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HAWKSBURN REVISITED: AN ECOLOGICAL ASSESSMENT

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Introduction

In 1955 Les Lockerbie excavated a moa-hunting site in the upper Hawks Burn Valley, Central Otago, finding several ovens and a refuse layer of abundant stone tools and moa bones (Lockerbie 1955, 1959). The association of moa bones and artefacts with ovens is unusual for inland Otago. The site (S133/5) lies in an arid wilderness of steep hills twenty kilometres south of Cromwell (Fig. 1), well away from the main river system. At present the natural environment is almost entirely devoid of food resources and materials for making shelters. The climate is such that even in summer abundant food, good shelter and warming fires would be necessary for survival, yet the only woody plants at present are thorny twisted shrubs of matagouri Discaria toumatou which provide a hot firewood but poor building material. 'Industrial' rock types such as silcrete or porcellanite are not known to exist in the vicinity.

Although this site has puzzled New Zealand archaeologists ever since Lockerbie's brief publications, its remoteness has obstructed reinvestigation. In January 1978, I had the opportunity to visit the site to bury a thermal cell as part of a research project organised by Foss Leach, Otago University, for dating obsidian flakes. The environmental anomalies of Hawksburn aroused my interest and this paper will have two objectives: to sum up what we know about Hawksburn as an excavated but virtually unpublished site and to develop from what we know of its palaeoenvironment, hypotheses which will assist us in site location analysis in Central Otago.

In terms of human economic behaviour, there are three sets of problems associated with Hawksburn. How did Polynesian man survive there in the face of an apparently hostile environment? Where were the raw materials of the numerous stone tools obtained and what was the objective of carrying so much stone material to Hawksburn and leaving it there? If we assume that the presence of moa populations in the valley are important parts of the answers to these questions, why was moa hunting so effective there and what were the moas living on?

Hawksburn: the evidence

From published data (Lockerbie 1955, 1959) and a brief investigation, it is apparent that Hawksburn was a well-used, moa butchering site, lying in the centre of a long narrow river flat where a rocky spur extends out into the flats. According to the landowner this is an uncomfortably windy corner of the valley but it is just feasible that the spur attracted

