NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION NEWSLETTER

SCORIA MOUNDS AT WIRI

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Abstract

Examination of scoria mounds at Wiri, on an area of basaltic volcanic soil near Auckland, leads to the conclusion that most are prehistoric and that few are primary structures, the majority deriving from breakdown of earlier walls.

The Wiri volcanic field at Manurewa, South Auckland, contains besides two now demolished terraced volcanic cone pa, Wiri Mt and McLaughlins Mt, the probable remnants of a prehistoric garden zone (Sullivan, 1972), where the most prominent field structures are mounds of basaltic scoria. Remains of wall lines and probable field shelters are also noticeable; but while possible shelter remnants can be counted in tens, and wall remnants in hundreds, scoria piles run into thousands, possibly as high as ten thousand originally, over a total area of about 700 acres; so that any attempt to interpret the pattern of field remains at Wiri must begin with an examination and classification of these.

Scoria mounds are found everywhere over the Wiri lava field which surrounds the former cones; there being very few areas of more than one-eighth of an acre where there are not at least one or two; and while a certain proportion of the Wiri surface has been destroyed by quarrying, aerial photographs of 1939 show a similarly ubiquitous distribution of scoria piles and wall fragments on an essentially intact surface (L & S, 1939). The state and frequency of mounds varies over the area; on some places mounds are clustered together in groups of several hundred, at a density of about one to every 10 m^2; elsewhere they are relatively or absolutely few. Average diameter of mounds is 2-3 metres, with a range of 1-6 m; heights vary from 5 cm to about 2 metres, with most between 30 and 60 cm high. Shapes range from roughly circular to ovoid, and by present appearance mounds can be grouped as follows:

(a) Earthed mounds. These have an earthed-up and grassed-over profile, usually 5-100 cm above surrounding ground, with some embedded scoria usually visible on the surface.

(b) Partly earthed mounds: with an earthed-up and grass-grown base, 5-80 cm high, and an upper section of bare piled scoria, often lichen covered.

(c) Bare mounds. The entire pile from the ground up presents a surface of bare scoria; these tend to be the highest piles, and are much less frequent than either of the first two types.

EFFECTS OF POST-EUROPEAN ACTIVITY ON EXISTING PATTERN OF FIELD STRUCTURES

It is hypothesised that the majority of field structures, including the scoria mounds, are prehistoric, with some possibly referable to the protohistoric period, and that post-European settlement activity had relatively little effect on the nature of field remains. The pre-1840 Fairburn claim to a vast tract of land including Wiri, and the inclusion of Wiri in the 1842 Clendon grant of 10,000 acres (L & D, 1845), can have meant little in terms of practical interference to any existing scoria structures, at what was then the far end of a vast unfenced area. The sale of 2,786 acres of the Clendon grant to T. M. McLaughlin in 1845 (L & D, 1845), probably dates the beginning of effective European impact on the Wiri volcanic block. Farming thereafter has been pastoral, as frequent lava outcrops make large scale ploughing impracticable, and a major impetus to clear the ground completely of scoria has been lacking. Initial management concentrated on fencing-in large blocks for stock runs, using plentifully available surface scoria as a fencing material. This work, put in hand by the McLaughlin family, appears to have been completed by about 1860 (McLaughlin, pers. comm.). The resulting double-faced dry stone walls are still prominent, with individual stretches up to three-quarters of a mile long; and it is probable that the completion of each of these enclosures marked the first introduction of sheep and cows on to ground inside. Along each side of the dry stone walls, clearance zones can be traced, there being almost no mounds or wall lines with bare scoria, within 50 metres of either side of a modern dry stone wall. However, such walls, post-European but pre-1860, do overrun earthed-up scoria mounds and earthed-up wall lines in a number of places, indicating that some at least of these pre-date 1860, and by extension, 1845. Local opinion on the scoria mounds and wall fragments varies; some people consider that they result from post-European clearance, but are not able to specify times or people concerned; while others attribute them to the prehistoric Maori. The McLaughlin family recall no farming practice carried out under their management which would have led to formation of scoria mounds in most areas on the scale seen now. Piling up of scoria into heaps was undertaken in limited sections of the central zone between the cones, under a scheme providing employment during the depression years of the 1930s; this scoria was later sold and removed, and the area now shows a low frequency of structural remains of all types,

compared with other areas where this practice is stated specifically not to have been carried out (McLaughlin, pers. comm.). Structural scoria pilings attributable to the period after 1845, including foundations and walls of buildings, loading ramps, road revetments, later subdivisional walls, and cairns over sheep carcass burials, are clearly distinguishable and limited in number.

