II.

THE LAKE-DWELLING OR CRANNOG IN EADARLOCH, LOCH TREIG: ITS TRADITIONS AND ITS CONSTRUCTION.

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CONTENTS.

1. Lake-villages and Lake-hutments.

Lake-dwellings or crannogs of considerable extent have been found in many parts of Scotland, the structure and relics of which show that they were the settlements of small communities inhabiting groups of huts.

Such crannogs are widely distributed from Wigtownshire and Dumfriesshire in the south to Aberdeenshire in the east and Ross and Cromarty in the north, and information regarding them has been collected and some have been described in Dr Robert Munro's standard work on *Ancient Scottish Lake-dwellings* (1882). But there is another type of lake-dwelling, less imposing in size and appearance, which is represented in many highland lochs. At the present day it appears as an island, lying not far from the shore, round or oval in shape, projecting little above the water, so small that it could have carried only one or two small huts, and nowadays generally wooded. The artificial nature of such a lake-dwelling is generally revealed by the more or less regular arrangement of the stones of which it is composed, and on close inspection by the presence of submerged wooden piles on its outskirts. Some of these smaller lake-dwellings have been recorded by Robert Munro (1882) and notably by Rev. Odo Blundell, who used a diving-suit for the examination of the submerged structures, but who made no attempt to reveal by excavation the internal construction of these artificial islands (1909, 1910, 1911 and 1913).

If we regard the more imposing type of crannog as a lake-village, the smaller islands may be described as lake-hutments, and the lake-dwelling of Loch Treig belongs to the category of the lake-hutment.

2. The Artificial Island, and its Recent Exposure.

The Loch Treig island as it formerly appeared has been described briefly by Rev. Odo Blundell, who says that its size was "40 feet by 18, nor could it at any time have been much more than 60 feet by 30, the sides of the rubble construction being visible all round" (1910, pp. 30–32 and figs. 12 and 13). He gives a general account of the under-water appearance of the island and of the position of a few large beams of wood, which he observed from the surface by means of a "water-telescope."

So the island had remained for centuries until, in operations connected with the Lochaber Water Power scheme and the building of the dam across the River Treig, the northward extension of Loch Treig, in which the island lay, was temporarily drained and the island completely exposed. At that time, in June 1933, Mr Ben N. Peach, the Resident Engineer of the Laggan-Treig works, wrote to me at Aberdeen on behalf of the Consulting Engineers of the Power scheme, Messrs C. S. Meik and Halcrow, saying that when at the end of the year the dam was completed and taken into use the island would be permanently submerged, and that they considered that an investigation of the site might produce some interesting information regarding it and its occupation in former times. They further made the generous offer that they were prepared to put a small gang of their men on to do any necessary excavation and that their staff would

undertake all observations that were deemed necessary. It was an offer which I most gratefully accepted.

In July, with the help of Mr Peach and his staff, my son, Dr A. E. Ritchie, and I commenced and completed an exploration of the island, and I must record my deep gratitude to Messrs C. S. Meik and Halcrow, and particularly to Mr Peach, for the opportunity of carrying out this work, for their interest in its progress, and for the assistance which made a thorough examination possible.

It may be added that since this examination was made in 1933 the Treig Dam has been in use and the island has been submerged. But a recent temporary lowering of the water-level has revealed great disturbance of the bottom deposits of the loch, due to the currents set up by the powerful inrush of water from the Loch Laggan dam through its seven-mile-long tunnel, and in April 1941 I took advantage of the opportunity to re-examine the site and the dwindling remains of the island.

3. The Site chosen for the Artificial Island.

One of the striking prospects from the West Highland railway, which skirts its eastern shore along all its five miles, is Loch Treig, nestling in the shadow of the desolate mountains of Lochaber in western Inverness-shire. The loch fills a narrow valley, half a mile across, between two steep mountains reaching a height of 3658 feet on the western side, 3433 on the eastern, and, as its position suggests, the loch itself is very deep, 436 feet at its greatest, the ninth of Scottish fresh-water lochs in this respect. Its mean depth, 207 feet, points even more clearly to sudden depths and places it fourth amongst the averages of Scottish lakes.[1] Loch Treig, deep and wind swept, with steeply descending sides, is one of the most unlikely lochs to be selected for a lake-dwelling, which demands shallow and placid waters.

But its northern end, from which the River Treig flows to join the Spean at Tulloch two miles to the north, was in strong contrast to Loch Treig proper. This portion, known in Gaelic as *Eadarloch*—the "Loch Between"—was separated from Loch Treig by a sandy spit which almost divided the two, leaving only a narrow channel just over 20 feet wide (see fig. 1). The spit, now entirely washed away by the Laggan inflow, was formed superficially of sandy layers interbedded in which were shallow deposits, dark in colour, containing organic matter and the shells of hazel-nuts. The origin of the spit is referred to in the following section (4).

Eadarloch, thus separated from Loch Treig, was a narrow shallow extension, 1500 feet long by 360 feet broad at its widest part, with an

[1] For a description of Loch Treig see Murray and Pullar, 1910, vol. ii. p. 369, and vol. iv.

average depth of little more than 10 feet and a greatest depth of about 23 feet in a hollow between the sand-spit and the island.

When the loch was drained, its floor was revealed as a slightly undulating bed, with several slight depressions, shown as pools in fig. 1, but with only two elevations which arose to within a few feet of the surface of the loch. One of these was selected as the site of the island, and the choice gives an indication of the special features which the builders

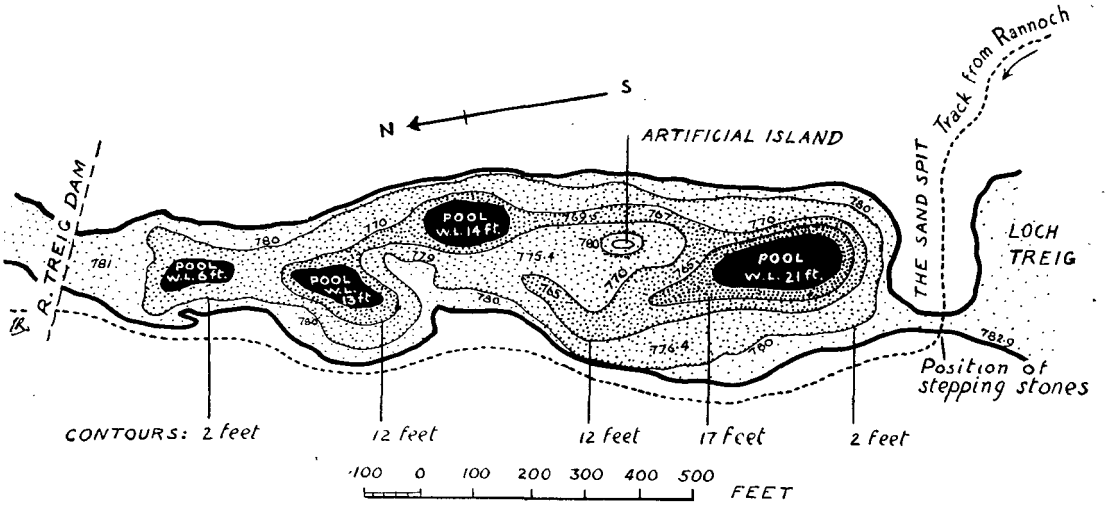


Fig. 1. Plan of the Eadarloch, at the north end of Loch Treig, showing position of crannog in relation to depths. The numbers 765–782·9 indicate feet above sea-level (O.D.).

regarded as desirable for their purpose and at the same time suggests the object they had in view.

One of the submerged elevations lay 200 feet off the western side of the loch and was a continuation of a short land spur which projected for 22 feet from the shore. Beneath the water it was connected with the shore by a ridge of sand covered by not more than 2 to 3 feet of water, and this was probably the chief reason for its rejection, since access to the site would have been a simple matter for man or wild beast.

The selected elevation was an almost symmetrical mound, which rose to an oval plateau, 65 feet long by 36 feet broad, at a level between 7 and 10 feet below the modern surface of the loch. Its centre lay 128 feet from the nearest point of the eastern shore and 208 feet from the western. It was surrounded by channels varying from 11 to 15 feet in depth, except on its northern side where the water was some 7 to 8 feet deep. These measurements represent the loch bottom as surveyed, but it is highly probable that some changes in the contour of the bed may have taken place, owing to the movement of silt, since the island was built.

Two main considerations appear to have influenced the island-builders in selecting this site. In the first place it offered a surface sufficiently large, and presumably near enough to the surface of the water, to allow constructions to be laid down without difficulty, a point of building technique to which I shall refer later. In the second place it was well defended on all sides by a considerable stretch of water too deep to be crossed by wading. The site had the added advantage that it was protected from the strong currents of the overflow of Loch Treig, which rushed by on its western side, or in winter spates expended their energy in the deep pool between the sand-spit and the island, and, breaking upon the mound upon which the island was pitched, were diverted along the channels on either side.

The Rev. Odo Blundell (1910, p. 32), handicapped by being compelled to observe through several feet of water, stated that natural rock projected from the bottom of Eadarloch, and that this was probably the foundation of the island which otherwise could not have survived the full force of the waters of Treig. While he rightly assumed that Loch Treig itself was unsuitable for the purposes of the builders, he was wrong in supposing that natural rock is exposed, and he failed to appreciate the part played by the sand-spit between the lochs, first, in bringing about the formation of the mound on which the island was built, and, second, in diverting the overflow from Treig past the island mound and forming a breakwater behind which the artificial island nestled in security.

4. History and Local Traditions relating to the Island.

In Loch Treig itself the shores, which dip steeply to a great depth, make the building of an artificial island an impossibility. The story of the modification of the northern end (where the bed-rock is still deep down below the surface), so that it came to form the Eadarloch and gave rise to the conditions of which the island-builders took advantage, goes back to the closing period of the Great Ice Age. At one stage in the slow disappearance of the glaciers of the Western Highlands, a dam of glacier-ice held up the waters in the valley so that they stood 78 feet (862 O.D.) above the modern surface of the loch. At the northern end of the Treig valley melting ice deposited moraines of gravel, which have been in part levelled into terraces prominent along the mountain slopes on the western side, and which also filled up part of the rock-basin of Loch Treig to form the shallow Eadarloch. The spit which separated Treig from Eadar, although its surface had been re-sorted by the waves into sandy layers, was an accumulation of morainic gravel, and Dr Murray Macgregor, Assistant Director of the Geological Survey, informs me that a boring made in the centre of the spit passed through 63½ feet of gravel without reaching the rocky bed of the loch.

There is no substance in the suggestion in Rev. Odo Blundell's account (1910, p. 31) that the spit may have been formed by a land-slip subsequent to the building of the island, for its history and its presence are essential to the conditions which made possible the building of an island in Eadarloch.

The mound on which the island was built was of an unusual and quite

Fig. 2. Mound of vegetable debris on which the crannog was built and of underlying morainic gravel, as shown in a section on west side made by torrent from Loch Laggan tunnel (1941).

unexpected character. When the dam was brought into use the force of the enormous inflow from Loch Laggan tunnel cut deeply into the deposits of the loch and exposed the structure of the mound on all sides. As examined in April 1941, when the water was again low, it was seen to be a vast accumulation of vegetable debris more than 20 feet deep resting upon the glacial deposits (fig. 2). The materials of which it was composed were almost wholly needles of Scots pine, together with small fragments of branches and of the bark of birch and pine trees, and an occasional tree trunk. The pine needles were deposited in layers, one or two inches thick, separated by thin deposits of sand (Pl. XVI, fig. 4).

I submitted a sample of this strange deposit to Dr G. K. Fraser, Peat

Research Officer at the Macaulay Institute for Soil Research, Aberdeen, for his expert examination, and his report is as follows:—

"The vegetable matter is almost wholly Scots Pine remains which I estimate to form over 90 per cent. of the total. In addition there are small pieces of wood not of Scots Pine but as yet not certainly identified; an *Equisetum* rhizome; several pieces of the moss *Hylocomium loreum*; and pieces of charcoal, most probably transported since they are irregularly mixed with the material as a whole, and all so far examined of Scots Pine.

"I considered more information was likely to be obtained from a pollen-grain estimation and so ran in a general sample of the material with some other samples. The results are as follows:—

Pine (*Pinus*)	. .	42·0	per cent. of total tree grains.	
Ash (*Fraxinus*)	. .	43·0	,,	,, ,,
Alder (*Alnus*)	. .	5·5	,,	,, ,,
Birch (*Betula*)	. .	5·0	,,	,, ,,
Hazel (*Corylus*)	. .	3·5	,,	,, ,,
Elm (*Ulmus*)	. .	1·0	,,	,, ,,

"Oak and Willow and probably Juniper and Aspen were noted once each in a general examination but did not appear in the count. Of the 'non-tree' grains Heather tetrads and Grasses each gave about the same figures as Alder. None of the other grains was noteworthy.

"I think the general conclusion to be reached is that pine forest was the abundant forest of the time, while Ash and to a much lesser degree Alder formed a fringe along the banks of the loch. I have never found Ash so frequent and this may be a sign of a very local Ash-wood only."

This great mass of vegetable matter with its uneven bedding had clearly been swept together in an eddy formed behind the sand-spit by the flow from Loch Treig, and its volume, which must have been of the order of 70,000–100,000 cubic feet, presents a vivid picture of the ages during which the accumulation was forming and of the dense tree-growth (in an area now almost treeless) which had shed its leaves into the waters of the loch, or into the streams which fed the loch.

The thin seams of hazel nuts which appeared upon the sand-spit itself may have been derived from contemporaneous bushes or from a deposit of hazel nuts varying from 18 inches to 3 feet in depth, which had accumulated on the western shore of Loch Treig and which was revealed by the Loch Treig tunnel excavations at a depth of some 50 feet below the normal water-level of the loch.

The island mound itself was formed at a time when, in the area, pine predominated in a mixed forest of pine, birch, ash, alder, hazel, and elm. The presence of fragments of pine charcoal may indicate the occurrence

of forest fires, but it is more likely to point to the presence of human inhabitants in the neighbourhood long before the lake-dwelling was built.

On this curious foundation, which was hidden beneath deposits of sand, and the nature of which was probably unknown to them, the builders constructed their artificial island.

It would be strange if so unusual a place as this solitary island, built in a portion of a deep and stormy loch in one of the wildest parts of the Highlands of Scotland, had remained unsung and unrecorded in the traditions of Lochaber. For the information gathered here I am indebted to the help of Emeritus Professor W. J. Watson and his former pupil Mr Lachlan MacKinnon, Gaelic master in Fort William School, and particularly to that keen observer, Mr Duncan Robertson, Head-Keeper at Currour, than whom no one is more familiar with the traditions of that country-side.

The loch in which the island stood was invariably known as *Eadarloch* or, with the article, *an t-Eadarloch*, the "Loch Between," that is the loch between Loch Treig and River Treig. The name is printed "Idir Loch" in the large Ordnance Survey Map (6 inches to 1 mile).

By contrast the island itself and the dwelling upon it had several traditional names, which may have originated at different times and emphasised different stages in the use of the island. But of the sequence there is no record.

The earliest references to both occur in a Gaelic poem, *A'Comhachaig* —the Owlet's Song—written by a famous poet Domhnall MacFhionnlaigh —Donald Mackinlay—who flourished about A.D. 1600. The poet tells how, for the first time uninvited through forgetfulness or by design, he made his way to share in a feast on the island, only to find that by the time of his arrival on the opposite shore the feast was well started. There was nothing for him to do but return to Fearsaid, probably the place near an Dubh Lochan, marked Fearsaid Mhór on the 6-inch Ordnance Survey Map, and the site of the dwelling of Angus of Fearsaid in the fifteenth century (see below). On his journey back he communed with an owl, and the striking and plaintive "Owlet's Song" was the result. Since these references to the artificial island, its dwelling, and its neighbourhood in the early seventeenth century are significant, some of them are quoted here, as translated by Professor W. J. Watson.

The poet speaking of his visit says:

> "I and thou, gray hound, sad is our journey to the Island"

and

> "If Donald were left out alone from Tigh nam Fleadh (House of Feasts), barely is a bubble complete when the cow-men will be in,"

a reference to the house upon the island and the use to which it was put.

The owl replies to Donald's queries:

v. 2. "I am of an age with the Oak, that was once a sapling in the moss, through many an age have I lived,"

an allusion which may point to the presence of aged oaks in the neighbourhood about 1600; none grow there now, although oak timbers were found in connection with the island.

v. 7. "I have seen Alastair Carrach, the goodliest man in Alba; often did I listen to him when he arranged the hunting knolls."

v. 8. "I have seen Angus after him; he was no meaner choice. 'Twas in the Fearsaid was his dwelling, and he made a mill on Allt Laire,"

the stream that runs by Inverlair.

v. 9. "Many a warfare and spoiling was in Lochaber in those times."

Alastair Carrach (v. 7) was Alexander Macdonald the progenitor of the Macdonalds of Keppoch, fourth son of John, Lord of the Isles to Princess Margaret of Scotland. He fought at Harlaw in 1411 and died about 1440. Angus (v. 8), his son, known as Aonghus na Fearsta, Angus of Fearsaid, which lies about $1\frac{1}{2}$ miles north of the island, died at Fersit about 1484. The statement that these were times of warfare and spoiling in Lochaber lends point to the protective purpose of the lake-dwelling in the fifteenth century.

That the island was regarded as an important landmark is indicated by another verse in which the owl explains where its ancestors were hiding during those troublous times; the poet assumes that the island was in existence in the fifteenth century.

v. 10. "The great part of my ancestors were between the Island and the Fearsaid, others of them were about the Deabhadh [see below], they would be crying of an evening."

Although the poet does not name the island other than as "the isle," he calls the dwelling upon it *Tigh nam Fleadh*—the House of Feasts—and indicates that it was a sort of special meeting-place.

In commenting upon "The Owlet's Song," an anonymous writer, Diarmad, in a Gaelic article in *An Gaidheal* (vol. v. pp. 330, 331, November 1878), gives his own description of the place. "The north end of Loch Tréig, where the river rises, is called An Déabhadh. A little way below the Déabhadh, the Tréig spreads itself out into a marshy broad standing pool, as if it were taking rest before it begins to race and leap down to Inverlair. This pool is called An t-Eadarloch. Right in the middle of the loch is seen a small island, some call this sort of islet a crannog. In this island is the site of Tigh nam Fleadh (the House of Feasts), and there Mac Mhic Raghnaill used to hold any special meeting with the nobles of

the district. Beside the Fearsaid Riabhach is seen the site of Tigh na Fuine (the Bakehouse), and in time of drought may be seen the stepping-stones that led to the island."

An Déabhadh, the "soft crossing-place between two lochs," clearly indicates the spit of sand and boulder-clay between Lochs Tréig and Eadar. Fearsaid Riabhach—the "Brindled Sand-spit"—apparently named in contrast to Fearsaid Mhór, which lies near An Dubh Lochan between Eadarloch and Inverlair, would also suitably describe the spit between Lochs Treig and Eadar, for the surface of the spit was formed of layers of sand interspersed with dark layers of organic matter containing many hazel nuts, so that denuded by the waves it would appear parti-coloured or "brindled." Here too, visible when the loch was first drained and marked on the 6-inch Ordnance Survey Map, were stepping-stones, continuing, across the narrow strait of water between the lochs, the mountain track which led from Rannoch to Glen Spean (see fig. 1). But if these are the stepping-stones he referred to, Diarmad was wrong in saying that they led to the island, for the island was surrounded by water too deep for passage on foot, and the stepping-stones offer no kind of approach. The reference to Mac Mhic Raghnaill signifies that the Chiefs of Keppoch in general used the island for special councils.

Most of the names of the island that have been preserved are, like "Island of the House of Feasts," derived from the dwelling upon it. Thus the 6-inch Ordnance Survey Map names it *Eilean Tigh na Slige*, and tradition, according to Duncan Robertson, *Eilean Ruighe na Slige*, the "Island of the Shell Sheiling." That might suggest that the dwelling had been a domed hut like a limpet-shell, and, although there is little to confirm such a suggestion, we did find during the excavations a large post-hole in the centre of the island, which might well have held a tree-trunk as the central support of such a structure.

Another traditional name, according to Robertson, was *Eilean Tigh nam Fiodh*, the "Island of the Wooden House," but the most interesting and suggestive of all the names was *Eilean Ruighe na Slighe*, which Mr Lachlan MacKinnon translates as "The Island of the Sheiling of the Track."