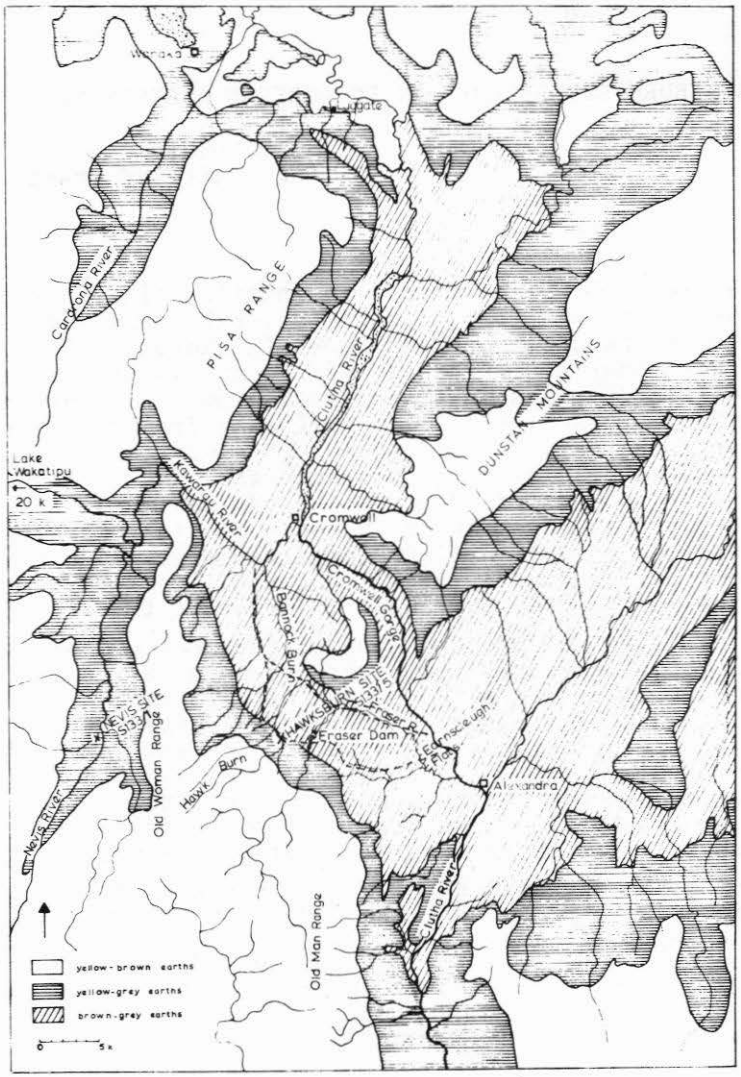

Fig. 1

River systems and soils of Central Otago in the vicinity of Hawksburn. Routes from Earnscleugh Flats to Kawarau shown by dotted lines.

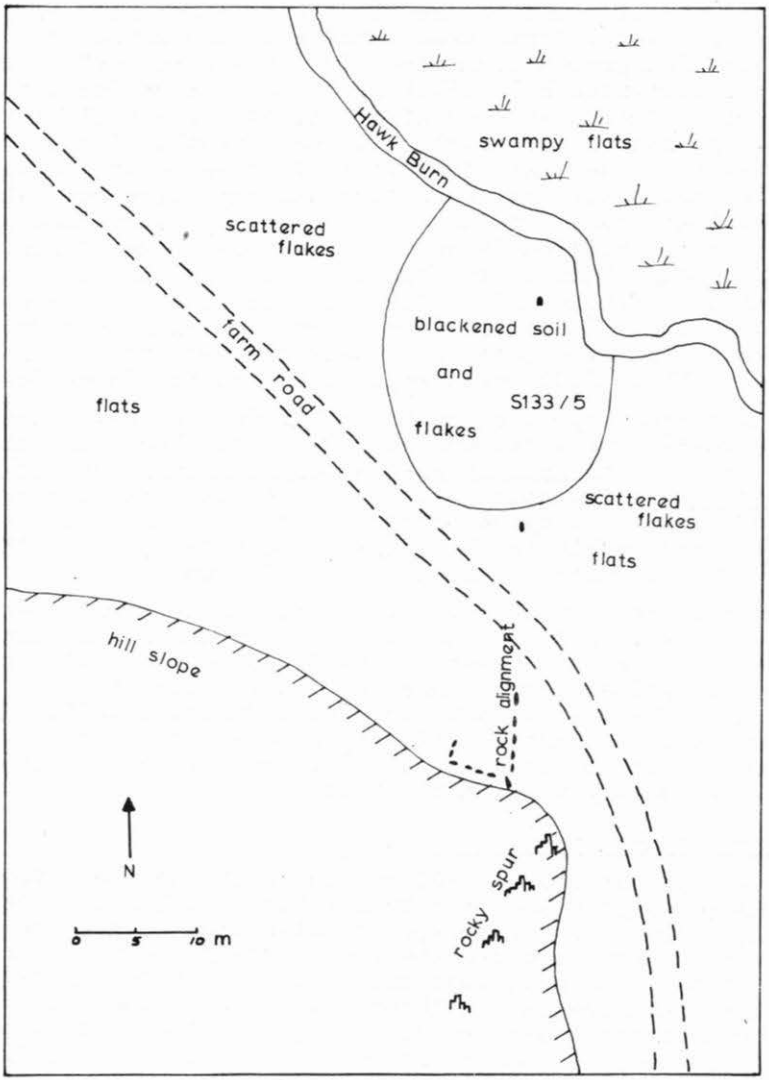

Fig. 2

Plan of the Hawksburn site (S133/5).