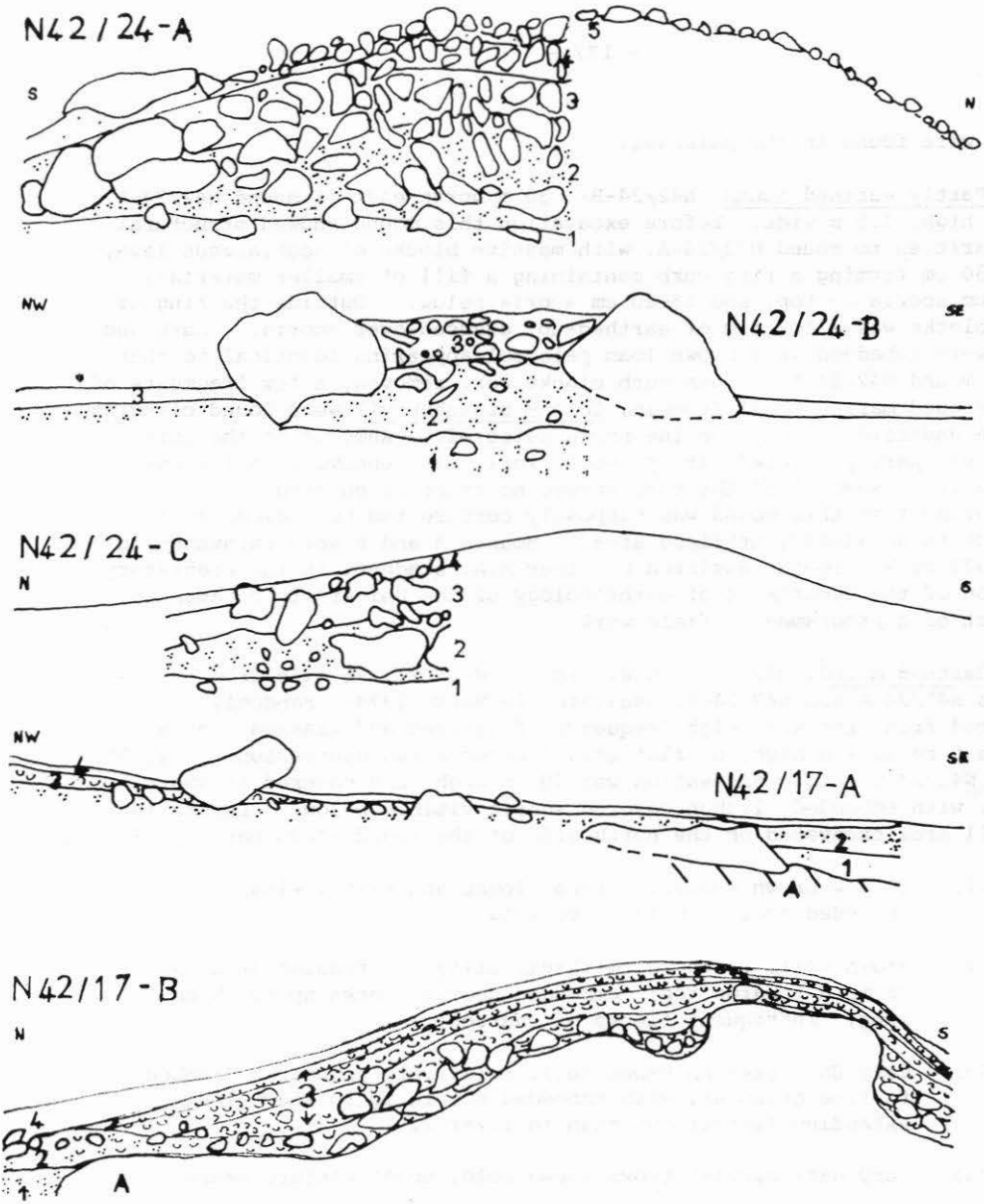
EFFECTS OF GRAZING ANIMALS

The effect of sheep and cattle on existing field structures is destructive, causing gaps in free-standing walls; maintenance on the McLaughlin block has included continuous repair of scoria fences. On low earthed-up scoria structures, sheep and cattle cut through tracks; many earthed wall-lines are dissected into smaller segments by stock gaps, 50 cm wide, occurring every few metres. Provision of farm access routes has also led to deliberate demolition of walls across 3-4 metre stretches. Scoria mounds, being less of an obstacle to stock movements, are less often dissected or removed. Cattle, especially steers, have been seen to produce pads of bare pawed earth 20 m across and 30 m deep, but this is unlikely to have caused any earthing-up of mounds or walls, as pads are located in clear areas; and the earthing of structures in general cannot be connected with the running of sheep or cattle. Concentration of stock round water tanks and gateways also breaks down the ground surface, unearthing buried lumps of scoria. Close to the McLaughlin homestead these were gathered up and stacked on the dry stone walls; however, the ground everywhere is pretty well free from loose surface scoria, and it is likely that some of the bare scoria piles, and some patches of bare scoria on partly earthed mounds result from the addition of such casually cleared scoria to nearby pre-existing piles at a distance from the modern walls in recent times.

INVESTIGATION OF SCORIA MOUNDS

Excavations carried out on a number of mounds indicated the nature of the stratigraphic surface on which individual mounds were constructed, and whether there was any variation in stratigraphic age; in particular, whether any mounds were constructed on the modern soil surface (Fig. 1).