The track would be the mountain track which led from Rannoch to Glen Spean. It hugged the eastern side of Loch Treig, near the northern end of which it left the loch to skirt Creagan Fàraidh—the "Ladder Crag" —then descended to the sand-spit and stepping-stones between Lochs Treig and Eadar, and continued along the western shore of the latter (see fig. 1). In the wild days when, as the following section will show, wolves proved a constant danger to travellers in this district, and elsewhere in Scotland hostels were erected to shelter benighted travellers from the danger of their attacks, a "sheiling of the track" in so lonely a place would

have become recognised as a harbour of refuge for honest travellers in a dangerous country-side.

The only name which has survived as applicable to the island itself, apart from its dwelling, is *Eilean na Comhairle*, the "Council Island," and perhaps a later version of that name is "Keppoch's Council Island," recorded by the Rev. Odo Blundell (1910, p. 32). Of it he says: "This island has long been known as Keppoch's Council Island, from the fact that Ronald Og, Chief of Keppoch, used to meet his clansmen there when he was in hiding in the cave above Loch Treig on account of the part he had taken in the insurrection of Sir James MacDonell of Islay." Sir James Macdonald, it may be recalled, escaped from Edinburgh Castle in the summer of 1615 through the help of Alexander of Keppoch and his son Ranald, and it is possible that the last and not Ronald Og, who died in 1587, was the refugee in the cave.

In any case "Council Island" signifies a secondary purpose to which the island was put, since the labour involved in the construction to be described would never have been undertaken for the convenience of occasional consultations. The name points to the much earlier origin of the island.

Duncan Robertson says that the island was sometimes called the Treaty Island, and that a local tradition is that when two chiefs had a dispute they came up on opposite sides of the loch and swam to the island to settle their difference, but if one or other failed to reach the island he lost his case.

5. The Purposes of the Lake-dwelling.

The traditional accounts of the island and its hut lay stress upon its social character, as a place of feasts, a meeting-place for deliberation by the wise men of the clans, or for the settling of disputes between chiefs. If these were its only or its main purposes it is odd that the site should have been so carefully chosen, for the only reason to recommend such social use of an island would be that the feasts or deliberations or disputes might be carried on without interruption from outsiders. Such a reason seems to be insufficient to warrant the tremendous planning and labour involved in the creation and constant upkeep of the island.

On the other hand the choice of the site is significant. Although another place in the loch was available the one selected was peculiar in that it was almost surrounded by channels ten feet or more deep. Clearly the purpose was protection, and judging by the limited surface above water, protection for a limited number of people, a family or two families at the most. But protection from whom or from what?

The suggestion that springs to the mind is that it was a place of refuge, sheltering its occupants from sudden attack in a troubled country-side or

from casual raids by wandering clansmen. It could scarcely have withstood a planned attack in force, for its garrison must have been small, and it was within easy range of an arrow from the shore; but boats could not readily be carried to the spot or improvised there, and a swimmer was an easy mark in the water. So that the inhabitants could rest there with their possessions, comparatively safe from the petty thief or even the more determined raider.

But there was an equally or even more pressing need for protection when the lake-dwelling was built. Its timbers show that where the hillsides in the neighbourhood are now bare, there flourished forests of mixed woods, great pine trees and oaks, besides abundant and enormous birches some more than a century old. Even in the sixteenth century these and other Scottish forests were haunted by packs of wolves, to the great danger of travellers and the concern of the authorities, who erected on the forest tracks hospices, hospitals, or "spittals," where benighted travellers might find refuge. Of this district it is recorded by the Stuarts that in 1848 there were still living in Lochaber old people who related from their predecessors that, when all the country from the Lochie to Loch Erroch was covered by a continuous pine forest, the eastern tracts upon the Blackwater and the wild wilderness stretching towards Rannoch were so dense and infested by the rabid droves that they were almost impassable (1848, vol. ii. pp. 231, 232). And one of the brothers Stuart states that "on the south side of Beann Nevis, a large pine forest, which extended from the western braes of Lochaber to the Black Water and the mosses of Rannoch, was burned to expel the Wolves" (published under the name of James Hay Allan, 1822).

The need for protection against the ever-present risk of attack from wolves was probably a contributing reason for the building of the island, for a stretch of 100–200 feet of deep water gave security which no land dwelling could offer. Wolves existed in these parts till perhaps the middle of the seventeenth century; in 1621 the price paid in Sutherland for the slaughter of a wolf was fixed at 6L, 13s. 4d., and Sir Robert Gordon in 1630 says that the forests of that county were, amongst other creatures, "full of reid deer and roes, woulffs, foxes and wyld catts." Certainly the lake-dwelling was made long before wolves were exterminated in the district, although it is quite likely that its occupation, continuous or casual, may have been carried on after its original purposes had vanished.

6. Description of the Island.

(i) *Its Superficial Appearance.*

The normal water-level of Eadarloch was 783 feet above sea-level, somewhat lower than the level of Loch Treig. Normally the island, as it

existed in recent times, must have been all but submerged (see fig. 1), but at low levels of the water surface it appeared as an elongated oval, the levelled surface of which had a maximum length of 45½ feet and a maximum breadth of 28 feet. This surface, on which grew reeds and grass and two small clumps of birch trees, rose very slightly above the water, the highest point, on the south-eastern side, projecting only for a couple of feet, while the water lapped a great part of the western margin. The levelled surface, underneath the vegetation and superficial sand and humus, was a mass of stones, and the sides, which sloped gently down into the water, were also built of rounded water-worn pebbles, gathered from the shores of the loch. It was noticeable even on superficial examination that the boundaries of the stone-work were irregular, and that the levelled surface toppled away to the west side where the sides of the mound were steepest.

It is clear that the modern condition could scarcely have represented the state of the island when it was inhabited, for as I have described it, it must frequently have been submerged when the mountain torrents were running in spate into Loch Treig.

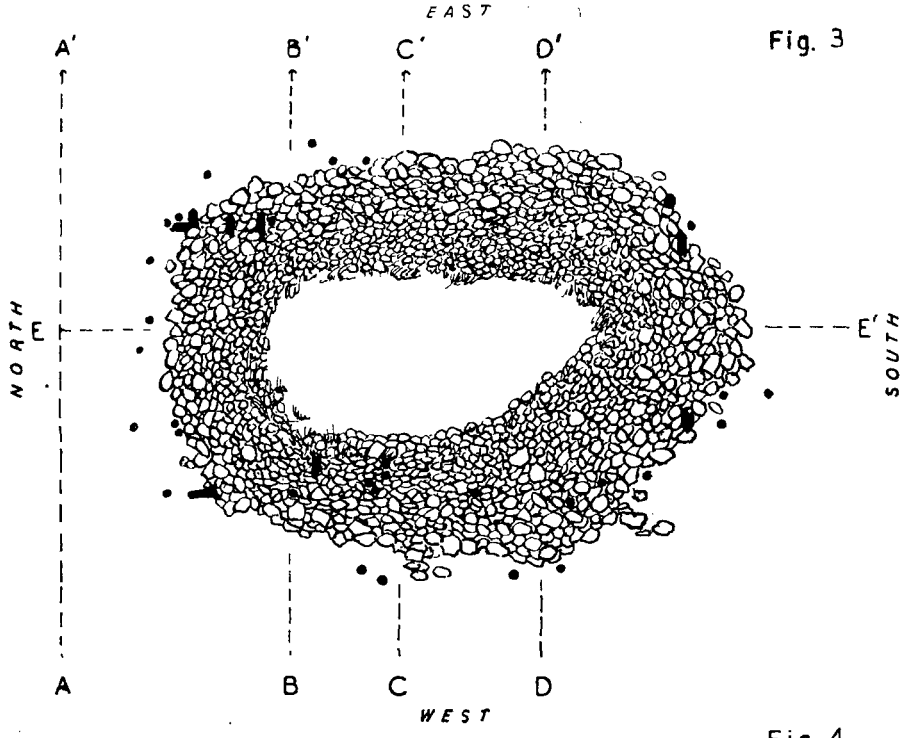
Exposed by the draining of Eadarloch, the island revealed itself as apparently a great oval heap of rounded stones and boulders (Pl. IV, figs. 1 and 2), resting upon layers of sandy silt which covered the mound of vegetable debris. The stony heap stood about 8 to 10 feet high, with a broad base 60 feet long by 40 feet broad, from which the sides sloped gently inwards to the levelled top. The stones upon the slopes were roughly graded, smaller water-worn pebbles forming the upper slope, and larger rounded stones with rare angular blocks being interspersed with smaller pebbles on the lower half or two-thirds of the slope. The gradation appeared to be designed, but it may have been contributed to by the sorting action of the water currents which for centuries had played around the island.

The superficial stone-work dominated the outer appearance of the island, and it was only an occasional projecting end of a baulk of timber or an upright post that gave any hint of the elaborate internal structure which was exposed by subsequent excavation (see fig. 3). Munro remarks that there are many artificial islands "still extant in several of our Scottish lakes, which appear to be entirely composed of stones and earth irregularly heaped together" (1882, p. 242), but the misleading appearance of the surface of the Treig island is a warning against the acceptance of the evidences of superficial examination.

(ii) *Plan and Sectional Survey of Island.*

Before excavation was begun a survey of the island and its surroundings was made with the invaluable assistance of Mr Lyall of the Resident

Engineer's Staff. Some of the results are shown in figs. 2–7, which include a plan, a longitudinal section, and three cross-sections of the island, with



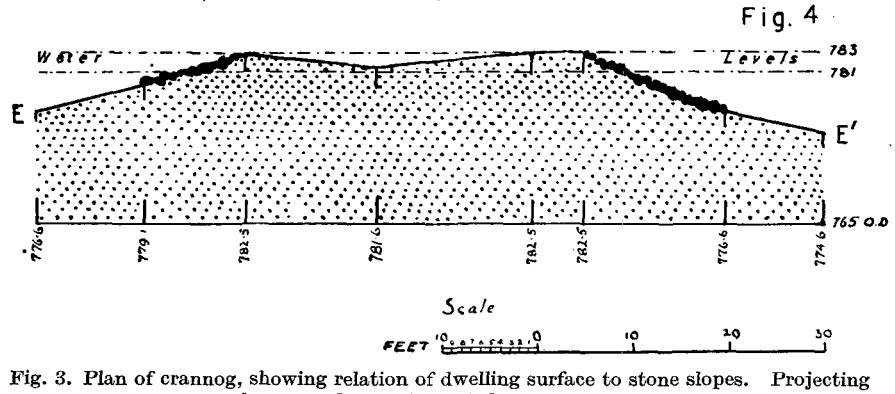


Fig. 3. Plan of crannog, showing relation of dwelling surface to stone slopes. Projecting beams and posts indicated in solid black.

Fig. 4. Outline of longitudinal section of crannog at EE'.

one section of the bed of the loch, 11 feet to the north of the limit of the stone facing.

The plan (fig. 3) shows the oval island, seemingly formed of an accumu-

lation of loose stones, broad at the base and rising to form a relatively small surface on which the inhabitants dwelt. It also shows the position of a number of wooden structures of two kinds—the ends of a few beams which in every case projected horizontally from the stone slopes, and upright posts arranged approximately in rows. On the west side this arrangement was most clearly preserved; here two rows were indicated, one projecting from about the middle of the stone slope, and the other projecting from the bed of the loch beyond the limit of the stones. Subsequent excavation showed that each row marked the position of a wooden framework which the posts were designed to keep in position.

A longitudinal (N.–S.) and almost median section of the island is represented in fig. 4. At this part the outer margins of the island were at the same level, but the centre was slightly depressed. Although the stone slope was more extensive on the south, both it and the northern slope were roughly symmetrical, lying respectively at angles of 22° and 17·5° with the horizontal. We can, therefore, regard the long axis of the island, lying parallel with the flow of the current, as having preserved its original contour except for the depression towards the centre, even if it may not have preserved its original level in relation to the surface of the loch.

The cross-sections (W.–E.) reveal a different story (figs. 5–8). Each of these shows a tilting of the surface towards the west, and an increasing steepness of the western stone slope, which reaches its greatest in the most northerly section. Thus, whereas the longitudinal surface remains level at its extremities 45 feet apart, the cross-section DD′ falls away towards the west 0·6 feet in 8 feet, CC′ 1·3 feet in 16 feet, and BB′ 2·8 feet in 18 feet. And while the eastern stone slopes of these sections retain angles about normal, of 19°, 14·5°, and 22° respectively, the western slopes show an increasing tilt from 22° at the southern end of the island to 27·5° at the middle, and 35·5° at the northern end.

It is obvious that some disturbance has caused a settling of the island on its western side, most marked at the northern end, and the source of this disturbance was most likely the main current from Loch Treig which flowed along this side of the island.

Moreover, the settling was due not to any significant tilting of the wooden framework upon which the island was built, for the timber upper platform remained almost level. It must therefore have been caused by the action of the current in disturbing the packing of the island, which consequently settled in the spaces between the wooden framework. This was confirmed by the surface at the section BB′, where although the greater part of the surface had a tilt of 5° to the horizontal, in the outer 4 feet the tilt was increased to 11°, although the wooden framework of the upper platform showed no change in level from east to west.

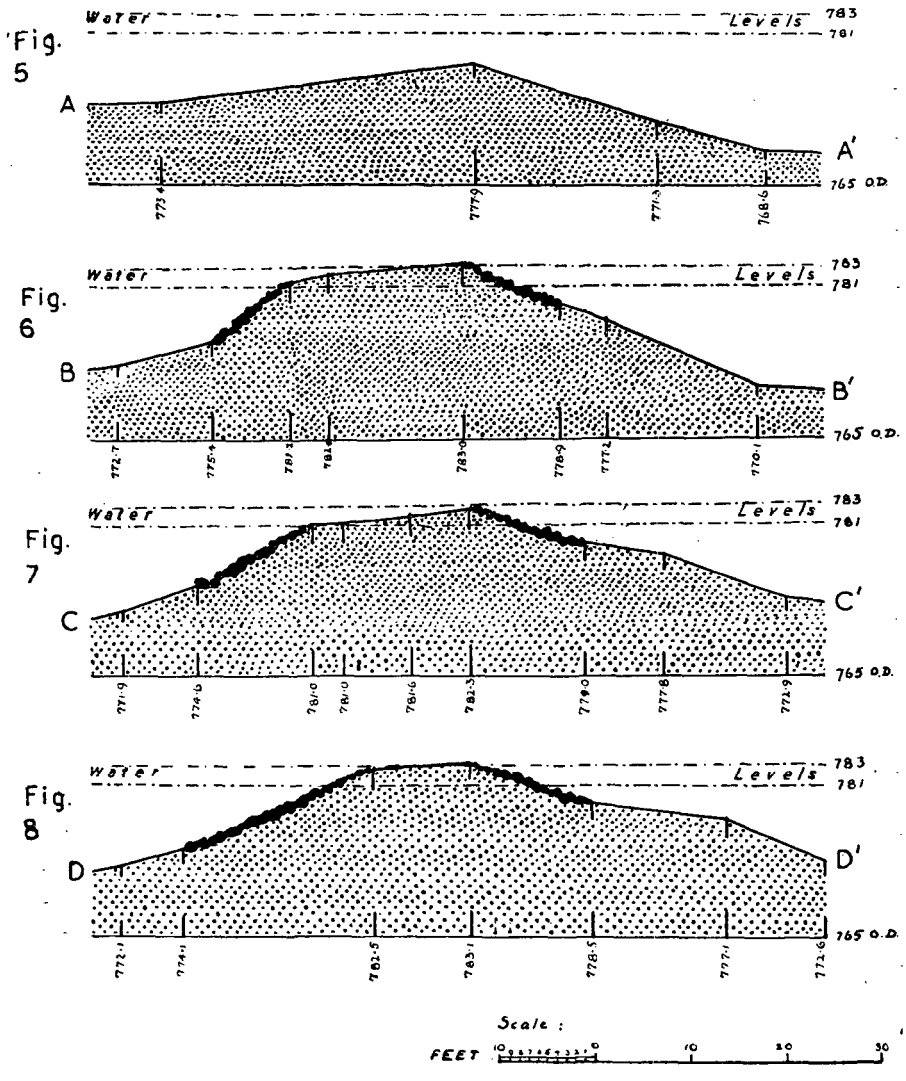


Fig. 5. Outline of bed of loch at AA′, immediately to the north of the crannog.

Fig. 6. Outline of cross-section of crannog at BB′, north end.

Fig. 7. Outline of cross-section of crannog at CC′, middle.

Fig. 8. Outline of cross-section of crannog at DD′, south end.

(iii) *Relation of Surface of Island to Water-level.*

The highest point of the surface of the island was 784 feet above sea-level, but its general level was only about 782 feet and at some places it dipped to 781 feet.

These elevations must be considered in relation to the water-levels in the lochs. The waters of Loch Treig proper vary greatly with rainfall. Thus, although the Ordnance Survey found the level to be 783·9 feet above sea-level on 13th July 1868, it was 787·0 feet when Sir John Murray completed its survey on 29th May 1902, an unusually high level due to preceding rains. The surveyors associated with the British Aluminium Company's works found the greatest height reached by Loch Treig proper to be 786 feet above sea-level, and at that time the level of Eadarloch, also at its greatest, was 785·6 feet. Under such conditions the artificial island must have been well under water. Many readings in Eadarloch were taken by the surveyors, and it may be considered that the usual flood-level there was 784·0–784·5 feet, and the normal level 783·0–783·5 feet.

Therefore, whether we consider flood or normal level, the island as it stood in recent years must have been almost continuously and almost wholly submerged.

Clearly the present cannot represent the original condition of the island. I shall show that part of the change has been brought about by the subsidence of the island itself, but there was probably a second contributory factor. The level of the surface in Eadarloch is ultimately regulated by the level of the sand-bar over which the outflow passes into River Treig. This was about 781 feet O.D. and was attained by a gradual rise in the bed of the loch from a level of 775 feet at its northern end. On the sectional drawings (figs. 4–8), in addition to the normal level of 783 feet, I have indicated this level of 781 feet to show how the island would have appeared had the outflow from the loch come to a stop, say in times of extreme drought. Even then the island would have been almost uninhabitable.

I suggest therefore that there is every likelihood that a change has taken place in the level of the sand-bar at River Treig itself, and that in times of spate the currents of the loch may have been slowly transferring sandy deposits from the bottom to heap up fresh accumulations at the outflow. A lowering of the bed at this point by 2 feet, added to an allowance for the amount of subsidence traceable in the island itself (see p. 28), would have raised the whole inhabited surface about 2 feet 6 inches above normal water-level, and that is probably about the height at which the island originally stood. At this height the surface would still have been well above normal flood-level.

7. The Structure of the Lake-dwelling.

(i) *The General Type.*

The lake-dwellings which have been investigated in this and other countries have been essentially built about a skeleton of wood. But the

character of the skeleton as well as the purpose it served have varied from country to country and perhaps also from time to time. In the oldest form, predominant in Central Europe in the Neolithic and Bronze Ages, erect trunks of trees or piles, firmly embedded in the lake-bottom, formed a foundation of posts upon which a stout level platform of tree-trunks or planks was laid, at a level several feet above the surface of the water, and on this platform the dwellings were built.

In the second type erect piles were reduced to a secondary purpose, and the main foundation had become a series of isolated wooden sections, each rectangular in shape and formed of horizontal wooden beams laid alternately at right angles, as in a log-cabin. Erect wedge-posts rather than piles were used at the corners of these sections simply to keep them in place, and at a suitable level a platform of heavy beams and planks for the huts was laid over the tops of the sections. This type was in use during the Early Iron Age in Northern Germany and France.

In a third type the use of a foundation of heavy timbers, either as piles or compartments, had been abandoned, and instead the exposed platform, upon which the dwellings were built, rested upon a succession of layers composed of brushwood, branches, and stems of small trees. Piles were driven through these masses as they accumulated to prevent them from floating or drifting. Occasionally represented in the lakes of Central Europe, these structures are known as fascine islands.

From these types, which depended almost solely upon wood as a foundation, a fourth type made a notable departure. Stout timbers, either dressed beams or natural trunks of trees, formed the skeleton of the artificial island; but these were held in place partly by upright posts but mainly by masses of stones and earth with intervening layers of brushwood and branches, and the dwellings themselves were erected on a substantial foundation of stones and earth. Indeed to all appearance such an island is an enormous heap of stones, the woodwork being almost entirely concealed. Piles, or rather wedge-posts, were used to keep the timbers in place, and, although it has been stated that such islands were surrounded by a stockade of piles, it is possible that the appearance of a stockade was in some cases a fortuitous one. The Scottish and Irish lake-dwellings or crannogs belong to this last type.

