites were excavated in January 1981. The excavators concluded that they served as eeling camps (Ritchie and Harrison 1981).

The density, distribution and short-term nature of the sites reflects transitory movement of Polynesian parties through the Upper Clutha area, probably en route to further inland resources such as the greenstone deposits above Lake Wakatipu. On the coastward journey *moki* rafts were probably used on the river wherever practically possible. A consequence of raft usage would be fewer camp sites. Two of the excavated shelters, Italian Creek and Rockfall I, could be regarded as small way stations within a coastal-inland movement pattern, their central location within the gorge making them convenient stopping places.

Whilst the Rockfall II site was also of short-term, the killing and consumption of a moa at the site, and the lithic remains, indicate it was probably of longer duration and may in fact have been a satellite camp of a semi-permanent base settlement such as that at Hawksburn. The difficulties of demonstrating such a relationship are twofold — proving contemporaneity and shared cultural traits. A specific comparative analysis of the lithic assemblages and butchering techniques at the Rockfall II and Hawksburn sites may show some relationship but proving contemporaneity is the biggest obstacle, especially with the error margins associated with radiocarbon dates on charcoal.

To conclude, evidence from the excavated sites in the Cromwell Gorge and the distribution and nature of nearby sites indicates that the gorge served as an important thoroughfare between the Alexandra and Upper Clutha basins. Considering the surrounding mountainous topography, the route is a logical passage to follow to and from the interior. The abundant rock overhangs would have afforded ready

shelter for travellers during inclement weather. The river itself is likely to have been important too as a means of conveyance on coastward journeys.

Although the other major river gorges such as the Roxburgh and Kawarau Gorges have not been investigated to the same degree as the Cromwell Gorge, it seems likely that they would have served similar roles. Internal obstacles, such as rapids or steep faces, would have been bypassed by skirting around them. It is suggested that the three reviewed sites are representative of many other small camp sites which formerly existed and, in some cases, still survive in the river gorges and valleys of Central Otago. Many of these sites must have been obliterated by subsequent events, notably the goldrushes and the formation of Lake Roxburgh.

In addition, it has been proffered that rock overhangs were a favoured type of moa nesting habitat, and that this trait was quickly recognised and exploited by the early Polynesian inhabitants of Murihiku. Although it is often difficult to prove cultural relationships between sites, it is also suggested that some of the small camp sites in Central Otago were satellite camps, established when parties ranged on hunting or collecting expeditions from larger base camps such as the Hawksburn site.

The radiocarbon dates from the reviewed sites suggest that the main period of prehistoric use of the gorge predated the extinction of the moa in the area, i.e. approximately three hundred years before A.D. 1500. Moa populations appear to have declined rapidly, probably from a combination of over-exploitation and man-induced destruction of their habitat. The paucity of sites bearing evidence of moa exploitation attests to a shortlived association. Furthermore, the lack of post A.D. 1600 radiocarbon dates from sites in Central Otago suggests that the demise of the moa resulted in a decline in visits to the interior. It is likely, however, that the gorge continued to be used as a major thoroughfare into Central Otago for parties from East Otago and Foveaux Strait, seeking nephrite and other interior resources. Many of these resources may have been discovered centuries earlier by Polynesian parties in quest of the moa.

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APPENDIX 1

LIST OF IDENTIFIED WOOD SPECIES IN THE ROCKFALL I SITE (S133/121)

1. *Discaria toumatou*
2. *Hebe* sp.
3. *Sophora* sp. *(microphylla* or *prostrata)*
4. *Nothofagus* sp.
5. *Larix* or *Picea* (more likely *Larix*)
6. *Olearia* sp.
7. *Podocarpus totara/P. hallii*

* Identifications by Dr R. N. Patel, Botany Division, Christchurch.

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