1. Bare scoria mound, N42/24-A, south-east of Wiri Mt on flat ground at edge of a probable garden area; height 80 cm, diameter 4 m. When excavated, this proved to be a structured pile, located on the surface of a brown soil, identified as a paleosol, under a layer of loose brown mold, under soil-free scoria, below the present dark greyish brown topsoil. A roughly circular curb of large flattish blocks of scoria, two courses high, contained an inner fill of small scoria; the whole structure being covered by the addition of later unsorted 'bare' scoria. A few fragments of eroded



24-A 1. subsoil 2. paleosol 3. mold 4. scoria without matrix 5. topsoil
1. 2. 3. topsoil - mold
24-C 1. 2. 3. topsoil 4. mold
17-A 1. 2. 3. shell lens 4. topsoil A. outcrop lava
17-B 1. 2. paleosol with shell 3. stratified shellmidden 4. topsoil A. lava

0 Metre 1 [24A-B based on drawings by R. Clough]

fig.1

shell were found in the paleosol.

2. Partly earthed mound, N42/24-B; 30 m north-east of mound N42/24-A; 50 cm high, 2.5 m wide; before excavation this mound showed structural similarities to mound N42/24-A, with massive blocks of scoriaceous lava, 50 x 50 cm forming a ring curb containing a fill of smaller material; 5-10 cm scoria on top, and 15-20 cm scoria below. Outside the ring of lava blocks was a low rim of earthed-up, grassed-over scoria. Curb and core were embedded in a brown loam paleosol appearing identical to that under mound N42/24-A. When curb blocks were removed, a few fragments of very eroded marine shell (cockle, Chione stutchburyi) were found clinging to the underside of one, on the brown paleosol. Removal of the core which was partly covered with paleosol soil, also uncovered a few shell fragments. Removal of the core showed no trace of outcrop rock, indicating that this mound was purposely constructed on a clean soil surface in an already utilised area. Mounds A and B were excavated in May 1973 by R. Clough, assisted by other M.A. students in the prehistory section of the Department of Anthropology of the University of Auckland, as part of a programme of field work.

3. Earthed mound, N42/24-C, N.W. side of Wiri Mt; ½ mile from mounds N42/24-A and N42/24-B, excavated in March 1974; randomly selected from area with high frequency of earthed and grassed scoria mounds 5 cm to 1 m high, on flat ground between two depressions (Fig. 3). Mound N42/24-C before excavation was 40 cm high, and covered in short grass, with embedded, lichen covered scoria visible below. Layers in a small area excavated on the north side of the mound (from base up) -

(1) Yellow brown subsoil; fine, loose and silty, with included scoria up to 10 cm long.

(2) Brown soil, up to 20 cm thick, silty or granular at base, crumbed towards top; embedded scoria blocks up to 35 cm long; infrequent flecks of charcoal.

(3) Very dark greyish brown soil, relatively compact; crumbed to fine granular, with embedded scoria up to 25 cm long extending further out than in layer 2.

(4) Very dark greyish brown loose mold, under pasture grass.

Layer 1 is an in situ subsoil zone of layer 2, which is a paleosol with the bulk of the scoria, including the largest blocks, embedded in it. The mound may have been structured with a curb, but the area of excavation was too small to confirm this. Layers 3 and 4 are

distinguishable only by texture, and make up the present topsoil zone. The colour change between layers 2 and 3 appears to mark a change of environmental regime, which may have acted through climatic, vegetational, faunal or other components. The mound was built on a surface of layer 2 material, which is stratigraphically equivalent to the paleosol under mounds A and B. Further layer 2 material built up over the lower part of the pile, covering scoria scattered from the top. Fall off and scattering of scoria continued into the layer 3 period, with layer 3 material building up to cover the outer scatter and the outer part of the pile. The small amount of scoria embedded in layer 4 indicates that dilapidation from the top of the pile continues at the present day. As mound C is identical in external appearance to the large number of mounds immediately adjacent, it seems initially permissible to extrapolate from it, and consider these, too, as probably built on the paleosol surface of the layer 2 period.

4. Denuded, partly earthed mound, N42/17-A, south of McLaughlins Mt, about one mile south of mounds N42/24-A, -B, and -C; on the edge of a flattish, cleared, probable garden area; excavated April 1972; surface appearance, low scatter of bare scoria and scoriaceous basalt above very low grassed base. Stratigraphy: topsoil of dark brown loam, brown paleosol, yellowish brown substrate; shell midden (cockle and mudsnail, Amphibola crenata) on the paleosol surface, extending on to a collection of loose pieces of scoria 5-30 cm long, resting partly on the paleosol and partly on the upper surface of an outcrop of scoriaceous basalt underlying the whole.