No detailed description of the construction of such as the Loch Treig artificial island has been published, and I have therefore given a reasonably full and illustrated account of a structure which may probably be taken as typical of the smaller lake-dwellings most common in Scottish fresh-water lochs and which is representative of a distinctive development in the building of lake-dwellings, even of the Scoto-Irish type.

The excavations were planned to expose representative sections in different parts of the island, but it will lead to a better understanding of

the construction if, instead of a chronological account of the work, a description is given of the units which composed the island from the surface down to the foundation, as revealed by the excavations as a whole.

(ii) *The Superstructure on which the Dwelling was placed.*

The exposed part of the island upon which the dwelling was placed consisted of a great accumulation of stones, earth, and a considerable amount of decayed vegetable matter, which together reached a depth of from

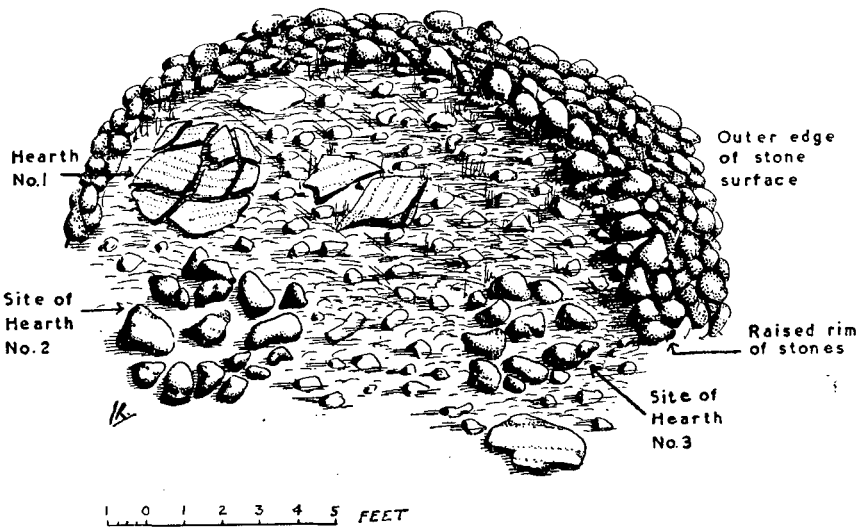


Fig. 9. Uncovered surface at north end, showing position of raised rim of stones and surface hearths.

3 feet 3 inches to 4 feet 3 inches (see Pl. VI, 1). This superstructure sloped inwards towards its upper surface, leaving available for the dwellings an oval area about 33 feet long by 15 feet broad at its widest. The dwelling surface, exposed by the removal of the grass and reeds which covered it, and the silt and organic debris upon which they were growing, was roughly levelled but was very irregular, as if owing to subsidence especially in the south-western portion. It was formed of closely packed water-worn stones, very unequal in size, mostly 4 to 6 inches across but often twice as large. Where the edge of the level surface was unbroken, as at the north-east end, larger stones formed a slightly raised rim just within the margin of the island (fig. 9), and a possibility is that this acted as a boundary to contain a layer of heather and moss which was used to carpet the surface, and which, although it had entirely disappeared as such, had contributed to the organic debris amongst the stones. The remains of such layers were discernible in the upper two feet of the superstructure, indicating

former levels of occupation, but otherwise there was no trace of orderly arrangement. The stone and earth superstructure was not of uniform thickness. It reached its greatest depth of about 4 feet 3 inches across the middle (E. to W.) of the island, and this was due to the sagging of the wooden platform upon which it was supported, and to additions of new material made to keep the surface level at a suitable height above water (see figs. 13 and 14).

At the foundation of this considerable mass was a uniform layer, 3 inches deep, of brushwood, formed of closely compressed bundles of heather with long stems (see Pl. XVI, 3).

Hearths.—On the cleared surface near the north-west corner was a hearth of flat slabs of schist, fitted together to form an area roughly oval, 3 feet by 2 feet 2 inches (fig. 9 and Pl. V, 1). Fragments of charcoal still lay upon the hearth, which was built up on water-worn stones arranged in a rude circle, and since there were two other groups of stones similarly arranged at the north end, near which lay large slabs of schist, these were probably also the sites of hearths (Pl. V, 1, and fig. 9). The practice of raising the hearth above the general level was not uncommon; witness the elevated clay hearths of which more than 200 were found at Glastonbury Lake Village (Bulleid and Gray, 1911, vol. i. p. 58) or the clay hearths at Lochlee crannog (Munro, 1882, p. 73 *et seq.*). It would have the advantages of convenience for cooking and of reducing the danger of setting alight the heather carpeting of the hut. At Loch Treig the more usual clay foundation, which was also characteristic of the Swiss lake-dwellings, was replaced by a setting of large pebbles.

At the surface level no further hearths were found other than the three at the north end, but later excavation discovered several at lower levels. The fourth hearth lay about 1 foot below the first and a little to the south of it, a single large flat slab of schist, 2 feet 9 inches in length, 2 feet 2 inches in breadth, and 6 inches thick. This stone had been cracked by heat, and on its surface lay several fragments of calcined bones.

Just below the level of the fourth hearth but east of it lay a fifth rectangular slab of schist, 2 feet by 1 foot 6 inches across. The last of the hearths was in the north-east corner, at a depth of 2 feet below the surface of the stones. It was formed of three slabs of schist, closely fitted together and covering an area 3 feet 6 inches by 2 feet 6 inches; on its surface lay sand and earth which had been burnt. Charcoal was found at a depth of about 2 feet in other parts of the island, but no other hearths were discovered. The scattered charcoal may indicate that one of the earlier habitations had been destroyed by fire.

The levels of the successive hearths are significant. I have pointed out that the normal water-level of Eadarloch was 783 feet above Ordnance Datum, so that in modern times all the hearths were generally under water,

the surface hearths Nos. 1 and 2 by as much as 2 feet. The discovery of hearths at different levels each covered, not by the natural accumulations which often submerge hearths, but by gatherings of stones and earth, shows that during the period of its occupation the island was sinking and had time and again to be replenished to keep its surface sufficiently clear of the water.

From the position of the hearths the total extent of this sinking can be calculated with reasonable accuracy. The deepest hearth at the north-west corner was about 1 foot 6 inches below the surface, which itself was almost 2 feet below the normal water-level. So that an elevation of 3 feet 6 inches would bring this hearth just clear of the water. Of course that would not be sufficient for comfort or practical purposes, but if, as I have suggested (see p. 24), the water-level was originally some 2 feet lower than at present, then a lift of 4 feet would have raised the lowest hearth in the north-west corner 2 feet 6 inches clear of the original water-level and clear of ordinary flood-level in those days.

At the north-east corner where subsidence was less marked a hearth was found 2 feet below the surface, and here an elevation of 2 feet 6 inches would, under the assumed conditions, have raised this hearth also clear of the water even at ordinary flood-level.

Since its construction therefore the surface of the island must have subsided at least 2 feet 6 inches at its north-eastern and 4 feet at its north-western corner, and during the period of its occupation the subsidence was at least 2 feet in the centre of the island, where as I shall show later (p. 37) the under-structure appears to have given way.

(iii) *The Dwelling.*

Very little is known about the buildings which surmounted the artificial islands, and accordingly in the course of the excavations special look-out was kept for any indication of posts or post-holes which might indicate the numbers and shape of the habitations. Unfortunately, so complete had been the destruction of the superstructure that no trace remained.

It must have been a timber construction, as one of the Gaelic names of the island suggests (see p. 17), and it must have been built of relatively light timbers and woodwork to have disappeared so thoroughly. Only a few pointers regarding it were gathered. In the first place the hearths were confined to one part of the island; had there been several huts there would most likely have been hearths distributed over the surface. In the second place, at the centre of the dwelling surface was a large circular hole rather over 1 foot in diameter (Pl. V, 2) which at first I thought might have been a well. But a well upon an island in a fresh-water loch would be superfluous, and I concluded that the hole was a post-hole which

had contained an upright tree-trunk of considerable girth. The suggestion is that this substantial pillar may have been the central support of the dwelling. Close by the hole was found a short length of trunk with one end burnt, and although it was not found *in situ* this may have been the remains of such a support, in which case it would indicate that the dwelling had been destroyed by fire. No post-holes were found elsewhere on the dwelling surface. In the third place, all the traditional names of the dwelling use the Gaelic words *Tigh* or *Ruighe*, house or sheiling, in the singular.

Such evidence points to the probability that the island bore a single wooden dwelling of moderate size, and not a collection of small huts or tents, and the likelihood is that the dwelling was somewhat tent-like, the roof rising to a point near the centre of the island. The name *Ruighe na Slighe*, Sheiling of the Track, is suggestive of the unassuming character of the structure.

The only evidence so far recorded of the hut of a Scottish lake-dwelling favours this probability. Munro discovered the stump of a stout oak pile in the centre of a crannog in Lochan Dughaill, near Balinakill in Argyllshire, associated with post-holes in radiating beams, which clearly formed part of a circular dwelling-house (1893, p. 213, and 1899, p. 334). The hut was "a large, circular, tent-like structure, 32 feet in diameter, constructed of wood, and supported by one central and some twenty surrounding uprights" (1893, p. 221). I surmise that the Treig dwelling was of somewhat similar construction, but oblong instead of circular (see Pl. XIX). Traces of a hut at Kilbirnie crannog, Ayrshire, were oblong, but there is no indication of how the roof was supported (Munro, 1882, p. 64).

(iv) *The Upper Platform.*

The superstructure of stones, earth, and the remains of artificial layers of vegetation, which I have described above, rested upon an elaborate level platform of timber, 57 feet long by 30 feet broad. The presence of this platform was indicated in the unexcavated island by stout horizontal timbers which in a few places projected from the rubble sides. These relics varied in level from 777·8 to 780 feet above O.D., but some were obviously displaced by sinking and one by tilting, and the level of those clearly in their original position was close to 779 feet O.D.

The platform level, therefore, was at least 2 feet below the water-level of Eadarloch, even if we assume that that level was lower in former than in recent times. There can be no doubt that this submerged position was a deliberate device to ensure the preservation of a structure so important in the composition of the island, for timbers kept in a constant medium, whether it be wet or dry, resist decay much longer than those subjected to alternations of dryness and wetness.

Here we have a notable divergence from the typical lake-dwellings of the Continent, for in the various types of these—pile, basement, or fascine —the upper platform was built well above water-level and directly carried the huts. The Scottish lake-hutment type was distinctive in having an under-water wooden platform; this carried a huge mound of stones and earth, on which the hut in turn was built.

Some of the timber framework of the platform was well preserved considering its age, but, as might be expected, the outer exposed ends of the majority of the trunks had decayed away, and even in the centre of the island some of the wood had disappeared or was in an advanced stage of decay. Sufficient remained, however, to reveal the construction of the platform, which was examined wherever it was exposed and particularly at sections made at the north end and the centre of the island.

The platform was constructed, first, of a heavy framework solidly built and in many places pinned together, and, secondly, of a floor or mass of loose timber laid in short lengths across the underlying framework.

The Framework of the Upper Platform.—The materials used in the construction of the framework were trunks of pine or birch trees. These were either trimmed and sometimes slightly squared, or more frequently were simply rough trunks with the branches cut short. There was a close approximation to standardisation in the conduct of the work, for most of the beams were about 31 feet long, although occasionally a corresponding space was traversed by two beams of between 15 and 16 feet. The trees selected were remarkably straight and showed little taper, suggesting that they had been cut in a dense and well-grown forest.

The framework was built methodically and on sound principles of construction. This may be illustrated by two typical areas—at the north end of the island, and at the centre (fig. 10). At the north end the outmost cross-beam of the framework, a trimmed trunk, 31 feet long by 1 foot in diameter, was first laid down; upon it rested, about 1 foot from its extremities, two longitudinal beams each about 30 feet long. Rigidity was given to the arrangement through the interlocking of the beams at the point of crossing by means of a deep square half-check cut in each, and a dowel hole through each junction showed that wooden dowel-pins had secured the positions. The second cross-beam, unlike the outer, from which it was 6 feet distant, *rested upon* the outer longitudinal beam. It was a half-length timber 16 feet long by 1 foot in diameter; its inner end was wedge-shaped—to key into a notch in the corresponding beam on the west side which was missing. The outer end was not fixed in any way to the longitudinal beam, and I suspect that this beam had moved southward about a foot from its original position. The third cross-beam, 32 feet long by 1 foot in diameter, rested upon the outer longitudinal beams, with which it was interlocked by corresponding half checks pinned at both ends,

the distance between these two fixed cross-beams (that is cross-beams 1 and 3) being 9 feet (fig. 10 and Pl. VI, 1).

This was not a typical arrangement, for at the centre of the island, where careful excavation showed the relative position of the cross-beams even although some were decayed and friable, the distance between successive cross-beams was regularly 4 feet. In every case where a cross-

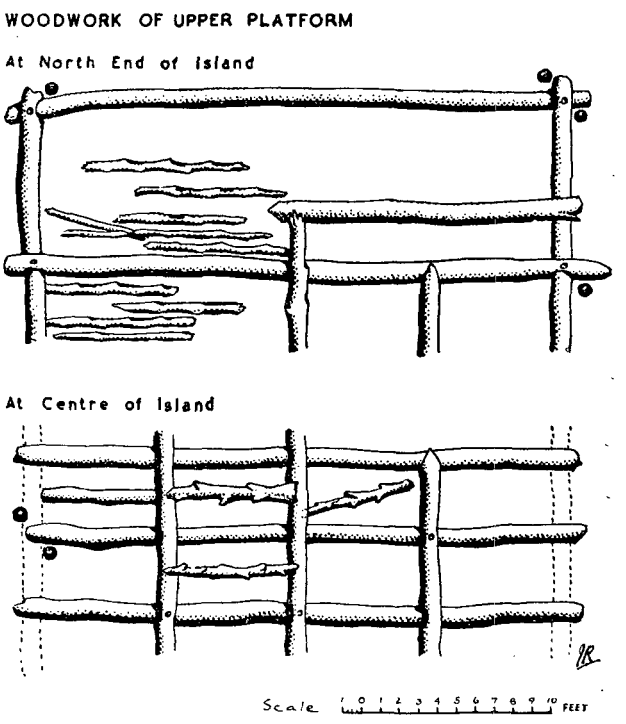


Fig. 10. Woodwork of upper platform—at north end and at centre of crannog.

beam was observed in position its outer ends rested upon the two outer longitudinal beams (Pl. VI, 2).

The method of building the framework of the upper platform was therefore as follows:—

First, the two outmost cross-beams were laid down at the north and south extremities of the under-structure; secondly, upon these two cross-beams and fixed to them were laid the outer longitudinal beams, 28 feet apart; thirdly, the remaining cross-beams were laid upon the outer longitudinal beams, to which they were generally, but not always, fixed by checks and dowel-pins, at distances of approximately 4 feet apart; finally, when the cross-beams were in position three sets of inner longitudinal beams were laid upon them fixed in places by checks and dowel-pins, and spaced at

distances of approximately 7 feet from each other and from the outer longitudinal beams. These distances are given as approximate, because, although they may be regarded as the normal spacing, the distance had sometimes to be modified to conform with an irregularity in a tree-trunk. For example, on one beam two adjacent checks were only 6 feet 5 inches apart.

In the heavy timbers of the framework, which were generally about a foot in diameter, well-preserved examples showed the deep checks to be carefully cut with an iron tool (see Pl. VII, 2 and 3), and the dowel holes which were roughly $1\frac{1}{4}$ to 2 inches in diameter were made by burning. The beams of the framework were not pinned at every crossing, but I could trace no system in the arrangement of such dowel holes as could be distinguished. On an average a dowel-pin was inserted at about every third cross-beam.

The dowel-pins themselves are worthy of special notice because of the skilful device adopted to prevent them from slipping or turning after they had been driven home. Instead of being round they had been roughly squared by an iron tool, and the sharp edges of the square had been dressed away so that in section each pin was eight-sided, with four larger faces separated by four smaller faces (see Pl. XIV, 1, *c* and *d*). The result was that when the pin was driven into a round dowel hole made by burning, the eight angles of the pin bit into the charred surface of the hole and made an immovable fixture.

The character of the timber used in the upper platform is indicated by one large pine trunk in which, although it was not perfect, 106 annual rings were counted, and the presence of such a tree is a suggestive commentary on the nature of the woodland in the district when the island was built. This elaborate and heavy framework, bound together to give a certain degree of rigidity, must have contained about 600 cubic feet of timber and weighed in air about 13 tons.

The "Floor" of the Upper Platform.—The beams of the framework, where they were complete, measured from 30 to 32 feet in length, or in a few cases half that length. But there were found about the platform a number of timbers, usually lengths of natural trunks or stout branches of birch or pine, which were much shorter; in the centre of the island where they were best preserved they measured 8 feet long, and in the north end, where they were probably partly decayed, 6 or 7 feet. They were very unequal in girth, ranging from 3 or 4 to 9 inches in diameter. They invariably lay parallel with the cross-beams, and their length and the position of the few which remained undecayed showed that they were meant to span the space between the longitudinal beams.

Thus a rough surface of short sections of branches or trunks formed a sort of uneven floor upon the framework. It seemed natural to suppose

1. Side view of Treig Crannog, from West.

2. End view of Treig Crannog, from South.

James Ritchie.

To face p. 32.

1. Hearth No. 1.

2. Post-hole.

James Ritchie.

1. Section at North End, showing Upper Platform, etc.

2. Framework of Upper Platform at centre.

James Ritchie.

1. Beams of Framework at centre.

2. End of Cross-beam.

3. Fallen Cross-beam.

James Ritchie.

1. Brushwood packing.

2. Platform Frame, Upright Wedge-post, Intermediate Timber, etc.

James Ritchie.

1. Intermediate Timbers exposed.

2. Intermediate Timbers and packing of earth and stones.

James Ritchie.

1. Basal framework, N.W. corner.

2. Basal timber lattice, S.W. corner.

James Ritchie.

1. Part of basal lattice, North End.

2. Key-point of wedged timbers, from S.

James Ritchie.

1. Key-point of wedged timbers, from N.

2. Birch posts deflected by pressure.

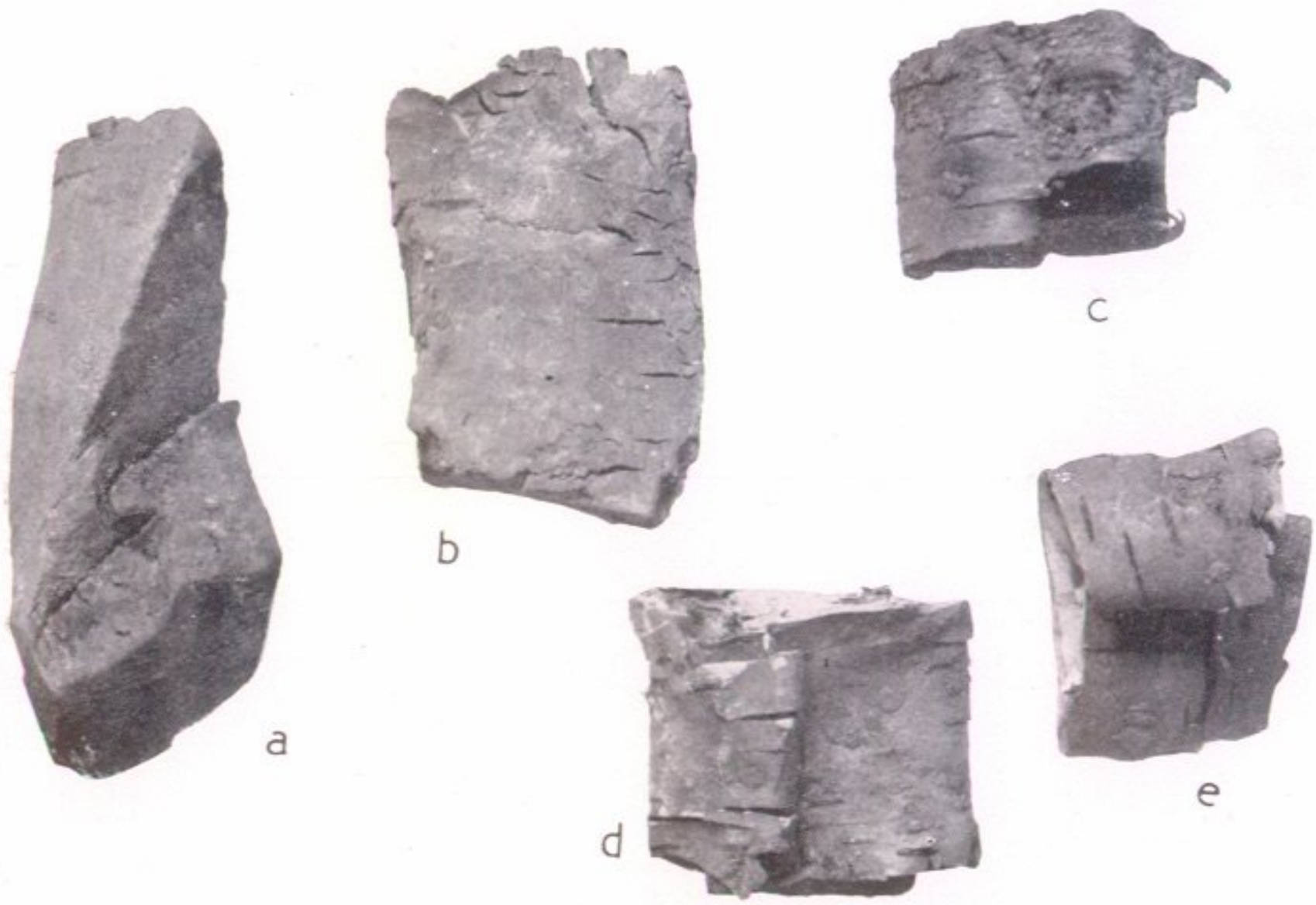
James Ritchie.