Polynesian man because it could be used as a hide from which to ambush moas moving down the flats. Structurally the site consisted of a line of about six ovens on flat ground ten metres from the stream (Fig. 2). The oven hollows were surrounded by a black deposit 15-18 cm deep, covering about 60 x 40 m with some high concentrations of stone tools and moa bones in it (see Appendix 1 for details). Though porcellanite and silcrete flakes were the most abundant artefacts, small adzes, slate knives, small flakes of obsidian and pieces of greenstone and argillite were also found (Lockerbie 1959). Some small artefacts collected from disturbed surfaces in January 1978 were identified in hand specimen by Graeme Mason, Anthropology Department, Otago University. All were of rock materials available in the upper Clutha or Manuherikia catchments but could have come from further afield. The only 'industrial' rock known on Hawksburn Station is four kilometres away from the site and consists of white, coarsely crystalline silcrete (NZMS 1, S133, grid ref. 031537 in the lower Hawksburn).

The faunal material deposited by Lockerbie in the Otago Museum consisted of the remains of three moas and two dogs. The moas belonged to three different species; Pachyornis elephantopus, Euryapteryx gravis and Anomalopteryx didiformis (identifications by Ron Scarlett, Canterbury Museum). Each individual was represented by both leg bones and other parts of the body and so presumably the birds were butchered on the site. The material is not just 'industrial' bone carried in from elsewhere.

Radiocarbon measurements of some of the moa bones gave dates of a.d. 1550±55 and a.d. 1500±60 (N.Z. 59 and N.Z. 60, Fergusson and Rafter 1957), but these may be too young as it was not realised in the 1950's that bone carbonate can be contaminated by younger soil carbonates (Polach 1972). Two other dates from charcoal of a.d. 1350±60 and a.d. 1360±50 (N.Z. 62 and N.Z. 61, Fergusson and Rafter 1957) may be more realistic. The presence of three species of moas is also more typical of a 14th century site than of a 16th century one (Hamel 1978).

The local environment and its problems

The Hawksburn site at 670 m (2200 ft) is in the northern foothills of the Old Man Range which rises to 1800 m (6000 ft). These hills lie on a topographically easy route for groups of Polynesian people travelling between the east coast of Otago and the greenstone sources at the head of Lake Wakatipu. Before a European road was made through the Cromwell Gorge of the Clutha, the coach road and walking track ran through low passes in the foothills north of the Hawksburn site (Fig. 1). There is however a secondary set of low passes from the Earnscleugh Flats via the Fraser Dam area and the Hawksburn site to the Kawarau River. If there was a food source to attract people higher into the foothills, then the Hawksburn site could be seen to lie on a logical route between Earnscleugh and the Kawarau, by-passing the difficult Cromwell Gorge. The food source could only have been moas.

Looking at the present environment of Hawksburn, it is difficult to understand what forage would have been available to support such large herbivores as moas. The degree of speciation in moas, the gizzard contents so far analysed and the generally forested Tertiary landscape of New Zealand during their evolution (Greenwood and Atkinson 1977) all suggest that moas were adapted to a variety of forest niches and that our native grasslands did not or could not support moa populations in the absence of forests. The evidence for forest in the vicinity of Hawksburn prior to the 13th century is interesting but not as yet clear cut.

From climatic and vegetational studies, Mark and his students (Mark 1974, Wells 1972) have defined four altitudinal zones, the boundaries of which follow the contours along the eastern slopes of the Old Man range (Mark 1974:531), but rise higher on the warmer north-facing slopes where the Hawksburn is located. The lowest zone, the montane, includes the semi-desert scabweed community of the river flats and lower foothills where mean annual rainfall is less than 400mm and summer temperatures so high that plants suffer from inadequate soil moisture for most of the growing season. This community has been induced from the original fescue tussock Festuca novaezelandiae vegetation by European grazing and burning and now rises to almost 800 m on the north-facing spurs. In the upper montane zone around Hawksburn where mean annual rainfall equals 450-700mm, the native vegetation is a fescue tussock community with dense patches of matagouri, particularly in gullies and on shaded slopes. Droughts occur during most summers. It is in this upper montane zone that subfossil logs of Halls totara Podocarpus hallii and buried charcoals indicate the previous existence of forest, mostly destroyed by fires in the 12th to 14th centuries (Molloy et al, 1963). In Central Otago most of these logs occur between 700 and 1200 m (B.J. Molloy: pers. comm. 1978). Above the montane, Mark (1974) defines subalpine, low alpine and high alpine zones supporting snow tussock, herbfield and cushion vegetation. It is the band of montane savannah-forest vegetation along the hillsides, confined between the arid lowlands and cool subalpine grasslands which would have provided the most abundant forage for moas in Central Otago, and the distribution of which is of considerable interest to the archaeologist.