5. Completely covered scoria pile, N42/17-B, 4 m south-east of mound N42/17-A, close to a wall remnant and, like it, covered by an extensive deposit of shell midden; unstructured pile of scoria lumps 20 cm long; 1.5 m wide, 30 cm high; roughly piled up on surface of scoriaceous basalt outcrop, and covered by 20-40 cm of stratified shell midden deposits which were covered by recent dark brown topsoil. Mound associated on lower edge with dark brown soil stratigraphically equivalent to brown paleosol of N42/17-A.

In each of the above five instances, formation of the mound is referred to the period of a paleosol of a different character to soil accumulating at present. These five mounds are in widely separated areas of the volcanic field, and include all the variations in surface appearance observed among scoria mounds, and collectively form the basis for the hypothesis that the majority of scoria mounds predate European settlement in the Wiri area.

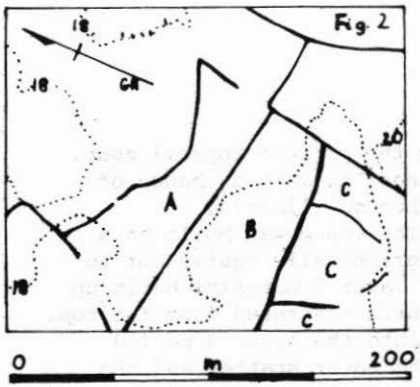


FIGURE 2

Wiri Mt, N42/24

A,B, - long strips

C, - long strip divided internally by cross walls

18,20- contour height; metres above mean sea level

FIGURE 4 N42/17

McLaughlins Mt

Long strip divided into plots

1 - 6,
Scoria mounds representing wall fragments

17,
Contour height in metres above sea level

S,
Scarp, descending 20 cm on south

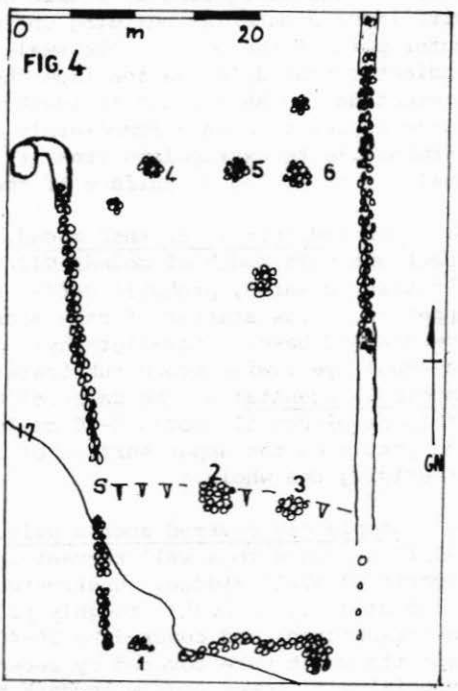


FIGURE 6

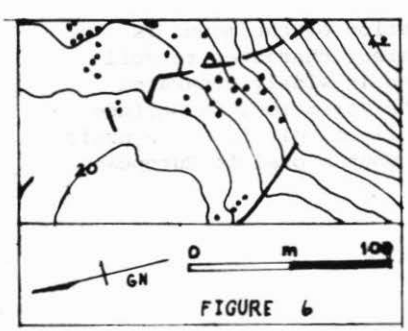
Wiri Mt; N42/24

Repiled mounds

A - long wall

·· - scoria mounds

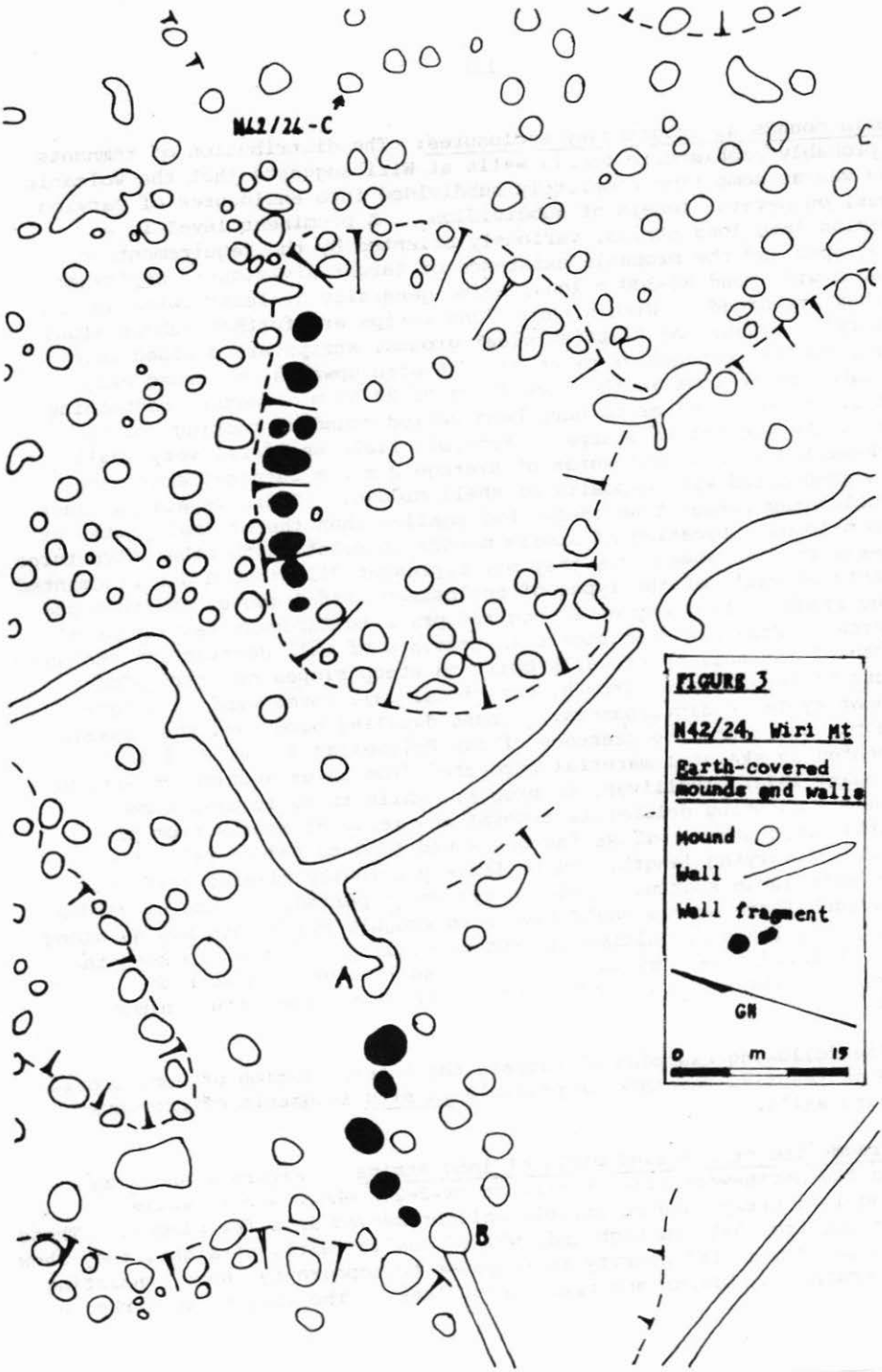
20,42
- contour height (Metres a.m.s.l.)



Scoria mounds as fragmentary enclosures: The distribution of remnants of probably prehistoric scoria walls at Wiri suggests that the volcanic zone was at some time completely subdivided into enclosures of varying sizes, on several levels of subdivision. A prominent level is a division into long strips, variously oriented by the requirements of topography and the probable existence of larger divisions; strips are 25-60 m wide, and 80-300 m long, being generally at least twice as long as they are