1. North end, early stage of excavation.

2. Remains of Ladder for access to island.

James Ritchie.

1. Wooden dowel-pins and peg.

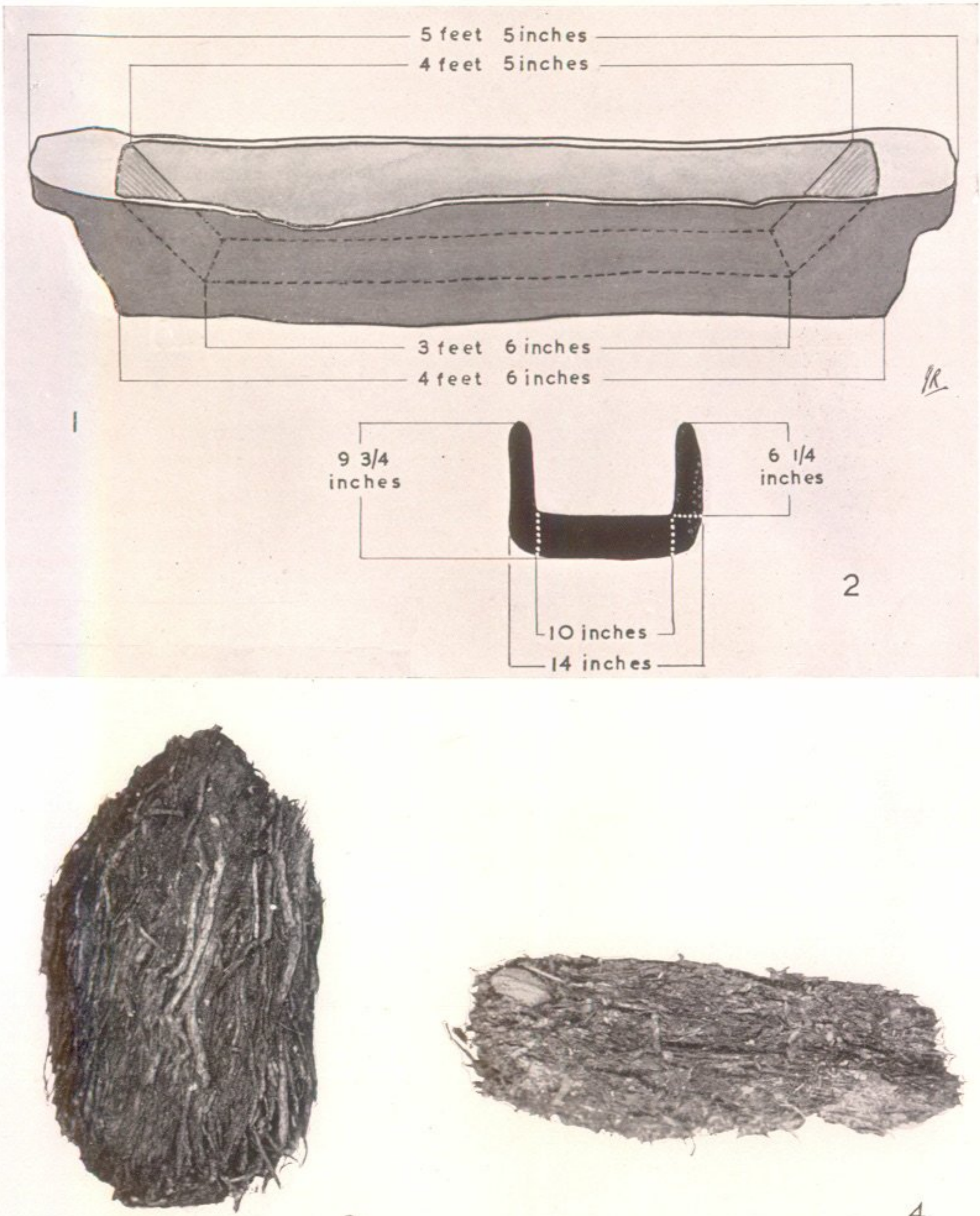


2. Adze-cut chips, and birch-bark rolls.

James Ritchie.

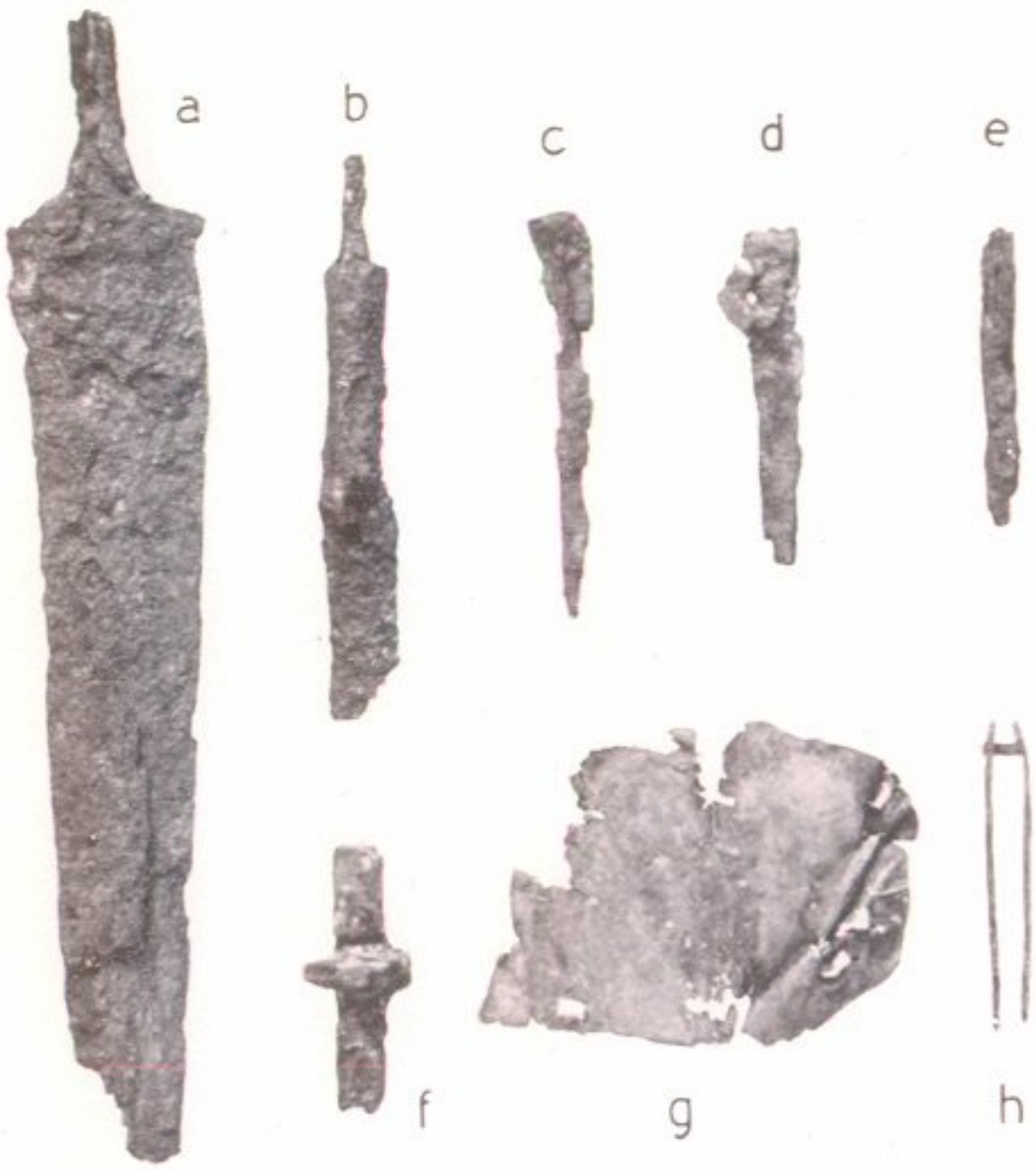
1, 2. Dug-out vessel of oak.
3, 4, 5. Various views of single-piece canoe of oak.

James Ritchie.



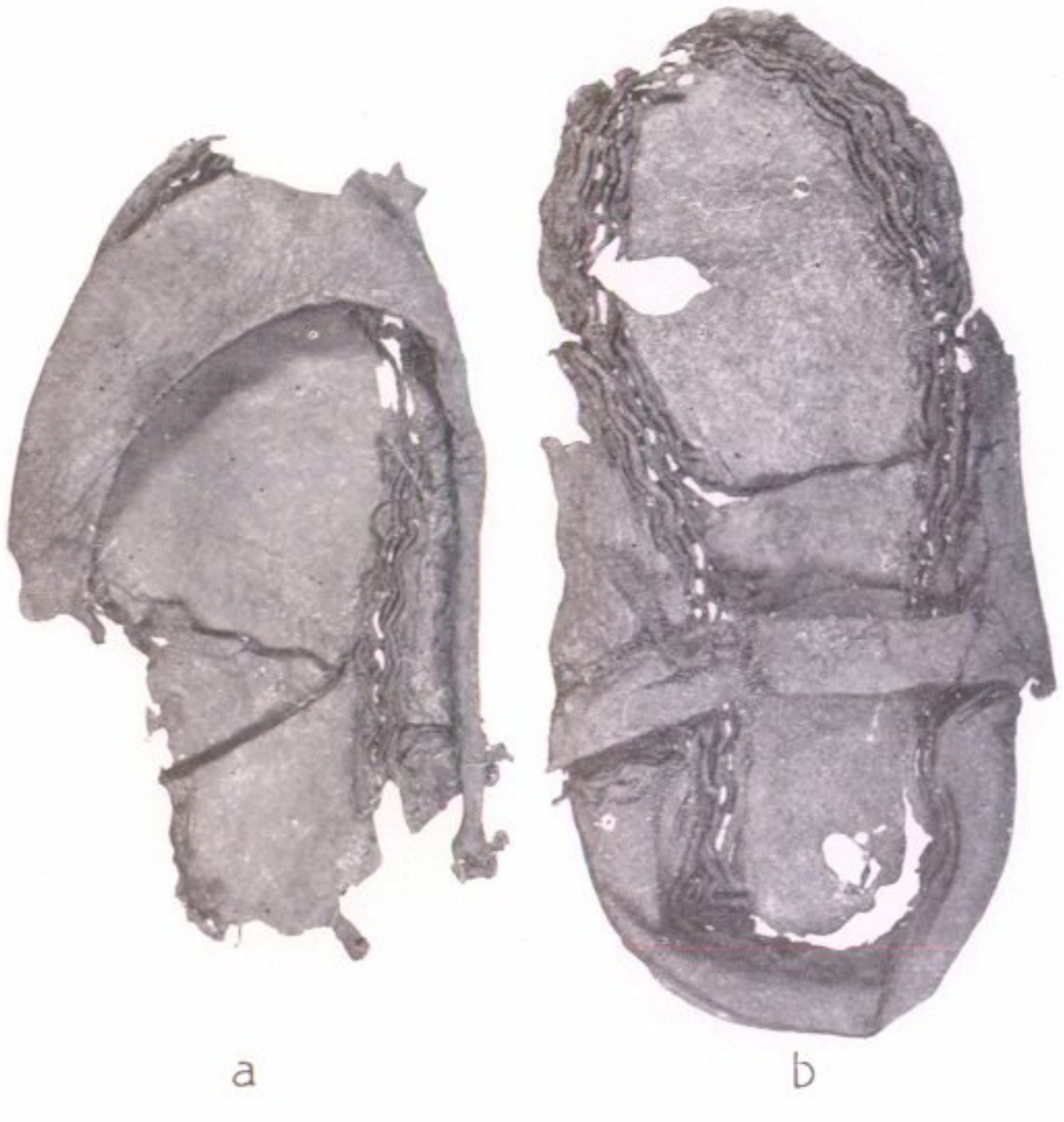
1, 2. Dug-out vessel of oak, dimensions.
3. Sample of brushwood layer.
4. Vegetable debris forming mound on which crannog was built.

James Ritchie.



1. (Upper): Metal implements.
2. (Lower): Wooden points.

James Ritchie.



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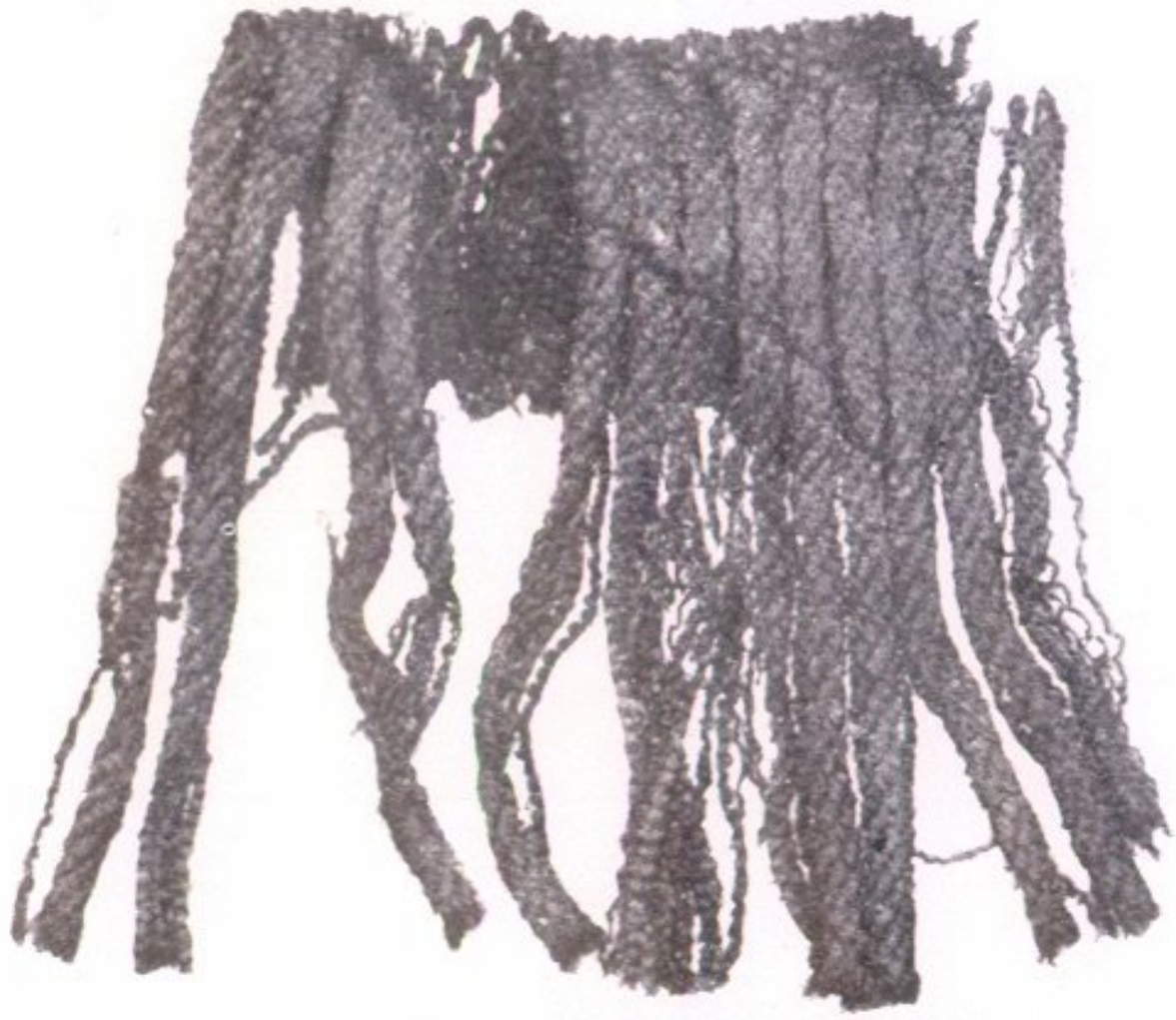
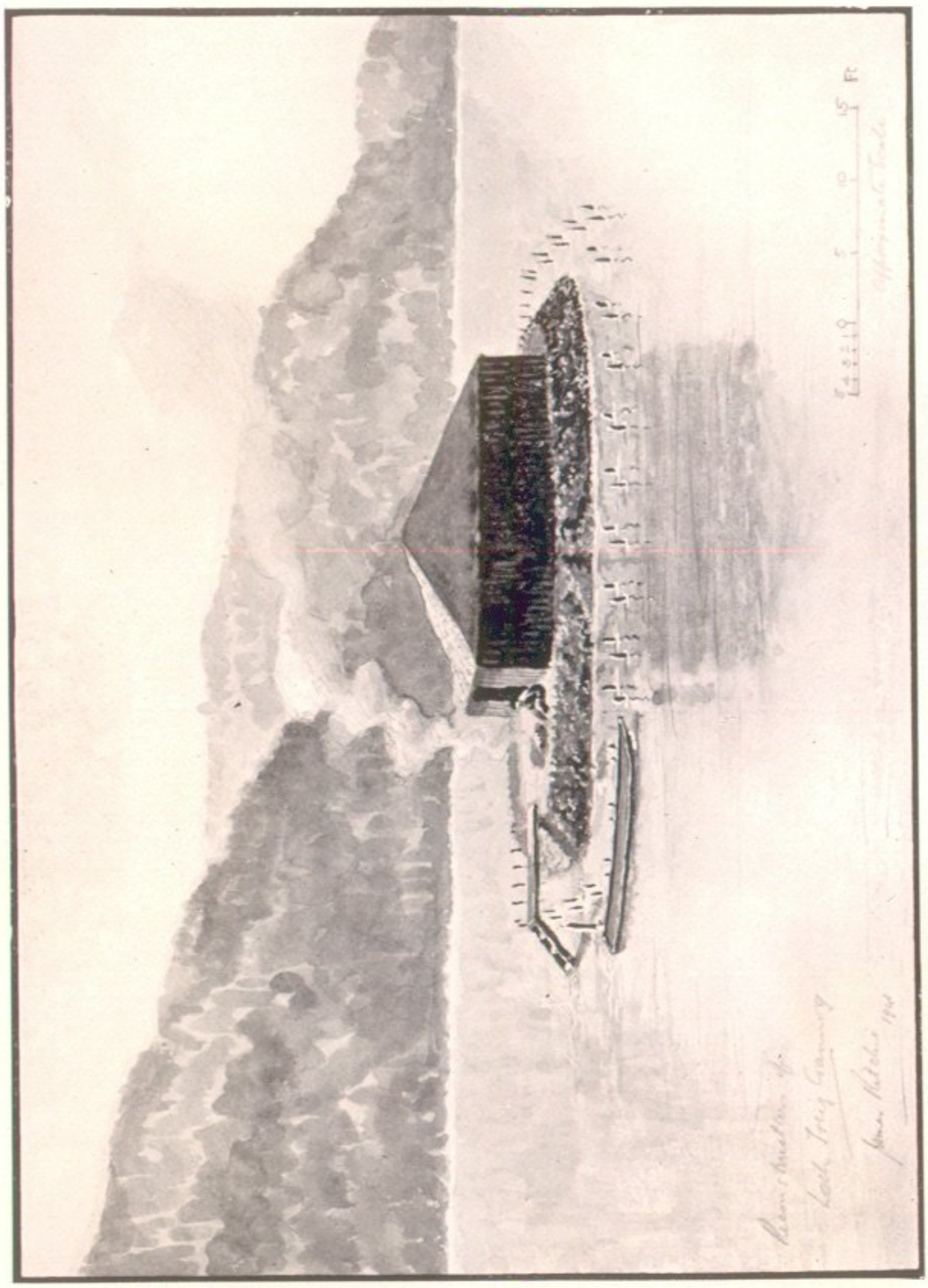


1. (Upper): Leather shoes.
2. (Lower): Woollen fabric.