Unfortunately the modern forest remnants have not been used by the botanists in defining their vegetational zones and the altitudes of local finds of charcoal and subfossil logs have not been published. The width of the forested band could not have been very great. At present the 10°C mean summer isotherm lies at about 1000m (Mark 1965) and above this, low summer temperatures prevent tree seedling establishment. The lower boundary of the present forest remnants is determined by moisture levels and it is likely that 600 mm mean annual rainfall is the minimum required for forest growth around the edges of the Central Otago basins (Mark: pers. comm. 1978). This implies that in the absence of fire and grazing animals forest would not extend much below an altitude of 900m in the Hawksburn area at present. Climatic differences 700 years ago may have allowed a

wider band of forest on the hillsides and the precise boundaries should be determined by the location of charcoals and subfossil logs.

The species composition of Central Otago montane forests was considered by Wells during her work on the Pisa Range, 40 km to the north. The present relict stands on the Pisas are mainly Halls totara with a few small stands of silver beech Nothofagus menziesii. Both species grow vigorously at present and, when not attacked by fire, regenerate freely. Subfossil logs of Halls totara on the Pisas are long, straight and unbranched, a form typical of trees grown within a closed forest. Charcoal of Nothofagus, which does not have a durable wood, is common in the soil and from this evidence Wells concludes that silver beech could have been an important component along with Halls totara in the original forests, and that the forest was dense with a closed canopy rather than of an open savannah type. However mean annual rainfall in this zone on the Pisas is between 700 and 770 mm, a value reached only at the top of the montane zone on the Old Man Range. Forest in the Hawksburn area may have been confined to gullies between 800 and 1100 m altitude, somewhat more open than in the Pisas and, since no subfossil logs of Halls totara have been found in the catchment, may have been mostly silver beech. The nearest totara logs to Hawksburn have been found on east-facing slopes at 915 m altitude in the Fraser River, three kilometres to the south of the site, and in the Nevis River at 800 m altitude and 15 kilometres to the west. The latter were radiocarbon dated at a.d. 1290±60 (N.Z. 47, Molloy et al, 1963).

The ecotone between hillslope forests and the arid lowland grasslands was obviously complex and for the archaeologist is best considered as quite a broad zone. Its definition and recognition after so many centuries of burning is difficult. Not only will its altitude vary with aspect but it will also fall from east to west as rainfall rises sharply towards the Lakes District. These altitudinal and east-west gradients of rainfall affect the pattern of mountain soils which show a pluvo-sequence from the brown-grey earths of the dry inland basins, through yellow-grey earths to yellow-brown earths at higher altitudes and further to the west (McCraw 1962). Soil maps of the Hawksburn area suggest that the location of the yellow-grey earths may be a useful indicator to the archaeologist of the natural position of the lower timberline in the past. This soil type is developed under 450-760 mm annual rainfall on the hillslopes around the Cromwell, Alexandra and Maniototo Basins and its location on the ground is best defined in the soil maps accompanying Soil Bureau Bulletin No. 27 (1968). The Hawksburn site lies on the lower boundary of the Arrow-Blackstone hill soils which are the local yellow-grey earths lying in a band two to four kilometres wide and rising 400 m in altitude up the Old Man Range (Fig. 1). If 600 mm annual rainfall is needed for forest growth in this area, the position of the lower timberline should have been within this zone with forest extending into the yellow-brown earths above. Charcoal is difficult to find in these yellow-

grey earths but finds of subfossil logs and charcoal increase higher up in the zone of yellow-brown earths (B.J. Molloy: pers. comm. 1978). It seems reasonable to expect that other early sites in the Upper Clutha and Maniototo may lie in the extinct ecotone demarcated by the yellow-grey earths.