broad. Within these long strips are further subdivisions of varying types; on flattish clear ground, strips are divided into small, mostly rectangular plots of 1/16 acre upwards, by cross walls. Sunklands or hollows in the lava flows of 20-50 m diameter, containing flat clear soil, appear to have been walled round by packing scoria against the encircling scarps. Possible field shelters, very small thick-walled scoria enclosures of average 2 x 2 m internal area, are often associated with deposits of shell midden. There is also a class of enclosures larger than these, but smaller than the minimal plots, at 10-20 m long. Location of scoria mounds in relation to other structures suggests that in some cases they may represent dilapidated and fragmented remnants of walls of the types of enclosures listed above, and that much of the fragmentation may have occurred prior to European settlement of the area. Possible prehistoric instruments of wall destruction include structural instability of walls built on steep slopes or scarp edges; effects of vegetational growth, occasional gale force winds and less frequent cyclonic disturbances; ground dwelling birds and the passage of people and dogs (the presence of the Polynesian dog at Wiri is documented by skeletal material recovered from an excavation on Wiri Mt in January 1974), (Sullivan, in prep.); while there is also some evidence suggesting deliberate removal and reuse of scoria from pre-existing structures. These factors would tend to reduce walls to segments of varying length, and to leave previously cleared surfaces strewn with loose scoria. Under a system of periodic re-use of garden plots, such loose scoria could have been roughly piled into moulds along gaps in wall lines by cultivators not especially concerned to keep the fabric of field walls intact, but more intent to get the work of re-clearing, digging and planting of garden plots done with minimum effort.

The following examples illustrate the interpretation of some scoria mounds as re-piled remnants or possible *in situ* fragments of previous enclosure walls.