James Ritchie.



Reconstruction of Lake-dwelling in Loch Treig.

James Ritchie.

that these were horizontal ties or stringers, which would add to the rigidity of the platform, but there was no evidence that they were fixed in any way to the framework, and we must take it that they were simply laid in place upon each pair of longitudinal beams, solely for the purpose of forming a floor to support the superstructure of stones and earth. They are shown in the reconstruction (fig. 11) as rather sparsely set across the spaces of the framework, as the excavations indicated, but it is possible that in the original condition of the platform they were more closely set as a sort of continuous floor planking.

The Method of Fixing the Platform in Position.—Before excavation began the preliminary survey showed a number of projecting upright posts, arranged in two series, distant about 7 feet from each other, the inner series projecting from the stone sides of the island, the outer from the silt just beyond the limit of the stone-work.

Plotting of the positions of the inner series showed that the posts were in two rows, about 2 feet apart, and the uncovering of the upper platform revealed their purpose. The posts were straight natural birch stems, 6 inches or a little under in diameter, still with silvery bark upon them. Several were found in their original positions in relation to the framework, firmly driven into the underlying material, and placed in diagonally opposite angles formed by the intersection of the cross-beams with the outer longitudinal beams (see figs. 10 and 11).

Their purpose therefore was to hold the upper platform securely in position and eliminate the danger of lateral shift. They were obviously placed there after the platform was safely resting upon its bed, and could not have been used to fix a floating platform down, for their position was erect, so that in water the platform would simply have floated upwards without hindrance.

Reconstruction of Upper Platform.—From the information given above and gathered during the excavations I have drawn a reconstruction of the Upper Platform (fig. 11), in which is indicated in solid black surrounded by a line the woodwork—beams or posts—visible before excavation commenced. I have not endeavoured to make the framework fit all the posts which were exposed and whose positions were plotted in the original survey, for some of these had been displaced by movements of the material in the island. But accepting the positions of the beams and posts which were evidently in their original positions, I have applied, throughout, the measurements made in the portions exposed, namely 4 feet between cross-beams and 7 feet between longitudinal beams. The result fits so nearly with the observed positions that the reconstruction may be taken as approximating closely to the original. The size of the platform framework was 57 feet long by 30 feet broad; it contained 15 cross-beams and 5 longitudinal beams.

A glance at the reconstruction shows that originally the upright posts fixing the platform in position must have resembled, as they projected from the stone-work, a close-set two-rowed palisade surrounding the island.

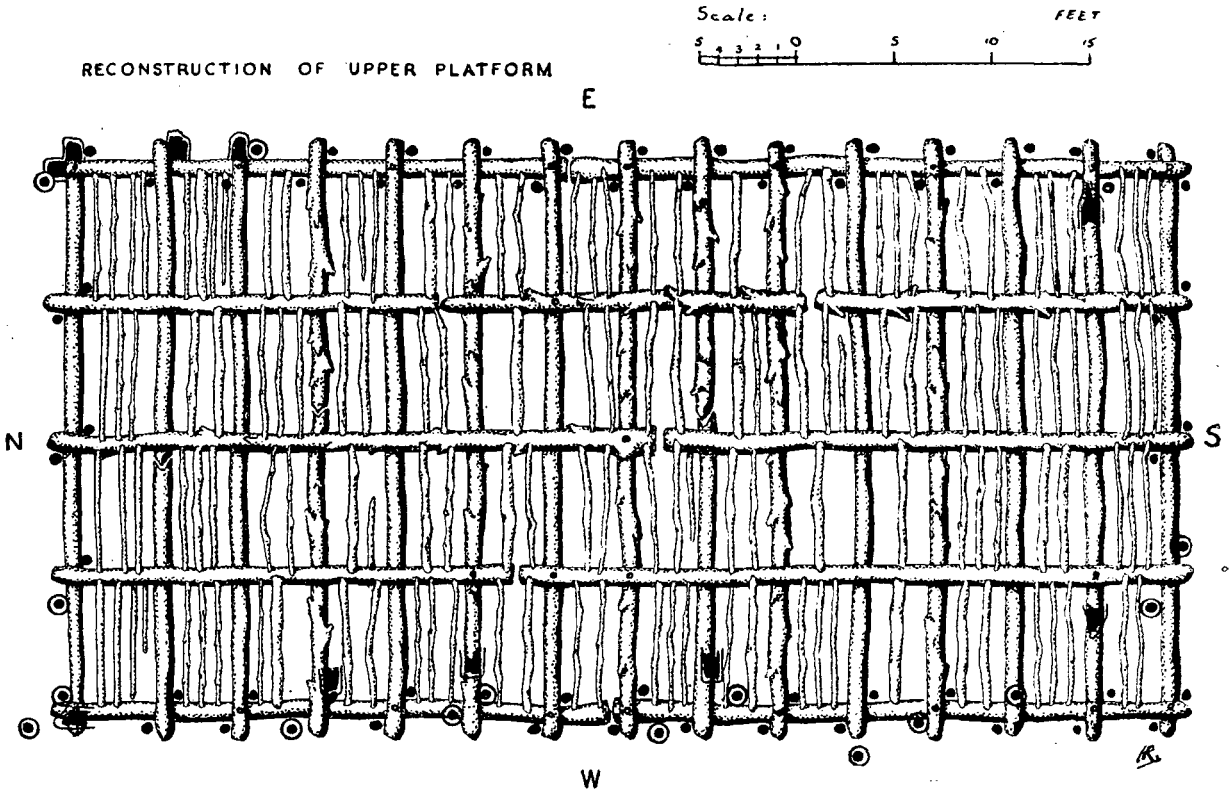


Fig. 11. Reconstruction of upper platform. Black dots indicate supposed positions of upright posts. Black ends of beams and dots, surrounded by a line, show actual positions of beams and posts visible before excavations began.

(v) *The Bedding of the Upper Platform.*

The Upper Platform may be regarded as the central feature of the island; upon its level surface was piled the mound on which the dwelling was perched, beneath it a foundation had to be laid, the double purpose of which was to raise it to a proper level and to give it unshakable stability. That this under-structure had to be carefully planned and elaborately built is scarcely to be wondered at since it had to bear a weight which in air amounted to approximately 13 tons of timber framework, not including the "floor" logs, and in addition about 250 tons of stones and earth. Even under water when the island was inhabited the pressure on the under-structure must have been about 150 tons.

The bedding of the upper platform was not uniform throughout the island, although a general plan of construction was evident. Everywhere the framework of the platform rested upon a bed of vegetation, 3 to 6 inches deep, almost completely composed of heather stems with bracken intermixed, tightly packed and compressed beneath the beams (Pl. VIII, 1 and Pl. XVI, 3).

The heather and bracken bed rested upon a mass of stones and earth, variable in depth at different parts of the island, but generally showing

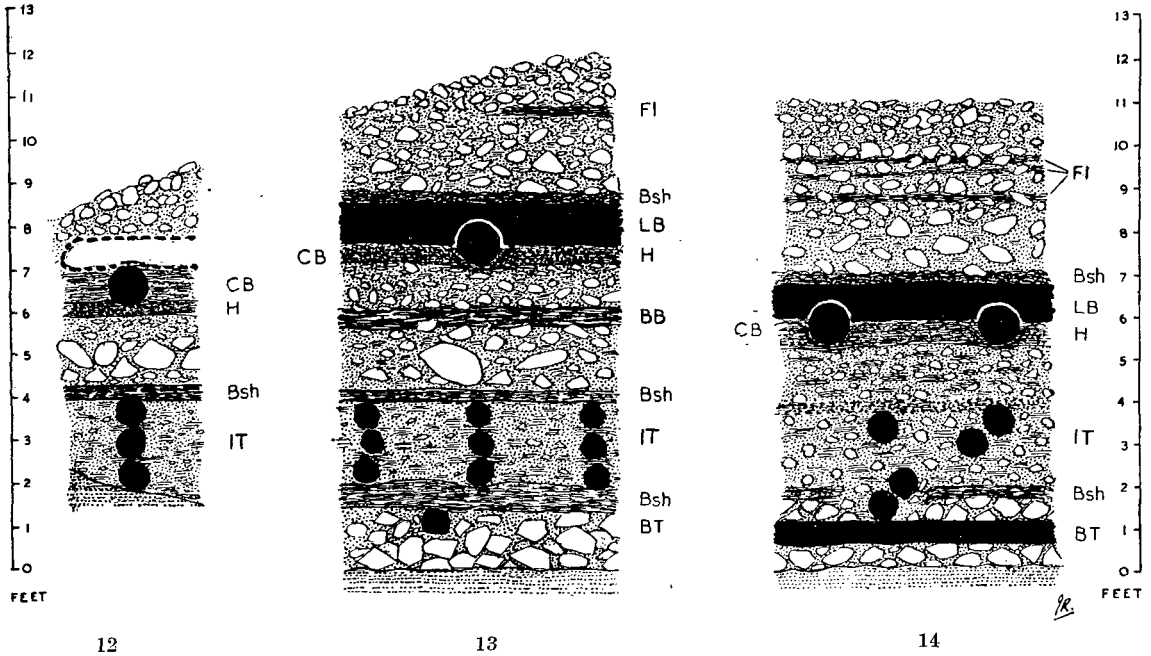


Fig. 12. Vertical section (N–S) of crannog at position of outmost cross-beam at north end. Depth indicated in feet from zero, which is at 771 feet O.D. Fl, old floor levels; Bsh, brushwood layer; LB, longitudinal beam of upper platform; CB, cross-beam of upper platform; H, heather and bracken layer; BB, layer of birch branches; IT, intermediate timbers; BT, basal timbers.

Fig. 13. Vertical section (N–S) of crannog at position of cross-beam 3 from north end. Lettering as above.

Fig. 14. Vertical section (N–S) at centre of crannog. Lettering as above.

a rough scheme of arrangement. Thus at the extreme north end of the platform, where the stone-and-earth layer was only 1 foot 8 inches deep, the uppermost 6 inches contained small water-worn pebbles 6 to 8 inches in length, followed by a layer containing large stones 1 foot across or more, some rounded and water-worn others irregular and angular (see fig. 12).

Under the third cross-beam, that is 9 feet from the north end of the platform, where the original condition of the interior was best preserved,

the stone-and-earth layer was 3 feet deep, divided into two horizontal sections by a layer of broken birch branches 3 or 4 inches deep. The upper section, 1 foot deep, contained fairly uniform stones, the lower, 1 foot 6 inches deep, included some large boulders one of which must have weighed over 400 lb. (see fig. 13 and Pls. VIII and IX).

In the centre of the island the stone-and-earth layer was only 1 foot 4 inches deep, and, intermingled with water-worn stones which were mostly smaller than usual, 3 to 4 inches across, was a great deal of broken and decayed brushwood, although no definite layer survived such as occurred in the section previously described (see fig. 14). At this part of the structure considerable disturbance and compression had taken place (see p. 37), and I suspect that the brushwood mixed amongst the stones represented in part the remains of the missing layer of broken branches.

The final constituent in the mass upon which the platform rested was a much compressed layer of brushwood only 3 to 4 inches thick, well shown in the sections represented in figs. 12 and 13 and less definite in the centre of the island (fig. 14), owing probably to the exceptional sinking of the stone-and-earth packing in this region.

The layers upon which the platform was bedded rested in their turn upon an elaborate timber construction which I have called the "intermediate timbers."

(vi) *The Intermediate Timbers of the Island and their Support.*

The upper platform, the central feature of the island, was between 7 and 8 feet above the bed of the loch, and the builders were aware that a mass of stones and earth of that height, however closely packed it might be, could not long withstand the effects of the great pressure above and of the strong currents which in times of spate rushed along its sides. It was deemed necessary therefore to fortify the understructure against both of these forces, and this was done by including in it an elaborate and carefully planned arrangement of timbers, which underlay the whole area of the platform and extended just beyond its northern end.

The timbers were almost all natural birch trunks, with the branches lopped off close to the stem and with the bark still showing silvery upon many of them. Most ranged in diameter from 7 to 10 inches, but exceptionally large individuals measured 20 and 21 inches in diameter, and in one of these 118 annual rings were counted. That birch trees more than a century old and of such dimensions should have grown on the neighbouring hillsides is itself an astonishing fact, and it is equally noteworthy that the birch trunks were as straight and regular as the stems of pine trees.

The trunks were laid in parallel series or tiers, each consisting of three, or occasionally two, trunks placed one above the other, but separated from each other by thin packings of brushwood (Pl. VIII, 2, and Pl. IX). These

tiers were set at right angles to the flow of water outside the island, so that, like groins on a sea-beach, they would protect the material between them from silting out. Thus they lay in an east to west direction, parallel to the cross-beams of the upper platform, and with these beams they had an interesting relationship in position, which pointed to careful planning in the construction of the woodwork.

The tiers uncovered were spaced at a distance of 2 feet 8 inches from each other, except at the extreme north end of the island where the distance was slightly greater. The selection of so odd a spacing seemed curious, but its significance was apparent when it was recollected that the alternate cross-beams in the upper platform were 8 feet apart, so that at a space of 2 feet 8 inches every third tier of the intermediate timbers corresponded to a cross-beam of the upper platform. The greater distance between the tiers at the north end was probably devised to accomodate the odd distance of 9 feet which separated the first two alternate cross-beams.

The tiers were held in position by packed earth amongst which was a good deal of brushwood, but stones were smaller and fewer than in any of the other stone-and-earth layers. The presence of a few upright posts of birch associated with the tiers suggested that the sets of trunks were supported by uprights while the earth was packed between them. But it was noticeable that the large boulders referred to in the description of the lower part of the superincumbent layer (p. 36) were frequently placed directly above a tier as if to keep it in place.

Munro mentions a similar use of large stones in the crannog at Lochan Dughaill in Argyllshire, where "a row of biggish boulders followed the circumference of the mound to an extent of about 4 yards, as if intended to keep down and consolidate the underlying woodwork" (1893, p. 213).

Reference must be made to an irregular arrangement of the trunks of the intermediate timbers, which appeared in a section at the centre of the island (see fig. 14). The trunks were obviously displaced, and one may have been missing from one of the tiers shown in the figure. This displacement strengthens the inference drawn from the greater building up of the stone-and-earth superstructure of the platform at this part (see p. 27), and from the compressed layers beneath the upper platform itself—that here unusual sinking had taken place in the island, a result being that the platform itself lay 2 feet below its normal level.

(vii) *The Bedding of the Intermediate Timbers.*

Throughout the whole area, except at the extreme north end, the tiers or ranges of trunks and the earth packing which lay between and supported them rested upon a layer of brushwood several inches thick (from 4 to about 8 inches).

Such a layer, however, would not have prevented the tree-trunks, under the enormous pressure bearing upon them, from eventually sinking in the sandy layers of the bottom of the loch, and so throwing all the upper construction out of alignment. This danger was avoided by two devices.

In the first place the brushwood bed lay upon a strong foundation of large stones and earth, in which the stones predominated and earth made a relatively unimportant packing. There was no trace here of brushwood or vegetation (see figs. 13 and 14). This stone foundation covered an area which lay under, and corresponded roughly with, the area of the upper platform, but it did not extend to the outer works of the island, to be referred to later.

In the second place additional support was given to the upper structures by horizontal squared beams lying below the brushwood layer and resting upon the stones. They were placed lengthwise and crosswise, but, so far as I could judge, did not preserve any definite relation to the arrangements of the tiers above them, the cross-beams sometimes lying directly beneath a tier, sometimes appearing below the space between two tiers. The level at which these beams were found showed that they formed part of the basal timber structure described below.

(viii) *The Basal and Outlying Timbers, and their Foundation.*

Of the units composing the island the construction of the basal timber framework was the most difficult to elucidate. This was owing partly to the large area covered by it and to the fact that a great part of that area was buried deep at the base of the island, so that interpretation depended largely upon inferences drawn from the more exposed portions lying outside the island slopes. But the difficulty was more due to the actual disappearance of many of the timbers and to the displacement of others in these outlying positions through lapse of time and the wear and tear of the loch currents.

I have mentioned that our first survey showed two series of upright posts, the inner of which was associated with the upper platform, whereas the outer projected from the sand beyond the stone limits of the island. These suggested the presence of a second framework which had to be fixed in position, and accordingly excavations were made beyond the margin of the apparent island, along the west and east sides, at a very complicated and interesting part of the north side, and on the south side, particularly at the south-east corner to discover whether special methods of strengthening were employed at key points.

The basal and outlying timbers included a horizontal framework, shoring beams, and lattices of criss-crossing stems and branches, which are described below.

The Basal Framework.—The basal framework was a rectangular construction, of which squared beams, running parallel with the short and the long axes of the island, were found on the north and on the west sides a few feet beyond the outer margin of the stone-work, but always at a lower level. The usual length of the larger squared beams was 9 feet, but some were 12 feet long or even longer.

On the west side the original arrangement was best shown. Here there was no appearance of physical disturbance, for two beams about 12 and 17 feet long lay horizontally and in line, parallel with the edge of the upper platform. They supported, at distances of 12 feet apart, four beams at right angles, which also were horizontal, except one which was displaced, dipping outwards at 5° to the horizontal. Smaller timbers underlay the crossing places as an additional support. The woodwork here was not of the usual natural trunks, but although much decayed was generally of roughly squared timber, 8 inches across and 7 inches deep (see Pl. X, 1). It rested upon a brushwood layer composed of heather, bracken, and small birch branches. Erect posts placed in the angles of intersection for fixing the position of the cross-beams were found at two points.

On the east side the basal framework had been much disturbed; none of the beams remained horizontal, the cross-beams being tilted upwards towards the island at small angles of 5°, which suggested accident rather than design. The four cross-beams discovered lay at successive distances of approximately 6 feet, 6 feet, and 12 feet from each other. No trace of the longitudinal series was found in position on the east side, although it was probably represented by two beams which lay across the others as if they had rolled down from their original position. The beams here rested upon a brushwood layer which ended just beyond the outer end of the second cross-beam, that is it spread for a distance of some 11 feet beyond the margin of the stone sides of the island.

On the south side no trace of the basal framework was definitely identified, unless it was represented amongst the mass of timber present at the south-west corner (see fig. 15 and Pl. X, 2). But here an interesting trunk was found which showed the method of checking for the interlocking of beams and of notching for receiving a shoring strut (Pl. VII, 3). This was clearly a trunk from the upper platform which had rolled out of place, and was probably the outer cross-beam on the south side. On the north side two or three beams, all of squared timber of the cross series, remained in position, the line of the north end of the framework being clearly marked by the end of the terminal beam on the west side and the middle beam on the north which was held in position by an elaborate arrangement of timbers. Several additional dressed beams were observed, but few seemed to be in their original positions.