Location of known Archaic sites in Central Otago

Philip George excavated a site (S133/1) where Schoolhouse Creek enters the Nevis (Figure 1), which must have been very similar to the Hawksburn site. It also lies at 670 m and is surrounded by Tiroiti and Arrow yellow-grey earths. Rainfall is higher since the site lies well to the west of Hawksburn and it is relatively high in the yellow-grey earth band. The material found consisted mostly of moa bones and tools similar to those at Hawksburn, lying in and around ovens but the site had been damaged by gold mining prior to George's excavation (George 1937). George also found heavy moa bones, flakes and a large silcrete blade on a spur two miles from S133/1 and several hundred feet above it, but this site has never been relocated. The Nevis Valley provides the easiest route from the Central Otago valley-basin systems to the Southland Plains and lakes Te Anau and Manapouri.

A site at Puketoi (S144/4) described by Murison (1871) lies beside Waitoi Creek where it emerges from the hills on to the Maniototo Plain at an altitude of 460 m. Like Hawksburn it lies at the lower edge of a band of Arrow yellow-grey earths stretching along a hillslope with brown-grey earths on the dry flats below. The site has been destroyed by farming operations but from Murison's description it must have been structurally similar to Hawksburn; a line of oven hollows 10-15 m from a small creek with numerous burnt moa bones, a dog jawbone, 'chert' (silcrete) flakes mostly made into knives and some polished stone artefacts lying in and among the ovens. The differences were that Puketoi had so much moa egg shell that it formed layers in places and there was a silcrete source 20 m away on a terrace above the site. The silcrete boulders visible today are of a technologically, low-grade crystalline type. Murison also commented on the lack of food resources other than moas, since the creek was inadequate as habitat for either eels or fresh water mussels. Like Hawksburn the spurs at the mouth of the creek could have provided cover from which to ambush moas feeding out on to the swampy flats.

It is interesting to find that the silcrete quarry at Oturehua (S134/1), 28 kilometres north of Puketoi, lies within a band of Blackstone-Arrow yellow-grey earths. This site dated to the 11th century (Leach 1969, a) consists of working floors around boulders where a blade technology requiring a high degree of skill was being practiced but no evidence for the cooking of moas, dogs or any other foods could be found beside the working floors. The site is part way up a broad spur and has none of the

topographical features of Hawksburn, Puketoi or the Nevis S133/1 site. Using these other sites as indicators, we should expect the food preparation area of the people working at Oturehua to have been in a strategic location where moas could be easily ambushed and cooked, e.g. where a nearby stream comes down on to the flats from slopes covered with yellow-grey earths which could have carried forest in the 11th century. There is in fact a report that ovens and moa bones were ploughed up where the stream to the north of the site flows out on to the flats less than one kilometre northwest of the quarry (B.F. Leach, pers. comm. 1978). Likewise the oven at Luggate, near Wanaka, which contained the remains of 'the largest size of Moa' (Gilkinson 1958:2) and whose location is no longer known, should be looked for where Luggate Creek or the Fall Burn emerge on to the flats, since Blackstone-Arrow yellow-grey earths lie along the slopes above these creeks.

The locations of these sites and the evidence about past forests suggest that simple ambushing may have been an important hunting strategy. It is also feasible that regularities in daily and seasonal movements of moas could have been observed and exploited. Moas, like the introduced red deer Cervus elephas in our forests, may have tended to move down from the shelter of the forest to feed for part of the day on the lush growth of the swampy flats. It is also interesting to note that of the native birds which graze at present in our tussock grasslands, takahe Notornis mantelli and kakapo Strigops habroptilus spend a large part of the year feeding in alpine forests and shrublands (Mills and Mark 1977). It seems plausible that moas in Central Otago also utilized complex ecotonal niches.