1. Fragmented or re-piled walls of long strips. Figure 2 shows an area on the north-west side of Wiri Mt (N42-24) where scoria walls bounding long strips are relatively well-preserved in a few places. These walls range from 5-50 cm high and, while usually fairly straight, they show departures from rectilinearity in response to topography, here consisting of low scarps, sunklands and outcrops of lava. The long strip marked B


N42/24-C
C
A
B
FIGURE 3
N42/24, Wiri Mt
Earth-covered mounds and walls
Mound
Wall
Wall fragment
GN
0
m
15

(Fig. 2) has both long walls and one short wall intact, being cut off on the west by a road boundary. The three areas marked C form internal subdivisions of a long strip into plots, by means of short, semi-straight cross walls, built along very slight scarps. The southern long wall of strip C was formed in part by the edge of a massive outcrop trending along the contour lines. In strip A, part of the short eastern end wall remains; and the long northern wall, though almost intact, is far from straight, as it follows the edges of a series of depressions, while keeping to higher ground. The short wall on the west end of strip A has been fragmented, with short stretches remaining at each end. The field plan of structures at this end (Fig. 3) shows numerous grassed scoria mounds 10 cm to 1 m high, in a similar condition to the wall fragments. The remaining fragments of the west end wall of strip A show signs of modification; ending in a very small enclosure on the north (A on Fig. 3), and a superimposed scoria mound on the south (B, Fig. 3). Between these two wall fragments, the ground slopes gently down on either side, and five earthed and grassed scoria mounds 20-40 cm high (solid outline, Fig. 3) appear to represent the in situ or repiled remnants of the missing segment of the end wall which ran along a slightly sinuous line between them.

2. Fragmented cross walls of subdivisional plots within long strips

Fig. 4 is a plan of part of an area of flat ground on a lava flow south of McLaughlins Mt, N42/17, which is terminated by a steep gully on the south. Remains of the long walls of a strip running north from the gully edge are clearly visible, at 20-50 cm high, with grassed-over base and bare scoria on the upper part, and traces of facing on either side. The south end wall of the strip is fragmentary and has been modified on the south side; on the north the strip terminated in a diagnonal line against the foot of a bank, where no clear trace of a wall remains, about 100 metres from the south end. It seems probable that this strip, consisting throughout of flat, cultivable soil, was internally subdivided for ease of working and access. There are few scoria mounds associated with it, and most can be allocated to the remains of internal cross walls. Mound 1, 10 cm high, is a fragment of the south wall. Mounds 2 and 3, 90 and 50 cm high, about 15 m north, are sited along the line of a 20 cm high scarp, and can be regarded as the remains of a cross wall marking off the southern-most plot in the strip. Mounds 4, 5 and 6, 40, 20 and 35 cm high, about 30 m further north, will be the remains of another cross wall, situated at the same level as the remnant of a cross wall in the next strip to the west which has a superimposed mound on its end. The ground between the lines of the two cross walls may have been a single large plot, as plot sizes tend to be irregular, or may have been subdivided further.