Reconstruction of Basal Framework.—I have said that the structure of the

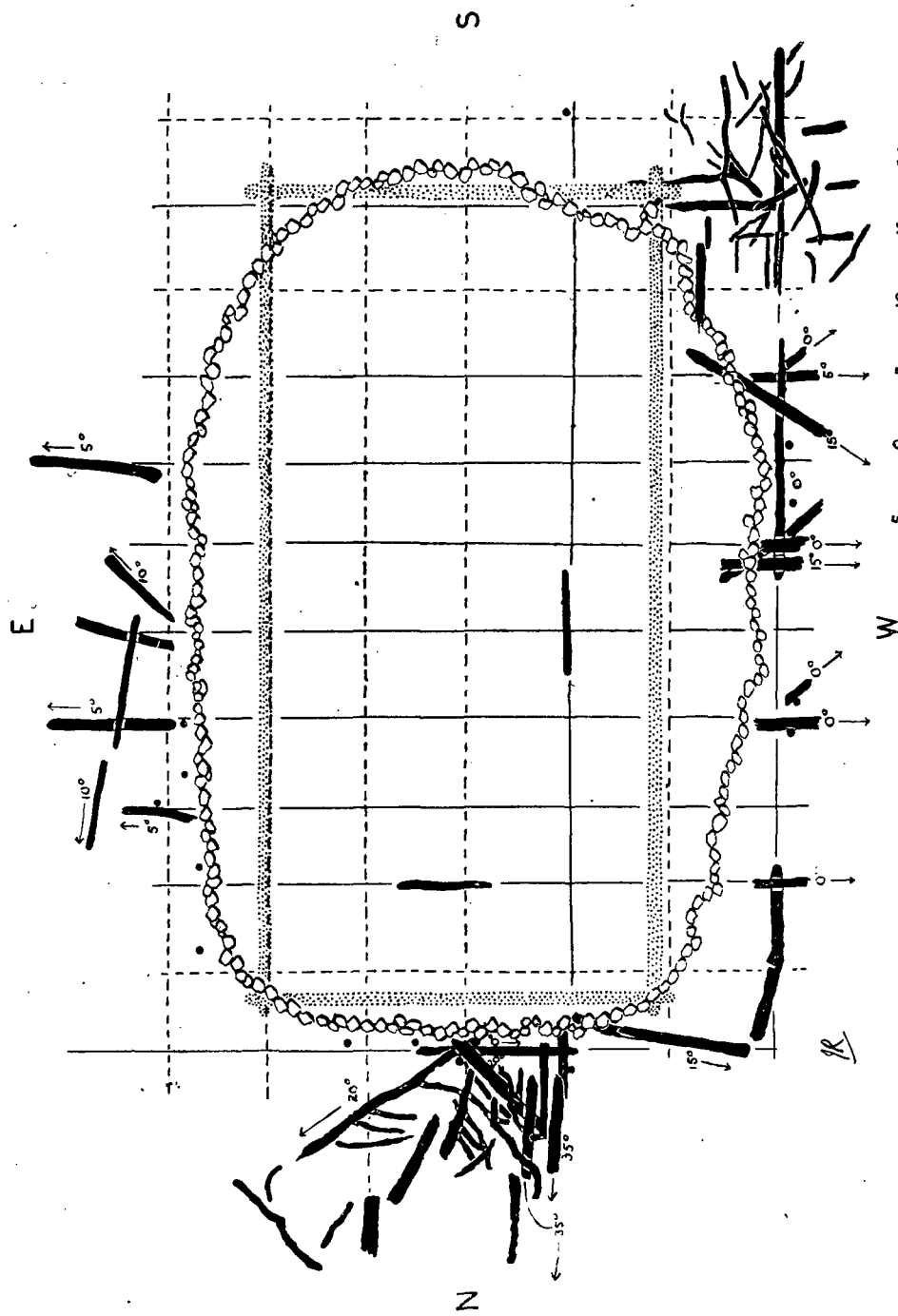


Fig. 15. Basal timber construction. The outer limit of the stone-work of the crannog and the position of the upper platform are indicated. Beams and posts revealed by excavation are shown in solid black. A reconstruction of the basal framework is indicated by unbroken lines, and where it is more doubtful, by broken lines.

original basal framework, because of its condition, has been more difficult to visualise than any other part of this remarkable island. Two sets of facts help towards a reconstruction, the most important being the position of such squared beams as survived or at any rate were discovered. A second indication is given by the positions of the upright posts, which, it may be safely assumed, were placed at intersections of beams to prevent their lateral movement. It must be remembered, however, that these positions, as fixed by measurement from base-lines during the preliminary survey, do not necessarily mark the exact angle of an intersection, for the survey, made before excavation was begun, could only mark the position of the projecting tip of a post. Since it was found later that in some cases pressure of the load of the island had moved a post from its upright position (see Pl. XII, 2), its bearing against the underground beams might well be a foot or even more from the point of its emergence at the surface.

In the case of the cross-beams, distances of 12 feet on the west, and 6 and 12 feet on the east, together with the fact that one beam had its fellow on the opposite side and that squared timbers were found at the same level within the island, suggested that the lines of the beams discovered should be continued from side to side. These definite lines are indicated by single unbroken lines in the reconstruction in fig. 15, and give a framework with six-foot spacing of cross-beams. The six-foot spacing has been continued (indicated by a broken line) where beams were not discovered, but it will be seen that, except in one case, the positions of upright posts tend to confirm the symmetrical arrangement.

As for the longitudinal beams their position must be regarded as uncertain. The evidence I have used in suggesting approximate positions, indicated by broken lines, in the reconstruction are: first, the definite position of the outer longitudinal series on the west side; second, the occurrence in the centre of the island of angled timber at the level of the basal framework lying parallel with and under the longitudinal beam of the upper platform second from the west side; third, the importance of a strongly fortified point at the centre of the north side (described below), which suggests that it was a key position of the framework; fourth, the indications given by the upright posts and by certain squared timbers at the north end, although few of these seemed to have remained exactly in their original positions. These indications point to the probability that the longitudinal timbers were spaced at distances of 7 feet, as were those of the upper platform, and accordingly they have been so shown, hypothetically, in the reconstruction. The basal framework covered an area approximately 65 feet in length and 42 feet in breadth.

The Level of the Basal Framework and its Foundation.—The basal platform as examined, judging by reference to the surveyed points, was not level, but tilted from east to west and slightly from north to south, the

levels being approximately 775 O.D. on the east, where it was highest, 774 O.D. on the north, 773 O.D. on the south, and 772 O.D. on the west. In the centre of the island the level of the timbers was also about 772 O.D.

But the levels bring out another point of interest in the construction of the island. The levels of the basal framework are *below* what was the original surface of the bed of the loch, according to the indications of the surveyed contours in the neighbourhood of the island. There are three possibilities—that the bed in the neighbourhood of the island had silted up since the island was built, or that the island had itself sunk into the bed of sand and vegetable debris, or that the site of the island was excavated by the builders before the foundation was laid.

That some silting had taken place is shown by the layers of sand without stones which covered the basal framework to a depth of up to 18 inches and lay upon the lower slopes of the island. This if anything was an advantage since it would protect the timbers from scouring by currents in the loch.

The danger of the subsidence of the timber foundations was foreseen by the builders, and they endeavoured to counter it in two ways. The basal framework on the outskirts of the island was bedded upon a layer of brushwood, much decayed, which rested upon the bed of the loch. But within the island, over an area upon which the pressure of the upper structures would be greatest, and which did not extend to the limits of the upper platform, at any rate on the north side, the basal timbers were laid upon a foundation of large closely packed stones. No brushwood was seen amongst these (see figs. 13 and 14).

It may be assumed that the foundation framework when laid was level. The presence, therefore, of a stone foundation over 1 foot in depth to carry beams which, outside the limits of the stone, rested upon the sand but for a thin layer of brushwood means either that the stones were laid in a natural hollow in the bed of the loch, or that a hollow was excavated for them. I have no doubt that the latter explanation is the correct one, and that since a levelling of the bed of the loch was bound to be necessary to accommodate a foundation 65 feet long by 42 feet broad, the requisite adjustments were made during that process.

The use of a stone foundation at Loch Treig bears some analogy to, though it is not identical with, the cases referred to by Keller (1866, p. 4) in which elevations of stones were made on the bottom of certain lakes, as at Nidau, as the bases of pile-dwellings.

Methods of Strengthening the Structures. Shoring Beams.—In addition to the horizontal beams set at right angles to each other on the west side there were two which were inclined upwards within the surface of the slope of the island at angles of about 15° with the horizontal, and one at 10° on the east side. These were probably shoring timbers bearing against the

posts of the upper platform, or directly against the beams of the platform itself, though the connection no longer existed. The decay and disappearance of the outer details of the woodwork make it difficult to imagine the original construction, but there were several loose timbers 7 to 8 feet long lying up and down the slope and several more scattered on the bed of the loch in the neighbourhood of the island. These had been rather superficial structures which had been the first to be washed out as the island deteriorated, and I suspect that they represented the remains of a system of shoring, designed to support the posts fixing the upper platform or even the outer beams of that platform itself as is indicated by the deep notch in the cross-beam shown in Pl. VII, 3.

Timber Lattices.—A second strengthening method, of a type which has been found in the groundwork of many crannogs, was the reinforcement of the outlying foundations by an irregular lattice-work of birch branches. These were of all sorts of lengths and diameters, sometimes straight, more often crooked, and they were laid down without any regular arrangement except that they crossed each other to form lattices. The purpose of these was to prevent erosion of the soil by the action of currents at critical points of the basal structure.

In the case of our island they were concentrated in two areas: along the south side, which was scoured by the flow from Loch Treig in spate, and particularly at the south-west corner where at all times there must have been danger of erosion from the Treig outflow (fig. 15 and Pl. X, 2). The second reinforced area lay on the north side. This was in the lee of the island, and it was protected not only by a lattice of birch branches and trunks (fig. 15 and Pl. XI), but its woodwork was reinforced by an elaborate arrangement of bearing-posts, referred to in the following paragraph.

A Key-point and its Construction.—It is remarkable that the most carefully strengthened part of the woodwork outside the island should have been at the north end, on the lee side of the island, where it could not have been subjected to direct currents from Loch Treig such as beat upon the southern and western sides. And since it is hardly conceivable that the eddies and suction of a tail current would demand such reinforcements, their purpose must be looked for in another direction.

This purpose was to form a series of barriers which would resist the outward pressure of the mass of the island and so prevent its subsidence. Why such precautions should have been taken only at the north side seems to have been due partly to the special facilities offered by the height of the bed of the loch at this part, but mainly to the fact that here was the place of access to the island with the consequent wear and tear and pressure of traffic and the risk of collapse of the island structures.

The key structure in the system designed to resist the outward thrust of the island was erected at the centre of the north side. Here the central

cross-beam of the outer framework, corresponding to the basal framework on the west side but at a higher level, was held down by two heavy timbers set at a wide angle to each other and overlapping above the horizontal beam. One was a dressed and squared beam, the other a natural birch trunk, and the outer ends of both dipped into the silt at an angle of 20°, so that they were firmly embedded. Additional strength was given to the structure by carefully designed wedging: a stout upright post in the angle took the main backward pressure, and a set of small wedges of squared oak fitting in checks in the sides of the timbers, and of uprights of natural birch fixed them in position. The construction of this key-point gave so

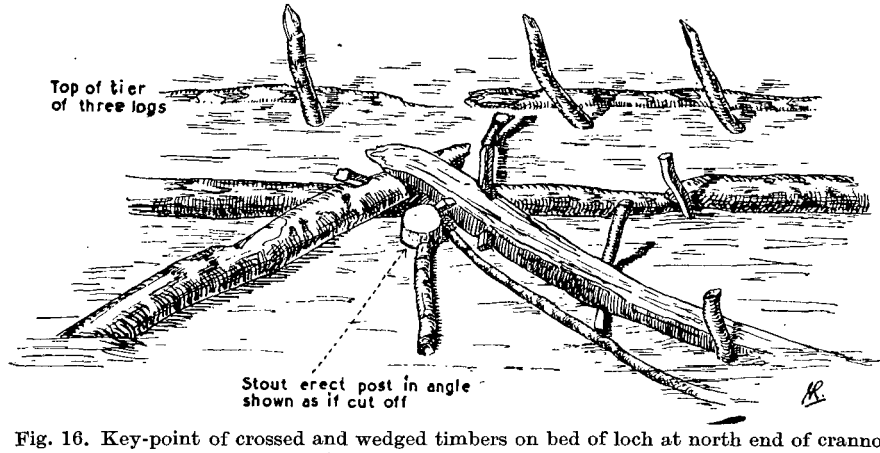


Fig. 16. Key-point of crossed and wedged timbers on bed of loch at north end of crannog (*cf.* Pl. XI, 2, and Pl. XII, 1).

excellent an idea of the wedging technique of the island builders that I have shown it in Pl. XI, 2 and Pl. XII, 1, and somewhat more diagrammatically in fig. 16.

Beyond this key-point the slightly sloping bed of the loch was fortified by a lattice of birch trunks and branches, amongst which were occasional squared timbers which may have been displaced members of the regular basal framework (see fig. 15).

Between the key-point and the island the construction was more significant. The key-point itself lay less than 2 feet below the level of the outer beam of the upper platform, beneath which the bed of the loch was at a depth of nearly 5 feet. So that a steep slope descending 3 feet in the intervening space of 4 feet appears to have been excavated to take the main outward thrust of the island mass.

Further to break the force of this thrust a range of three superimposed birch trunks was placed midway down the slope. This was similar to the tiers of the intermediate timbers within the island of which it might be regarded as a continuation, except that it had on its outer side a series

of upright posts of birch trunks supporting it against the outward push. The intensity of the pressure and the need for special precautions in this area is shown by the angles at which these posts have been forced outward from the perpendicular (see Pl. XII, 2). A firm packing of stones and earth embedded and held in place all these structures.

The combined effect of these devices for checking the lateral thrust of the island will be appreciated by a glance at fig. 17. But additional support was given by the introduction of heavy baulks of dressed

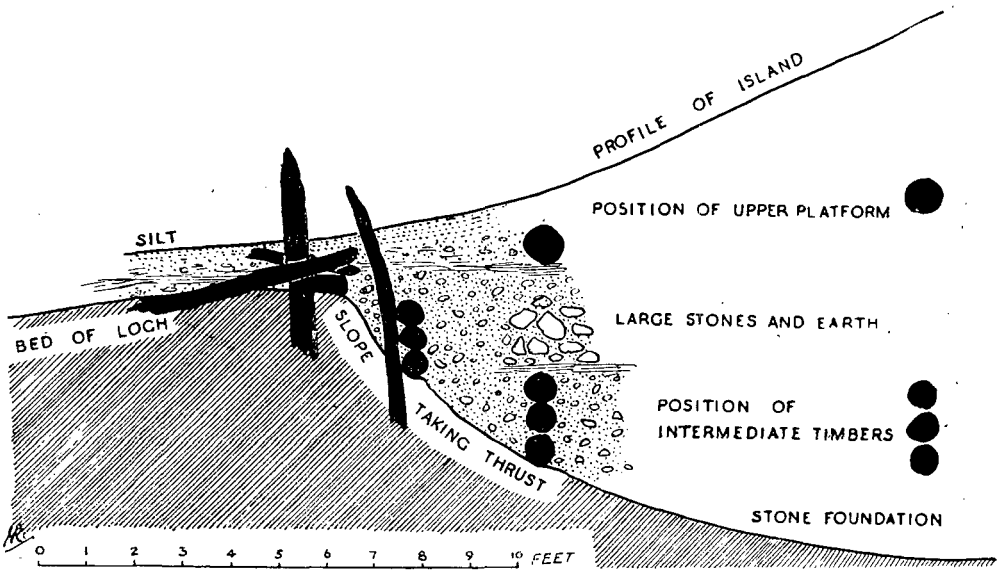


Fig. 17. Vertical section (N–S) at boundary of crannog on north side. showing devices thought to be for withstanding the lateral thrust of the mass of the crannog.

timber, two of which, rising at an angle of 15°, are shown in Pl. XIII, 1. They resembled the timbers of the regular basal framework, of which they probably formed part.

(ix) *The Stone Covering or Breakwater.*

As the general description and the illustrations of the undisturbed island show, the internal structures were concealed beneath a great accumulation of stones which covered and protected all the woodwork except the outer extensions of the basal framework, which were buried in sand and silt. The stones, roughly graded in increasing size from the top to the bottom of the slope, had at first probably assumed the regular and natural angle of such material deposited in air at random, that is an angle of about 35°, for there was no sign of an attempt at building, in the

sense in which a dry-stone dyke is built. But the influences of time and the currents had destroyed the original symmetry and produced the various less marked slopes which I have described in discussing the sectional drawings (p. 22).

Whether the grading in size of the stones was deliberate or was due to the sorting action of the water cannot now be decided, although I suspect that it may have been part of the design. But at any rate it cannot be doubted that the stone covering as a whole was a deliberate and well-conceived plan for protecting the essential timber structures of the island, and for acting as a breakwater which would take the force of the currents, and save not only the timbers, but the earth, stone, and brushwood components which supported them, from gradual dispersal and destruction. That the structure of the island had survived its immersion through many centuries was a tribute to the efficiency of the stone breakwater.

(x) *The Landing-place.*

Many of the Scottish crannogs were connected with the shore by a wooden gangway or by stepping-stones, both probably submerged, so that the way of entry was a secret of the inhabitants and their friends. The same idea is suggested in Diarmad's reference to the stepping-stones at Loch Treig, but as I have pointed out these had another purpose and in any case did not lead to the island.

In view, however, of the frequency with which gangways have been found at other crannogs I had trenches excavated along and across the ridge to the north of the island, the only place where a gangway to the shore could have been constructed. No trace was found of any arrangement of timber which could have been the supporting framework of a gangway, and the few branches of birch lying horizontally in the silt had the casual appearance of drift-wood.

Since there was apparently no gangway from the shore, access to the island must have been solely by boat, and that implies a landing-place and some means of reaching the top of the island without climbing its stony sides, for these would have suffered under constant traffic. We were fortunate in finding this landing-place.

At the north end of the island, at the bottom of the stone slope and about one-third of the distance along the upper platform from the western corner, were two heavy beams embedded in the bed of the loch at a relatively high angle. At other parts of the island beams were found set at angles to the horizontal, but these angles never exceeded 15°, except in the case of the heavy bearing-beams at the key-point, where the angle was 20°. The beams now to be described projected from the bed of the loch, sloping upwards towards the island at an angle of 35°. It is probably significant that the angle of repose assumed by the sides of a heap of gravel "in the dry" is

30° to 40° (Dean, 1935, p. 210). For a structure submerged in water the angle of stability would be less (26° to 34°), but the stone face of the island above water-level must originally have been at about 35°. The sloping beams, the upper formerly exposed parts of which had decayed away, would therefore if produced have run up parallel with the exposed slope of the island. Their relationship to the slope of the submerged part of the north side is shown in a photograph (Pl. XIII, 2) taken during an early stage in the excavations.

The beams themselves were stout and squared, 6 feet long by 9 inches deep and 6 inches broad, set parallel to each other at a distance of 1 foot, with the narrow surface upwards. Their appearance suggested the side-bars of a ladder, and this was their true function, for close examination showed the presence of shaped dook holes for receiving the steps. Three of these may be seen on the inner side of the remote side-bar in the photograph (Pl. XIII, 2) at distances of about 1 foot apart, the middle one being difficult to distinguish because it is plugged by the wood of the broken step. It will be seen that the steps were shaped and placed in position so that the "tread" of the step was the broadest part and was horizontal.

It may be taken therefore that the island was landed on by means of a fixed ladder, which lay parallel to the exposed stone slope and the head of which was probably connected with the dwelling surface by a short horizontal gangway (see Reconstruction, Pl. XIX).

A relic of such an arrangement is suggested by Munro's description of the crannog at Lochan Dughaill, in Argyllshire, where "leading outwards from this [a supposed doorway] were six or seven round beams laid parallel to this [the door-step] and kept in position by a couple of beams running along their ends . . . an arrangement which undoubtedly served as a causeway of some kind leading to the water's-edge" (1893, p. 216). Of course this horizontal causeway would not lead to the "water's-edge," because that would mean that the dwelling surface was at water-level, but it led to the edge of the raised dwelling surface, and probably there connected with a gangway and ladder.

The boat which conveyed the inhabitants must have been moored in the neighbourhood of the landing-place, and it is likely that the post shown close to the ladder in the photograph (Pl. XIII, 2) was the mooring-post. The upper part had the appearance of having been worn as by a rope, but this appearance may have been due to differential weathering of the part exposed in air as contrasted with the submerged portion.

8. The Building of the Lake-dwelling.

From the foregoing description it will be seen that the Loch Treig lake-dwelling was a definitely planned structure of an elaborate kind, very

different from the true pile-dwellings of Europe. Keller suggested that the Scottish and Irish crannogs bore "a great analogy with the fascine dwellings of Switzerland" (1866, p. 6), but the succession of distinctive layers is much more elaborate than the simple brushwood body of a fascine island, and indeed it is more elaborate than any of the continental types.

Artificial islands of the type of Loch Treig must be regarded as highly specialised structures peculiar to our area, combining some of the features of continental types with new developments which contributed to the stability and the permanence of these habitations. Unfortunately it is impossible to say how far the island I have described is typical of the Scottish or Irish crannogs, for few in either country have been described in detail, and from the Scottish sites most thoroughly described, those in the south of Scotland investigated by Dr Robert Munro and others, there are differences in detail as marked as the features common to both.

From his knowledge of Scottish crannogs Dr Munro laid down very precisely the successive stages in the building of such erections (1882, p. 262), but his interpretation in some respects does not agree with the appearances at Loch Treig. I shall, therefore, indicate here the methods by which the builders appear to have overcome the difficulties which faced them in this particular case, although it may be that all of these conclusions are not applicable to other artificial islands, where conditions may have been different.