Discussion

I do not wish to imply that by observing the modern distribution of yellow-grey earths and measuring temperature and rainfall gradients up hillsides, we can evolve a cook-book formula for locating moa hunting sites in Central Otago. Soil and climate and the resultant vegetation patterns are only the background against which human and moa populations moved. The patterns have obviously not been static over the past 1000 years but the changes will have been restrained and regular in nature and hence predictable.

The present soils and vegetation can be used as indicators of the pattern of rainfall and temperature gradients, gradients which being intimately related to the distribution of past forests, affected the incidence of moa populations. An investigation of buried charcoals in soils and subfossil logs will be necessary to establish finer details of forest distribution relative to site locations.

The variables controlling the location of moa hunting sites were obviously not just moas. In fact there is no reason why we should assume that the location of any given site was wholly determined by a single

factor. From the nature of the known sites, both the exploitation of industrial rock types (Puketoi and Oturehua) and their utilization (Hawksburn) affected choice of location. (It is worth noting that the quantity of stone tools from Lockerbie's excavations at Hawksburn seems to be far in excess of that required to butcher three moas.) Besides moas and industrial rock, the third obvious variable involved is the location of topographically easy routes, which can be postulated as either a) leading from one district to another, e.g., Central Otago basins to the Southland Plains, or b) leading from or to a specific rock resource, either within Central or outside it, e.g. Wakatipu greenstone. This is the most difficult variable to handle since given a site it is usually easy (and tempting) to "discover" the place which the site is en route to. Part of the solution here will lie in accurate sourcing of stone materials and the critical use of stone technologies as "fingerprints" to establish site conjunctions (Leach 1969b).

It seems profitable to view the locations of Central Otago sites as compromise solutions by their occupants in the fact of conflicting needs. From the known sites, it seems they needed locations where there was a reasonable certainty of finding food, especially moas prior to the 14th century, within easy walking distance of a rock source, or else on a reasonably good route which could be incorporated economically into a seasonal schedule of travel between rock and/or food recources of both the inland and the coast. Needless to say that once moas were extinct the relations between these variables changed.

Acknowledgements

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Appendix One

Lockerbie's data, 1955

Structures

Ovens, a hut site and a deposit 15-18 cm deep.

Materials

High concentrations of flakes - more than 500 in an area 3.5 x 3.5m (10 x 10 ft), and 257 pieces of stone and bone in an area 1.2 x 1.2m (4 x 4 ft). Much surface material - flake knives, "chippings of quartzite and jasperoid rock, as well as occasional small adzes, broken slate knives and small pieces of obsidian and greenstone" (Lockerbie, 1957). Ground flakes were quite numerous. "From a hut site, small flakes of obsidian, pieces of greenstone and argillite, and a sea shell were recovered" (Lockerbie 1959).

INVESTIGATIONS 1978

Structures. There were originally about six oven hollows about 0.75m deep (Ron McIlroy, pers. comm.) and their location is now indicated by a slightly uneven surface of blackened soil 60 x 40 m in area. Where the site is sectioned by the creek there is 15 cm of natural grey silty soil overlying 30 cm of blackened silt lying on a bluish grey pug. A hole, 15 cm square, dug into the backfill of Lockerbie's excavation to bury the thermal cell, showed 25 cm of blackened soil lying on a stoney grey silt.

Artefacts surface collected January 1978

Porcellanite flakes - purplish-red, purplish-grey, light grey, bluish-grey.

Silcrete flakes - reddish grey, bright brown, black, grey and white.

Portion of adze - well indurated, dark grey, fine sandstone.

Fragment of cutting edge of an ulu - finely polished, well indurated, fine siltstone.

Bones Deposited in Otago Museum by Lockerbie

Pachyornis elephantopus: femur, tibia, fibula, metatarsus ischium, pubic processes, tracheal rings.