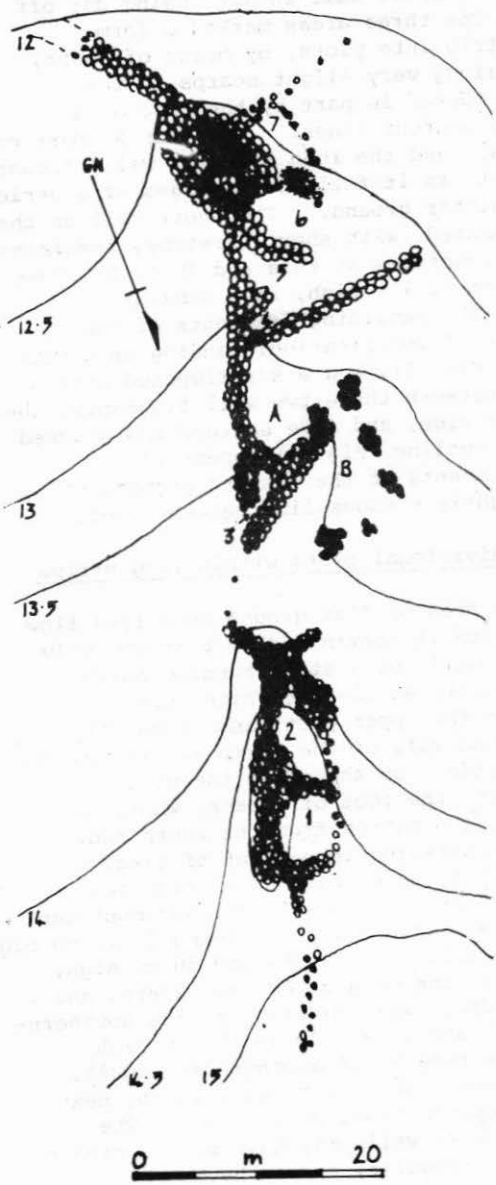


FIGURE 5

N42/17

Oyster Point,
McLaughlins Mt

Modified long wall of paenga

1-7
Possible field shelters

8
Shell midden

12-15
Contour heights in metres above mean sea level

A,B
Small enclosures

Scoria

Scoria mounds

3. Fragments of internal scarp walls around lava sinks.

Sunklands, where cooled lava has subsided leaving straight-sided depressions 1-2 m deep, are common on lava surfaces. The ground in depressions is usually flat, with fairly deep soil, which retains moisture longer in dry periods, and the sinks all show signs of clearance and probable use as gardens. Clearance structures are illustrated from a 20 x 12 m oval sink in the central zone of Wiri, where the one metre deep scarp has been packed up to the level of surrounding flat ground on two sides, with a continuous deposit of scoria lumps, 20-30 cm long, and on a third side with larger blocks of scoriaceous lava; the fourth short side is cut by a farm track. On two sides there is a total of four superimposed piles of small pieces of scoria 5-10 cm long, on the larger scoria, suggesting removal of debris from the soil during cultivation, as opposed to probable initial clearance of surface scoria represented by the larger material. It is likely that scoria mounds close to a scarp inside sinks or depressions can be interpreted as remnants of encircling or bordering walls, as in Fig. 3, where depressions or sinks are indicated by a dotted line at the edge, and wedges on the downward side.

4. Fragments of walls of small enclosures

Field plans record a number of remains of enclosures intermediate in size between garden plots and possible field shelters; often clustered adjacent to such shelters. These are of irregular outline and between 8 and 20 m in greatest dimensions. Figure 5 is the plan of part of a long wall of a strip in the Oyster Point area south-east of McLaughlins Mt, which has been extensively modified into small enclosures which are possibly field shelters (1-6, on Fig. 5). Area A represents the remains of a larger sized enclosure of irregular outline, about 8 x 10 m. Scoria mounds shown in solid black, surrounding a second irregularly shaped area (B) appear to be fragments of walls forming an enclosure of similar size and shape to area A.

5. Scoria mounds as displaced and repiled remnants of collapsed structures

Scoria walls built on a sloping base have lower stability than those on flat ground, and in some situations sloping walls appear to have collapsed downhill on to sloping garden ground, and the resulting debris to have been roughly repiled at the edge of the cultivation, with no attempt made to rebuild the wall. Thus the long wall A seen in Fig. 6, on the north side of Wiri Mt, has been built down a long narrow outcrop, and is now only a denuded line of scoria cobbles embedded in a thin soil on the outcrop surface. On the west of this wall, while 4 scoria mounds along the 27 m contour could be remnants of a long wall, the cluster of mounds below this which is set on an unmodified 15^{o} slope, do not appear to be remains of enclosures, and are most economically explained as repiled scoria derived from wall collapses.

STRUCTURED SCORIA MOUNDS

The above five headings cover instances where scoria piles can be interpreted as structural fragments and replaced or displaced remnants of collapsed structures. However, mounds such as N42/24-A and -B appear to have been purposely built as curb and core mounds on already cleared and cultivated ground. These may be either casual clearance mounds, built for convenient stowage of limited amounts of scoria turned up in cultivation, or they may have been intended as supports for the cultivation of such crops as gourds (Lagenaria sp.). So far, no association of scoria mounds with human remains has been encountered at Wiri, though several kinds of repository for human remains are reported.

CLUSTERS OF SCORIA MOUNDS

Clusters of scoria mounds on slopes are relatively easy to classify, either as displaced and repiled remnants of walls upslope, or as remains of clusters of small enclosures in the case of smaller groups of mounds on slopes showing signs of levelling. But infrequent thick clusters of mounds occupying extended areas on flat ground are not readily explainable in this way. Some of the concentrations of mounds seen in the upper part of Fig. 3 are probably to be explained as parts of wall lines, either long strip walls, plot walls, or sink walls, but this still leaves a large number unassignable. These mounds are all earthed and grassed, with a little embedded scoria visible on the surface. While only one has been excavated, and that only in part, the siting of large embedded lumps of scoria round the bases of some suggests that they are structured mounds, and that the area may represent a zone of intensive gourd cultivation. Though it is alternatively possible that the area could be the remains of a concentration of small enclosures, this is discounted on the grounds that such concentrations elsewhere are associated with heavy signs of occupation in the form of shell midden deposits, of which there is no trace here. Use of the area as a gourd garden, or in some other activity involving turning over soil, would explain the earthing-up of the lower part of mound N42/24-C with paleosol soil. However, such suggested explanations of the functions of mound clusters on flat ground are not entirely convincing, and their significance must be regarded as uncertain at present.

PREHISTORIC FERN ROOT GATHERING

The main cultivar of the Wiri gardens was probably sweet potato, Ipomea batatas, but the importance of the semi-cultivated rhizome of the bracken fern, Pteridium aquilinum var. esculentum, in the total economy of the area should not be underestimated. Ethnographic evidence, and recent work by K. Shawcross (1967) shows that it was a quantitatively

more important vegetable staple than kumara in areas where it grew plentifully. Bracken is universal at Wiri now, and becomes dominant when stock are removed, so that the whole lava field is to be regarded as a potential prehistoric source of edible fern root as well as being a zone of garden cultivation. The extent of prehistoric fern root digging on volcanic soil at Wiri is difficult to estimate. Surrounding non-volcanic areas also grow bracken, and allowance must be made for factors such as the length of the fertility replacement cycle after kumara cultivation, possible population levels, and whether fertility replenishment was allowed to proceed to completion as measured by the appearance of seedling trees above the bracken on fallowed cultivations. However, it seems certain that some fern root gathering was done from the gardens at Wiri, as a wooden fern root beater was recovered by Mr G. Dreadon from a stream a short distance west of mounds N42/17-A and -B. Fern root harvesting with digging sticks may therefore have caused the reduction of some wall structures to mounds in the prehistoric period, especially if, as suggested, the largest and most nutritive rhizomes are to be found growing on volcanic ground (Robinson, 1970, 64).