The succession of the layers of the Loch Treig island, at the part where it was best preserved, may be summarised as follows:—

	Feet.	Inches.
Stone and earth superstructure, containing successive hearths or settlement levels	3	3
Brushwood layer	..	3
UPPER PLATFORM	1	6
Heather and bracken layer	..	3
Small stones and earth	..	9
Layers of broken birch branches	..	3
Large stones and earth	1	9
Brushwood layer	..	2
INTERMEDIATE TIMBERS and *brushwood*	2	..
Brushwood layer	..	6
BASAL TIMBERS	..	8
Foundation of large stones and a little earth [1]	1	..
Bed of loch	..	..
Total depth of structures	12	4

The first business of the island builders was to make a foundation upon which the basal timbers might rest. This involved the general levelling

[1] Beyond the area of this foundation the basal timbers lay upon a layer of brushwood which rested upon the bed of the loch.

or smoothing of the bottom of the loch and the scooping out of a hollow in the central area of the island to receive the foundation layer of stones, so that the *upper surface* of the stone layer coincided with the bed of the loch, over which the basal timbers were continued. Since the foundations are at a level varying from 772 to 775 O.D., and the original level of the loch was probably at about 781 feet O.D., 2 feet below the modern level, the foundations would appear to have been laid in a depth of from 6 to 9 feet of water.

The first great problem, then, is—how did the builders work at such a depth? I must confess that I think it impossible that they could have done so, and from this and other difficulties which shall be referred to in due course, I have been forced to the conclusion that they did not build the island in relatively deep water, but employed a device to enable them to work, as engineers express it, "in the dry."

In order to overcome the difficulty of explaining a foundation laid in several feet of water, Dr Munro stated (1882, p. 262) that "immediately over the chosen site a circular raft of trunks of trees, laid above branches and brushwood, was formed, and above it additional layers of logs, together with stones, gravel, etc., were heaped up till the whole mass grounded." Applied to the Treig crannog the suggestion involves difficulties almost as great as working at a depth.

The basal "raft" in the case of Loch Treig was some 65 feet long by 42 feet broad. It was formed mainly of squared beams at distances not less than 6 feet apart, a very open framework, rather loosely fitted together. If such a raft was constructed over the site chosen, as Dr Munro says, then the men who built it were standing in water from 6 to 9 feet in depth or were working from boats. How did they keep this enormous mass of timber from drifting in the currents of Eadarloch as they worked, or how, even if they were successful in piling up logs and stones upon the open framework, could they have induced it to sink, when the moment it was submerged the logs above would have floated, unless they too were held down by more stones and earth? And could the open framework have borne the enormous weight of the masses above it without disrupting? When it is recalled that in our island the stone and earth covering did not extend to the outer timbers of the basal framework, it is clear that so great weight concentrated upon the centre must have crashed through the loosely-knit frame.

At each stage of the construction we are faced with the same difficulty. Can we imagine that logs of the intermediate timbers were piled in tiers three on top of each other, at regular distances, and the whole packed with earth and small stones *under* water as deep as a man? The intermediate timbers had a volume of about 1180 cubic feet, and taking the weight of a cubic foot of water at 62·5 lb. and the weight of the wood at 42 lb. a cubic

foot, the buoyancy of the wood in water would be 20·5 lb. a cubic foot; in other words, it would have required about $10\frac{3}{4}$ tons of stones and earth to keep the intermediate timbers down, and this weight would have to be placed above and not between the tiers.

So also with the upper platform: it would have offered a somewhat easier problem because it was much nearer the surface of the loch when the island was completed. Nevertheless to build in position and sink in, say, 2 feet of water a structure weighing considerably over 13 tons, which required more than 6 tons of stones and earth to put it under, which was not built with very great rigidity and the superficial floor of which consisted of loose logs, would have been a serious engineering feat.

I have said nothing about the layers of brushwood which underlay each of the timber constructions, but if the timbers were sunk as Dr Munro suggested, then also layers of brushwood covering an area of more than 30 by 50 feet must have been arranged on the water and sunk before or perhaps, in the case of the upper platform, with the timbers.

Another suggestion which has been made is that the timber structures were assembled on or near the shore and floated to their proper position, where they were then sunk. The suggestion does not meet the difficulty about sinking the loosely constructed frameworks, and does not affect the intermediate timbers, which were not joined together, and must have been placed singly. But it involves a further difficulty—namely the launching of, for example, the completed upper platform, a framework 57 feet long by 42 feet broad which was not rigidly constructed, and which must have weighed about 13 tons in air; and this, considering the structure of the platform, would present an insurmountable problem.

I am driven to the conclusion that this lake-dwelling at any rate was not formed by the sinking of already prepared wooden rafts, after the manner suggested by Dr Munro, but that it was built "in the dry," and the method I conceive to have been as follows.

The level of the water in Eadarloch was determined in the first place by the level of the outflow at River Treig, and that was between 780 and 781 feet above sea-level (O.D.), and in the second place by the amount of water flowing into Eadarloch from Loch Treig. In normal conditions the Loch Treig flow accounted for a depth of 2 or 3 feet over the sand-bar separating Eadarloch from River Treig, but in very dry summers this flow almost ceased, so that the level of Eadarloch was reduced to the level of the sand-bar, about 781 feet (O.D.).

My suggestion is that the island builders deliberately lowered the level of Eadarloch by cutting the sand-bar, so that the loch drained into River Treig sufficiently to expose or almost to expose the mound on which the island was constructed. Presumably they would choose the most favourable conditions for such an engineering feat, that is a very dry summer, and in

such conditions a lowering of the sand-bar by some six or seven feet would have enabled them to build the island "in the dry."

Subsequently they would have reconstructed the sand-bar, causing the water to rise to the required level, as beavers form obstructions to dam up the water about their huts. But our island builders were skilled engineers, and the evidence suggests that they did not complete the island and then in one effort subsequently complete the dam, but that, instead, the reconstruction of the dam proceeded step by step with the construction of the island, so that the water rose as the island rose stage by stage from its foundations.

The advantages of such a gradual restoration of the water-level are obvious. Hundreds of tons of stones, soil, and timber had to be conveyed from the shore and placed in position, and the raising of the waters almost to the level at which work was proceeding would enable logs to be floated and stones and soil to be transported close to the places where they were to be laid. The means by which the transportation was carried out are referred to in the subsequent section dealing with the objects found in the loch.

The evidences which support the suggestion of the concurrent raising of the waters and the island are, first, the presence of large boulders resting upon the tiers of the intermediate timbers. The great difficulty of transporting these boulders from the shore indicates that they had some very special purpose, namely, to prevent the trunks from floating. But they would not have been necessary had the whole weighty superstructure of the island been in position before the water was raised to its ultimate level; on the other hand, they would have been necessary if the water-level was raised as the work proceeded, for in that case the intermediate timbers would have had to be held in position while the superstructures were being floated into position above them. The second evidence is circumstantial: it is difficult to conceive how some of the enormous tree-trunks which were used, some of them 20 and 21 inches in diameter, could have been placed in position unless they were floated close to their site, or how the trunks of the upper platform, most of which would have taken six men to carry them, could have been borne some 6 or 7 feet up the sides of a rubble-constructed island without damaging its surface. Such difficulties would not arise if the water-level was raised as the building proceeded.

The Use of Brushwood in the Structure.

The use of brushwood in the construction of crannogs deserves more notice than it has received. Apart from its dominant use in the fascine lake-dwellings of Europe, where it formed the entire foundation of the dwelling platform, its rôle has generally been regarded as of very restricted

significance, namely, to prevent the sinking of the foundations in the layers of peat upon which most crannogs were built. Thus at Glastonbury Lake Village layers of brushwood up to 2 feet in thickness lay beneath the hut-mounds and upon the peat, and the clay floors were placed upon the brushwood. Dr Munro's summary of the structure of Scottish crannogs mentions brushwood only as intervening between the basal timbers and "an unfathomable quagmire" (1882, p. 262), although his descriptions of several suggest that brushwood layers occurred elsewhere than under the foundations. For example, at Kilbirnie in Ayrshire a six-inch much compressed layer lay between 18 inches to 2 feet of gravel and the underlying construction of timber (1882, p. 64), and at Lochlee a thin layer of brushwood lay between the superficial log pavement and the massive system of tree-trunks which supported it (1882, p. 97).

The investigation of the Loch Treig island, however, brings new meaning to the latter observations, for it shows that brushwood layers played quite an important part in the technique of the island builders. In our island there were seven distinct layers of vegetable matter used in construction, that is omitting the organic deposits which indicated different settlement levels in the stone-and-earth superstructure and which had no constructional significance (see table of layers, p. 48 and fig. 13). An analysis of the positions of these layers with reference to the materials below and above them will help to indicate their purpose. Three layers of brushwood rested upon timber constructions, two upon stone-and-earth material, and one upon the sand deposits of the loch. On the other hand, there lay upon the brushwood layers three timber constructions and three deposits of stones and earth. The seventh layer formed a packing between the tree-trunks of the intermediate timbers and thus had timbers both above and below it. This summary makes it clear that the brushwood was not associated with any particular layer either above it or below it; its purpose, therefore, must have been of some general nature.

Indeed a glance at the table referred to above shows that, as a general rule, wherever two layers of different sorts of material followed one another, they were separated by brushwood. The only exception was the basal foundation of large stones, below which no brushwood lay and upon which the basal timbers rested directly.

One purpose of the brushwood undoubtedly was to distribute the pressure of the structures resting upon it, so that they would not sink irregularly into the underlying layer and destroy the level, for example where the basal timbers were separated from the sand of the loch bottom, or in the case of other crannogs where the substratum was soft peat. But that purpose would scarcely apply to a timber framework resting upon packed stones and earth. A more general and probably the primary purpose of the brushwood layers was to form a soft bed into which the

structures above, whether timber or stones and earth, sank slightly, so that they were retained in exact position and prevented from side-slipping. The brushwood acted as a sort of primitive mortar locking the various structures of the island in place.

This would explain why no brushwood was found below the large and angular stones which formed the foundation of the island, or between them and the basal timbers; for the stones became fixed in position by embedding themselves in the sand, and the basal timbers which rested upon these large stones similarly could be entrenched and locked amongst the angular faces.

It was noticeable that various grades of this brushwood "mortar" were used for different purposes. Where the carefully designed and constructed upper platform followed above a layer of small stones and earth there intervened a fine textured layer of heather and bracken, and the same materials were inserted between the trunks in each of the intermediate tiers. The rougher timbers of the intermediate tiers, and the stone-and-earth layer above them, rested upon rougher brushwood, mainly bundles of stout heather stems (Pl. XVI, 3). And where two successive layers of stones and earth occurred, the upper with smaller and the lower with larger stones, the intervening brushwood was formed of birch branches about $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, with little admixture of finer material.

The Question of a Defensive Stockade.

It is characteristic of the lake-dwellings of the British Isles that they are surrounded by upright piles. E. Dumbleton, quoted by Keller (1866, p. 660) refers to a "crannoge, or stockaded island, in Llangorse Lake, near Brecon (South Wales)." Keller himself summarises the information relating to the piles of Irish and Scottish crannogs thus: "They are surrounded by a stockade of piles, driven into the bed of the lake, so as to enclose a circle or an oval. . . . These piles are usually in a single row, but sometimes the rows are double or even treble. Occasionally the piles are boards not round stems" (1866, p. 6). Munro, stating the position at a later date, says of Scottish lake-dwellings: "All these accounts, as well as the more recent notices of crannogs, are characterised by two prominent structural features, viz. (1) upright piles in the form of one or more circles; and (2) the remains of flat beams containing large square-cut holes at their extremities" (1882, p. 260).

There has been a strong tendency to look upon the ring or rings of piles as stockades in the military sense, defence works behind which the inhabitants could shelter from enemies. Wakeman expressed that point of view very definitely: "the Irish crannog, great or small, was simply an island, either altogether or in part artificial, strongly staked with piles

of oak, pine, yew, alder, or other timber, encompassed by rows of palisading (the bases of which usually remain), behind which the occupiers of the hold might defend themselves with advantage against assailants" (1873, p. 305). And the placing of emphasis upon the stockade led to the view, held for example by Dr Stuart, who first published comprehensive descriptions of Scottish crannogs in the *Proceedings of the Society of Antiquaries of Scotland* (1868, p. 114), that the purpose of the mortised beams was to keep the piles which formed the stockade firmly in position. It was Munro, following upon his excavations at Buston, near Kilmaurs in Ayrshire, who, although he still wrote of the uprights being "linked together by horizontal beams having square-cut holes" (1882, p. 107), realised that "the main object of the whole of this elaborate structural system was to give stability to the island, afford fixed points on its surface, and prevent the superincumbent pressure of whatever buildings may have been erected over it from causing the general mass to bulge outwards" (1882, p. 198).

Professor Childe accurately sums up the position as it has been surmised hitherto: "The pavement was surrounded by two or three rings of stout oak piles. The piles were joined together by oak beams, mortised into one another and into the piles. The rings of piles, thus elaborately clamped together, may have helped to give stability to the island and to diminish erosion by waves, but they served primarily as the basis for a stockade surrounding the central platform" (1935, p. 211).

The Loch Treig island throws some light on the purpose of piles. It was surrounded by the customary two rows of stakes, of which the inner at any rate was double. Instead, however, of forming circles or ovals, the rows formed a rectangle, following the outlines of the wooden frameworks. The primary purpose of these uprights is clear; they were placed in the angles of intersection of the beams of the frameworks to fix the framework and prevent lateral movement, and the presence of a double row, the stakes of which were 1–2 feet apart, was due to the fact that the piles were placed in diagonally opposite angles. But had they a second, defensive purpose? To have reached the surface of the water, *without projecting above it*, the stakes of the outer series would have measured 5 to 9 feet high from the ground; even a slight pressure upon the upper end of such a stake, a birch stem 5 or 6 inches in diameter, would, owing to the leverage, have tended to break or dislodge it, and thus would destroy its first purpose of anchoring the basal framework. The outer series of stakes, therefore, can scarcely have been intended to form a defensive stockade.

The inner series, rising from the middle of the stone slopes, would have reached the surface of the water had they projected 2 feet from the stones, and their ends would have been *level with the surface of the island* had they projected about 4 feet 6 inches from the stones. It is not

likely that they formed any sort of breastwork, for this would have required additional length and such a breastwork would have been 5 or 6 feet away from the edge of the inhabited surface. But they may have formed a sort of palisade, projecting 2 or 3 feet from the water at a distance of 3 feet from the stone slope, which would have prevented the running of a boat against the side of the island (see Reconstruction, Pl. XIX).

If the island had any wooden breastwork protecting the dwellings, as some of the more elaborate crannogs of south-western Scotland seem to have had, it must have been erected around the margin of the levelled surface; no trace of such a structure was found.

9. Relics found at the Lake-dwelling.

Although careful watch was kept during the excavations, the collection of relics turned out to be a meagre one. Special search was made on the island and in its vicinity for a kitchen-midden, but no trace of any accumulation of food or other remains was found, and I surmise that food refuse was cast into the waters and was swept away by the currents. The scarcity of relics suggests that the inhabitants of the lake-dwelling had few possessions, and the nature of such as were found also points to poverty and absence of material resources. Nevertheless some are of special interest.

I have grouped the objects roughly according to whether they were wooden objects associated with the construction of the lake-dwelling, were metal tools and weapons, were for domestic use, or were personal relics.

(a) *Wooden Objects associated with the Construction of the Lake-dwelling.*

Dowel-pins and Pegs.—Several dowel-pins and pegs were found, generally about the level of the upper platform. They varied considerably in size and character. The most primitive was a much-weathered length of natural birch branch still with bark upon it, cut to make a rather irregular pin, 8 inches long by $1\frac{1}{2}$ inch in diameter (Pl. XIV, 1, *a*). Almost equally simple was a stout pin merely cut from a natural branch, unshaped except for the flat ends and the cutting of the branches roughly level with the surface (Pl. XIV, 1, *b*). It was a uniform cylinder 9 inches long by about 2 inches in diameter, and although it was not found in position its diameter agrees with that of some of the larger burnt-out holes at the interlocking square checks in the upper platform.

Of more skilful construction was the surviving portion of a dowel-pin extracted, with some difficulty, from a hole penetrating the centre of a square check in a longitudinal beam of the upper platform. It had been

abraded flush with the surfaces of the beam so that its length of $5\frac{1}{2}$ inches represents the distance from the outer surface of the trunk to the inner face of the check. The pin was of oak uniformly thick, eight-sided, with four larger faces, and four smaller faces which alternated with them, and it measured about $1\frac{1}{4}$ inch from face to face (Pl. XIV, 1 *d*). A pin of similar eight-sided design which had not been used, but the point of which showed signs of charring, was 9 inches long and about 1 inch thick. The head end was cut at a slant and an appearance of tapering at the lower end was probably due to partial destruction by fire and decay (Pl. XIV, 1, *c*). The constructional value of this eight-sided type of dowel-pin has already been referred to (p. 32).

It is not surprising that a submerged framework should have been fixed together by wooden pins, for they would withstand decay better than iron; but it is remarkable that throughout the island so little trace of iron nails was found. This may have been due to corrosion, but it permits the interpretation that the builders were more adept at wooden construction, and that their habitation, as well as the submerged frameworks, was almost entirely put together of wood.

A purpose different from that of the dowel-pins was served by a stout peg of oak, with a crudely shaped head which projected beyond the line of the stem at one side only. It was 12 inches long and $1\frac{1}{2}$ by $1\frac{1}{4}$ inch thick, bevelled at the tip to form a chisel-shaped end (Pl. XIV, 1, *e*). The peg was not found in position, but it may be surmised from its shape and its presence near the upper platform that it was used to peg down the underlying brushwood layer while the platform was being laid.

A peg of similar size and shape was found at the crannog at Kilnamaddo, in Co. Fermanagh, Ireland, and is said to have been used "probably to secure the lower logs in position" (Wood-Martin, 1886, p. 192, and pl. xlvi, 7), but at Loch Treig the dowel-pins were driven flush with the surface of the timbers they pierced, and the "headed pin" was obviously devised for some other purpose, namely, holding down brushwood.

Oak Club.—An interesting relic, which gives a clue to the method of the builders, was a heavy oak club of squared timber (fig. 18). Lozenge-shaped in section, $26\frac{3}{4}$ inches long, $2\frac{1}{2}$ inches deep by $2\frac{1}{4}$ wide, edge to edge, at the handle, the club gradually increased in size to the head, which at its deepest was $3\frac{3}{4}$ inches. The lower surface of the head curved upwards like the prow of a boat. At the striking surface, indicated by hollows due to abrasion, the edge had been trimmed away to give a flat surface 1 inch across. The size of this surface and of the abraded hollows upon it makes it certain that the club was used for driving home the dowel-pins used in the construction of the framework, and force was given to the blow by the lozenge shape of the club which resulted in the greatest depth of oak being directly behind the striking surface.

In general appearance the club bears some resemblance to a wooden object described as a "wooden spoon-like implement" found at the crannog at Barhapple Loch in Wigtownshire, except that the latter has a shaped handle; its size unfortunately is not indicated (Munro, 1885, p. 121, fig. 42).

Boat-like Relics.—Two somewhat puzzling objects of oak, which have been regarded as boats, were found in the vicinity of the island. Both had been washed from the deposits in which they had been preserved so that their original positions are unknown, but their association with the inhabitants of the island is a matter of reasonable conjecture.

The first was found washed up on the western shore of the Eadarloch by workmen engaged in the early operations there. Not realising the

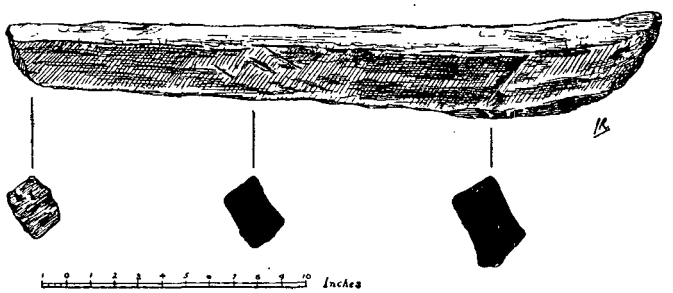


Fig. 18. Club of oak used for driving wooden dowel-pins into their sockets; three cross-sections are shown.

interest of their discovery, they placed stones in it for ballast and set it adrift on the waters. Shortly afterwards it was found again, grounded upon the eastern shore, by Mr Duncan Robertson, Head Keeper at Corrour, who appreciating its interest took it to the proprietor, Sir John Stirling-Maxwell, by whom it was presented to the West Highland Museum in Fort William. The accompanying photographs (Pl. XV, 1, 2) were made there by Dr A. E. Ritchie and myself in April 1941, thanks to the permission and assistance of the Curator, Miss MacAndrew. The vessel has been "dug-out" of a solid trunk of oak, the marks of the adze being still visible on some parts of it. It is canoe-shaped, except that the ends are square instead of pointed and that the upper surface is continued at the ends in solid, horizontal, lug-like projections 3 inches deep at one end, 2 inches at the other. The sides, which terminate in a sharp edge, are slightly bulging, the bottom flat, rounding gently into the sides, and the square ends slope slightly inwards to the bottom. The thickness of the wood varies from $1\frac{3}{4}$ to 2 inches at the sides, and is slightly thicker at the bottom. The dimensions of this problematical object are: length over all, 5 feet 5 inches; depth from edge to under-surface of bottom, $9\frac{3}{4}$ inches; breadth varies from $9\frac{3}{4}$ to $10\frac{1}{4}$ inches; the length of the cavity is 4 feet 5 inches, its depth $6\frac{1}{4}$ inches; other measurements are given in Pl. XVI, 1, 2.