Euryapteryx gravis: femur, tibia, fibula, sesamoid process, phalanges, claw, ischium, pubic processes, vertebrae, tracheal rings, sternum, sternal ribs, thoracic ribs.

Anomalopteryx didiformis: femur, vertebrae, ribs, tracheal rings.

Canis familiaris: mandibles, pelvis.

Local Environment, 1978

The site lies on the west side of the Hawk Burn (N.Z.M.S.1 S133, grid ref.008500) on a river flat three kilometres long and 300-400 m wide. It is situated where a rocky spur from the west narrows the valley to about 120 m wide so that the site is confined between the stream and a moderately steep hillside. The river flat is a mosaic of dry gravelly alluvium and boggy areas covered with low clumps of Scirpus. The drier areas and the adjacent hillslopes are covered with short fescue tussock Festuca novaezelandiae with occasional clumps of matagouri one to two metres high. There are no cabbage trees Cordyline australis in the vicinity though they occur at similar altitudes 30 kilometres to the south on the Old Man Range. Maori onion Bulbinella hookeri, a plant with useful fibrous leaves about 40 cm long, is abundant in shaded gullies and the Scirpus species of the swamps could have been used for thatch. The only bracken that the landowner knows of is a 0.1 ha patch in a neighbouring catchment.

The creek is unsuitable for eels, lampreys, freshwater mussels, whitebait or lobsters but there may have been sufficient cover originally in the swamps of the valley floor to carry a small population of ducks. There are small numbers of open country birds such as harriers, gulls and oystercatchers in the district but mostly at lower altitudes.

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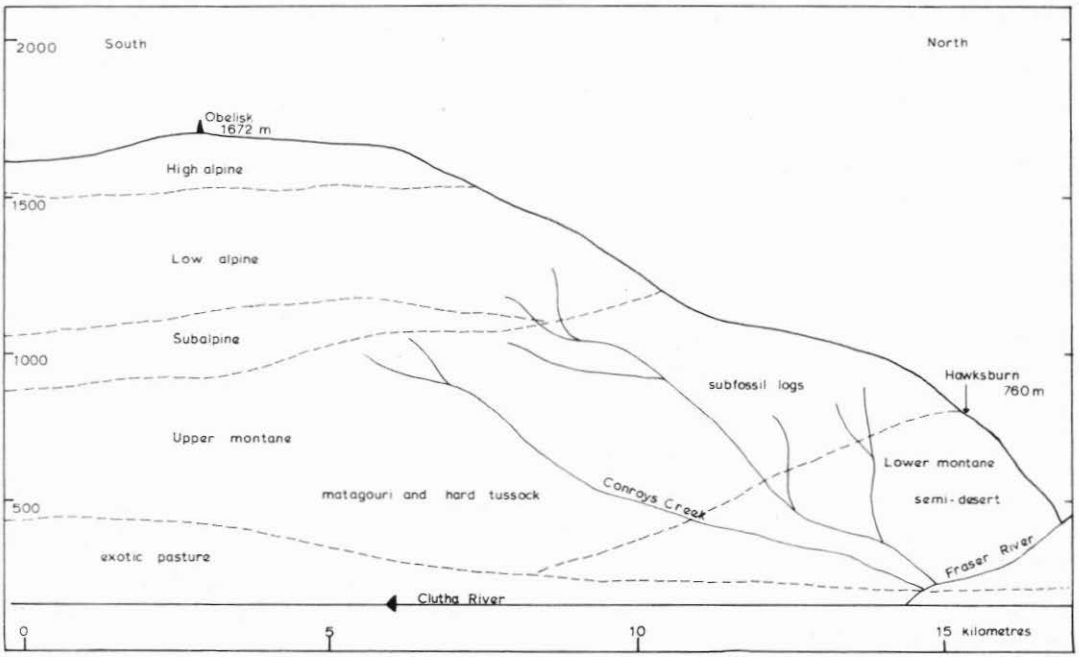

Fig. 3

Diagram of vegetation zones on the Old Man Range, Central Otago (after Mark 1974).