PROTO-HISTORIC USE OF FERN ROOT AND THE KEEPING OF PIGS

Pigs were introduced into New Zealand after 1769 and were present in the Auckland isthmus from the later 18th century. The bracken fern rhizome, as well as continuing as an item of Maori diet near Auckland till at least 1863 (AJHR, 1864), also provided forage for pigs kept by Maori inhabitants of the isthmus from the late 18th to the later 19th century. While pigs were sometimes tethered, they were also allowed to range freely, and the deep and extensive digging which pigs will undertake in search of fern root can be seen in areas of New Zealand with present day feral pig populations. Some earthing-up of structures, and some destruction of scoria walls may be attributable to rooting by pigs, whose presence in the area in the early protohistoric period is shown by the recovery of immature pig bone from a horizon well below the base of the modern topsoil at Pukaki Creek about two miles north-west of Wiri (Sullivan, 1973). The effect of pigs on scoria walls appears to have been marked, as they were capable of tunnelling underneath them to get at growing crops (AJHR, 1862). They are known to have been run on the east central zone of Wiri in the later 19th century, where some structures, especially mounds, show a degree of earthing-up comparable to that on the area north-west of Wiri Mt, shown in Fig. 3 where they are not reported in the historic period. If initiation of formation of the modern dark brown - dark greyish brown topsoil zone can be ascribed to environmental changes dependent in part on the introduction of ruminants, then some earthing-up of mounds with paleosol soil, as seen in mound N42/24-C, could possibly be ascribed to the earlier protohistoric period before such changes took effect, and attributed

to the effects of protohistoric fern root gathering and pig keeping.

RECAPITULATION

Examination of scoria mounds at Wiri thus indicates that most could be prehistoric, with some possibly protohistoric; that mounds as mounds are probably in a minority, and that a large number can be satisfactorily explained as derived from earlier structures, mainly walls, by breakdown and repiling, either in situ or elsewhere, with breakdown agencies including climatic forces, effects of vegetation growth and human and animal activities. While demolition of scoria-built structures at Wiri has continued and intensified after 1845, it cannot be shown to have led to the formation of any existing embedded scoria mounds at Wiri, but only to minor accretion to some already existing. It therefore appears permissible, in interpretation of the Wiri settlement pattern, to use, with appropriate care, the existence of scoria mounds to extrapolate across missing segments of boundary walls in the overall plan.

ACKNOWLEDGMENTS

The above discussion of scoria mounds is part of a continuing programme of investigation at Wiri, and opportunity is taken here to make a preliminary acknowledgment of some of the many areas from which assistance has been provided. Credit is due to Mr R. G. W. Jolly of Papakura, who initially and continually drew attention to the archaeological significance of the area and urged its investigation, which was begun by Peter Bellwood. Owners and occupiers of land at Wiri have been most helpful, and in particular Messrs Downer & Co. Ltd, including the manager, foreman and staff of the Wiri Quarry; Mr G. Dreadon of Manurewa; the District Engineer, Railways Department, Auckland, Mr R. H. Newton; and supervisors and staff of the Railway Quarry, Wiri; Mr T. W. McLaughlin, who has also provided valuable historical information; Mr Kirkham, Mr J. Livingstone, Mr P. Rapley, Mr N. Hall, Mr and Mrs Gibson, and the late Mr E. Shepherd and family. As have also Mr W. J. Adie, Papatoetoe, Mr Lee and Mr A. Fanning and other members of the Works Department, Auckland Regional Authority, and Mr Boguss, Manukau City Council.

The project has had the continuing support of Professor R. C. Green of the Prehistory Section, Department of Anthropology, University of Auckland, and practical assistance from Anthropology Department staff members, Mr K. M. Peters and Mr C. A. Schollum, and M.A. students in archaeology including G. Boyle, D. Brown, R. Clough, M. Morwood, M. Rowland, B. Deverell and A. Geelen, and many members of the University of Auckland Archaeological Society. The work has been supported by grants from the University of Auckland Research Grants Committee, the Skinner Fund for Archaeology and Anthropology of the

Royal Society of New Zealand, and the N.Z. Historic Places Trust, and the opportunity is also taken to acknowledge valuable practical assistance provided by Janet Davidson, Auckland Institute and Museum, and from D. R. Simmons and Nola Arthur of the same institution.

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