The likelihood is that this vessel was associated with the island; its workmanship is primitive, and at the north end of the island near the place of access and beside the brushwood layer below the upper platform were found many oak-chips cut by an adze (Pl. XIV, 2, *a* and *b*), which must have been derived from this or a similar object, for no other oak dressed in the same manner was found in the structure of the island itself. Its purpose is not so easy to fathom. It is too small to have been used as a boat by an adult, but the suggestion has been made that it may have been a boy's canoe. Another suggestion is that it may have been used as a trough which contained food, and which was carried by means of the lugs at the end. In this connection its resemblance to the wooden dug-out trough found at the crannog at Lochlee is striking (see Munro, 1882, fig. 44, p. 93), but that vessel was less than 2 feet long, and its shallow cavity had a length of only about 1 foot 3 inches. Similarity in design, where the sizes are so different, need not indicate similar purposes. Indeed the design is repeated in an undoubted canoe "hollowed out of a single piece of oak" found at Toome Bar in Ireland, but that canoe was much larger than the Treig vessel—"the length fifteen feet, with projecting beaks at prow and stern; it is twenty inches wide, fourteen inches deep, and is flat-bottomed." The illustration shows that it had two thwarts (Wood-Martin, 1886, p. 49, pl. iv, 3).

My suggestion is that the vessel may have been a cargo vessel made for floating materials from the shore, such as the vast quantities of earth and small stones required in the construction of the crannog and for its upkeep afterwards. In the early stages of construction the builders would be able to wade from the shore, and in the later stages when the water-level was artificially raised, as I have suggested, they would have to swim, but in either case the lugs at the end of the vessel would serve conveniently for pulling and pushing. Moreover, the bottom of the boat has the appearance of having been smoothed by friction, so that it may often have been loaded up and dragged over soil or shingle before it reached the water. In this respect it has a close analogue in the Irish dug-out, trough-shaped "portable canoe," 8 to 12 feet long, square at both ends, round in the bottom, and having projecting handles at either extremity, "apparently for the convenience of carrying it from lake to lake" (Wood-Martin, 1886, p. 47). But its construction would equally well serve the purpose I have suggested of carrying goods either over land or afloat.

The second problematical wooden object is also of dressed oak, a long, stout flat "board," 15 feet 9 inches long by 2 feet 4 inches across. Both surfaces are carefully shaped. The under-surface, in cross-section, is like a horizontal parenthesis, ⌣, thicker at the margins and curved gracefully to the centre where it projects as a ridge or keel carved from the solid wood and running almost the full length of the board. The keel is $2\frac{1}{2}$

inches broad, and projects $1\frac{3}{4}$ inch from the surface (Pl. XV, 3 and 5). On this surface the wood is bevelled away at each end and towards the sides. The upper surface is flat and smooth, except for a slightly raised rim and two curious low bosses, carefully carved from the solid wood of the board, which lie near the sides and almost opposite each other, about half-way between the ends. The best preserved of these is 4 or 5 inches in diameter and about an inch high (Pl. XV, 4). The ends of the board are rounded.

This board was discovered by Mr B. N. Peach after the second lowering of the water in Eadarloch. It was embedded in silt washed out from Eadarloch towards Loch Treig, and Mr Peach tells me that it must have been washed out of the shore near the island as it was found in a delta formed by the discharge from the Laggan tunnel since 1938.

It is probably the remains of a single-piece canoe, and if that be so the low bosses on the upper surface would have been rests for the feet of a rower. And indeed similar rests have been described in an Irish canoe found in a crannog at Lough Mourne—"the most remarkable feature of this canoe consists of four prominences with abrupt edges (also left in the solid) for the feet of the rowers" (Munro, 1890, p. 389, and fig. 125).

There is another and perhaps remote possibility. One of the problems of the builders must have been to move the enormous tree-trunks (two were 20 and 21 inches in diameter) from the hillside where they were felled to the loch shore where they could be floated to the island. The shaped board may have been a skid used for bringing these heavy trunks to the water. Its length corresponds to the standard length of the half-timbers (15–16 feet) used in the island; the ridge or keel and the shaping of the bottom surface with the bevelled edges and fore and aft ends would help to keep the skid on its course and reduce friction; the low bosses on the upper surface would act as checks to prevent sideways movement of the trunk upon it, as also would the slight rim at the margins.

(b) *Metal Tools and Weapon.*

Although the woodwork shows clear evidence of the use of a variety of iron tools, remarkably few of these were found during the excavations, and all were fragmentary and much corroded.

A fragment of the tang and slightly curved blade of a knife is $4\frac{1}{2}$ inches long, with blade $\frac{5}{8}$ inch broad; a circular collar lies between tang and blade (Pl. XVII, 1, *b*). Mr A. J. H. Edwards and Mr R. K. B. Stevenson report that it is unlikely to be earlier than the sixteenth or seventeenth century.

An indeterminate iron fragment, 2 inches long, with a square collar at its centre, was found above the lower hearth in the north-west corner

of the island (Pl. XVII, 1, *f*); and three irregular hand-forged nails $3\frac{1}{2}$, 3, and $2\frac{1}{2}$ inches long were found near the same place (Pl. XVII, 1, *c*, *d* and *e*).

The only iron weapon recovered was part of a sword, identified by Mr A. J. H. Edwards as a backsword, $9\frac{1}{4}$ inches long, with blade $1\frac{1}{2}$ inch broad at the hilt tapering to less than an inch, and tang $1\frac{1}{2}$ inch long, found amongst charcoal and ash in the middle of the island about 1 foot from the surface (Pl. XVII, 1, *a*). It seems likely that this weapon was destroyed by fire, for the rust with which it was encased contained fragments of charcoal which suggest that it had been sheathed in a wooden scabbard. Mr Edwards regards this sword as also belonging to the sixteenth-seventeenth century period.

At one time the smelting of iron took place in the neighbourhood of the island, for the site of a primitive "bloomery" or iron furnace lies near the River Treig at Fersit, about a mile away, and fragments of iron slag still witness to the smelting probably of bog iron ore.

A much folded sheet of thin bronze, $2\frac{1}{2}$ inches deep and about 4 inches broad, was perforated by rectangular holes which probably served as rivet holes (Pl. XVII, 1, *g*). When a paper model of the bronze was folded over according to the indication of folding in the bronze sheet itself, it formed a pointed triangular sheath in which two of the rectangular rivet holes coincided. Its purpose is unknown.

(c) *Objects of Domestic Use.*

Since no kitchen-midden was discovered, little can be said about the food used by the islanders, but on the hearths were remains of calcined bones which include fragments of the limb-bones of a small sheep and a single fragment of a molar tooth of a young ox.

Earthenware.—The only other definite domestic relics were two fragments of earthenware. The oldest, found above the lower hearth in the north-west corner of the island, is the base of a jar, roughly glazed outside and without glaze inside. The bottom is 3 inches in diameter and $\frac{3}{8}$ inch deep, and its lower edge has been rudely trimmed with a knife before firing. Its appearance, according to Mr Edwards and Mr Stevenson, suggests work of sixteenth-seventeenth century date.

The three other fragments, found at the surface, piece together to form part of the neck of a well-glazed, buff-coloured, parallel-sided jug of stoneware. The outside is decorated with horizontal bands, and between two of these, at 2 inches from the rim of the jar, ran a floral design. This is clearly a late importation, eighteenth century or later, and probably had nothing to do with the inhabitants of the island.

Wooden Cones.—Finally, and with doubt, I place amongst the domestic relics some problematical wooden objects. They are cone-shaped, tapering

to a point, and vary in size from $10\frac{3}{4}$ inches long by $3\frac{1}{2}$ inches broad at the head to $3\frac{3}{4}$ inches long and $\frac{3}{4}$ inch broad. Two of these points are solid (Pl. XVII, 2, *e* and *i*); the others are deeply hollowed, and one has a long slot cut in its wall (Pl. XVII, 2, *a–d* and *f–h*). The nine specimens were lying horizontally end to end in a row, west to east, at a depth of 2 feet below the surface of the island, at the level of the deeper north-west hearth, and not far from it. They had obviously been collected and deliberately placed in position. The objects themselves are probably weathered-out "knots" from pine-trees, and a suggestion has been made that they were collected as a resinous "kindling" for the fire. But the points of some are worn by friction, in some the broad ends also are smoothed, and the slot along the side of another (Pl. XVII, 2, *a*) is clearly artificial, while none shows any mark of burning.

For what purpose they were used I cannot imagine, unless the hollow ones may have been stuck in the ground to carry a torch. The only relics to which they bear any resemblance are the tines of deer antlers found at the crannog of Drumgay, Co. Fermanagh, said to have been used in the making of fishing-nets (Wood-Martin, 1886, p. 80, figs. 48–52), but probably the resemblance is only superficial.

Birch-bark Rolls.—Several strips of birch-bark twisted into loose rolls were found upon the brushwood layer under the upper platform (Pl. XIV, 2, *c–e*).

(d) *Personal Relics.*

Most varied and interesting of all the meagre discoveries of artefacts were the personal relics. They include objects of metal, leather, and woven fabric.

Silver Coin.—A single coin was found by Mr B. N. Peach in the south-east corner of the island within 9 inches of the humus surface and 6 inches or less below the grass-roots of the surface layer—that is, it was above the stone-covered surface. It was a silver coin of the reign of Mary Queen of Scots, bearing on one side a St Andrew's cross and crown, three roses, and the letters MR, and on the reverse the words MARIA REGINA SCOTORUM. Unfortunately the date was undecipherable and after Mr Peach had made several rubbings the surfaces began to break up so that the design has disappeared. Mr R. Kerr informs me that the above description does not correspond exactly with that of any known coin of Queen Mary, the nearest being the half-bawbee of the period from 1542 to 1558.

The presence of such a coin, though its superficial position shows that it had nothing to do with the builders of the island, points to the continued use of the island in the latter half of the sixteenth century or later, and confirms the evidence of the Gaelic poet referred to in an earlier section.

Two bronze articles were found at greater depth in the island.

Bronze Brooch.—The first is a simple circular brooch of which the pin is missing. It is composed of a crude amalgam of copper and brass, which suggests that the makers were not highly skilled metallurgists, and its construction is equally primitive. For it has been formed from a very thin strip of bronze, curved to form a circle, and joined by an overlap on both sides of the narrow bar on which the pin was hinged. The bar itself is, therefore, formed of two thicknesses of metal and the crudeness of the welding is shown by the presence of the flux, which has the appearance of some sort of resin.

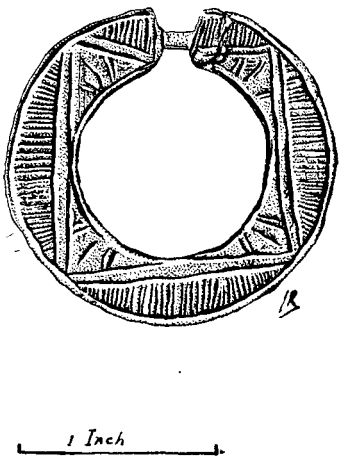


Fig. 19. Bronze brooch.

The brooch is $1\frac{9}{16}$ inch in diameter, and the width of its metal circle $\frac{5}{16}$ inch. It is ornamented by an incised design composed of a series of straight lines contained within two circular incisions which follow the outer and inner edge of the circle (fig. 19). The essence of this simple and crudely wrought design is a double-lined square, the sides of which touch the inner circle, and the corners of which rest at the outer edge. Outside the square the spaces are filled with close-set lines; inside, each angle contains an arrangement of a single median stroke flanked on each side by a double line. All the lines have been cut in the bronze by a sharp graving tool, and, although the workmanship is irregular, the design as a whole is striking enough in its simple repetition.

The brooch resembles the elaborate plaid brooches of the sixteenth century, but its light structure precludes the idea that it could have been used to fasten a heavy garment, and Mr T. D. Kendrick suggests that it may be a cheap variety made for cottage folk as opposed to the more flashy and expensive examples. Mr A. J. H. Edwards considers that the design indicates that the brooch is of late type, belonging to the eighteenth century, and Mr Kendrick concurs in this determination.

The brooch was found at the extreme north end of the island, in the brushwood layer which lay below the outer cross-beam of the upper platform. Since this is not far below the surface of the slope, it may be that it had slipped into that position from a higher level.

Bronze Tweezer-like Article.—The second personal relic in bronze is a small article resembling tweezers, formed of two independent bars of bronze each $2\frac{1}{2}$ inches long, $\frac{5}{32}$ inch across, and $\frac{1}{16}$ inch thick. The top ends of the bars have been hammered slightly wider than the shafts, and there the arms are connected by a bronze rivet, the intermediate portion of which holds them $\frac{3}{16}$ inch apart (Pl. XVII, 1, *h*).

Tweezers have been found in Roman settlements, at Glastonbury, and elsewhere, but these are made of a single piece of metal and spring is obtained by bending the top end in a wide hoop. Whether the Treig relic was used as a pair of tweezers or in some sort of mounting for leather-work cannot be decided. It was found just above the hearthstone in the north-east corner of the island, 2 feet below the surface and not far above the level of the upper platform. It therefore belongs to an early stage of habitation.

Woollen Fabric.—A single fragment of cloth, unique in weave, was found at the north end of the island just above the level of the upper platform. It is only about 4 inches long in the direction of the warp by $2\frac{1}{2}$ inches broad, and although it is turned in at one end and seems to form a fringe at the other, this appearance is due merely to the decay of the weft threads so that the warp has become loose. Mrs Crowfoot, whose report follows, suggests that it may have been part of a narrow belt, since the fragment appears to be complete from selvage to selvage (Pl. XVIII, 2).

Microscopic examination of the material of this fabric was made with the object of learning something of the character of the wool which composed it. The fabric itself in its outer parts is a rusty brown, but where the surface has been unexposed it is black. The wool has been dyed, but the presence and distribution of pigment granules within the wool fibres showed that the fleece had been originally brown or "moorit." Further, the wool was fine in quality, the fibres being 0·020–0·024 mm. in diameter, and in the fabric the fibres were very short, like those in the "shoddy" cloth of modern days; but this may have been due to the breaking of the fibres during their long submergence, under the strain of the twist of spinning.

The surface character of the fibres shows that the wool was good for spinning, for the cuticular scales are rather close set and have irregular slightly toothed edges (fig. 20), so that the fibres would adhere well to one another.

I have compared this wool microscopically with that of black-face and Cheviot sheep and of the most primitive of domestic breeds known at the present day—the Soay sheep (see fig. 20). The natural brown colour of the Treig wool, its fineness and its scale pattern show it to be very different from that of the modern breeds and most closely related to the wool of the Soay sheep. These sheep survived in modern times only on one of the islands of the St Kilda group, but there can be little doubt that they represent one of the earliest breeds brought to Scotland by the prehistoric peoples, and that they may be the direct descendants of Studer's sheep, *Ovis aries studeri*, of the Swiss lake-dwellings, as J. G. Millais suggested in his *Mammals of Great Britain*, and of the large-horned sheep whose remains have been found in Roman camps and Romano-

British villages, as stated by General Pitt Rivers, Professor T. H. Bryce, and Professor Cossar Ewart (see Curle, 1911, vol. ii. p. 373). Unfortunately it is impossible to say how long this ancient race of sheep continued to exist in remote parts of the mainland of Scotland as a pure breed or as an admixture with races subsequently imported, although the small short-tailed fine-woolled sheep described in 1578 by Bishop John Lesley as inhabiting the vale of Tweed may have belonged to the latter category (see Ritchie, 1914, p. 103).

Unable to find a cloth of similar texture amongst the small collection of ancient Scottish fabrics in the National Museum of Antiquities of

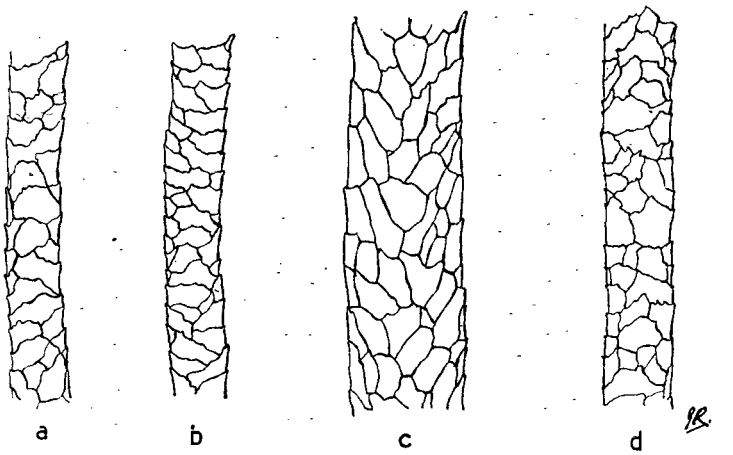


Fig. 20. Wool fibres of some typical breeds of domestic sheep. *a*, from woollen fabric found in crannog; *b*, from primitive Soay breed; *c*, from Scottish black-face; *d*, from Cheviot. Magnified 300 diameters.

Scotland, I sent it, through the kind intervention of Mr T. D. Kendrick of the British Museum, to Mrs Grace M. Crowfoot, whose knowledge of woollen fabrics and expert analysis of the St Cuthbert and other textiles has already proved of great value. Mrs Crowfoot, by examination of the crannog fragment itself and by experiments attempting to duplicate the weave of the fabric, in which she succeeded, has been enabled to draw up an interesting description of this unique sample. Her report is here included:—

NOTES UPON THE WOOLLEN FABRIC FROM THE CRANNOG AT LOCH TREIG.

By Grace M. Crowfoot.

The preserved portion of this fabric is about four inches long, folded over above, with threads cut at both ends, and is therefore incomplete. The original width was probably as seen at present, about two and a half inches, because the selvage is well preserved on the left-hand side and a very

small portion also appears to be present on the right. These selvages are not specially woven as such, but the loops of the weft can be seen still intact and binding the outermost warps. From the presence of these selvages the distinction between warp and weft is certain.

Warp and Weft.—Two qualities of warp can be seen, one coarse and one fine, the weft being finer than the finest warp. The weft is certainly S spun, or in English usage, left spun, as also is the fine warp; the twists are difficult to see on the coarse warp because it is very lightly spun, but I think it is also left spun. There are fourteen blocks of eight fine warps, and one coarse warp is set up at the beginning of the weave and one at the end, while two coarse warps are set between each block of fine warps; the fine warps equal 112, the coarse 28, total 140 warps; the wefts are probably about 40 to the inch.

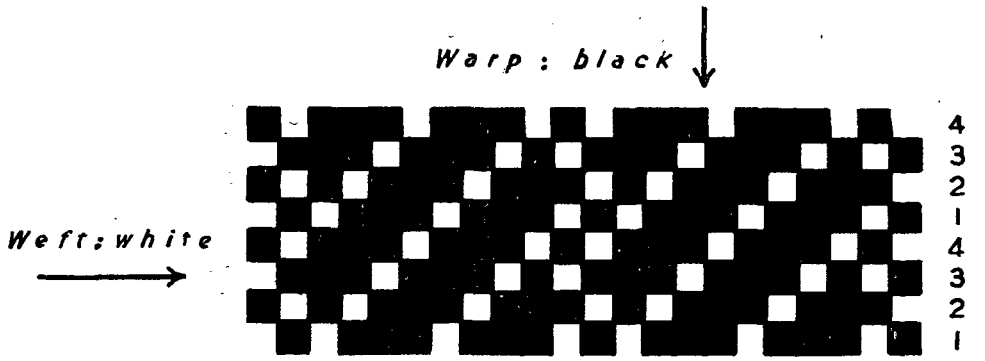


Fig. 21. Diagram of the construction of the woollen fabric, showing two repeats of the weave; the warps, perpendicular, are shown in black, the weft, horizontal, in white. The pattern repeats on four throws of weft, as indicated by the numerals at the side.

Weave.—In order to discover how the fabric was woven I made some trial weaves from material spun from Shetland wool, and to judge from these samples the weave is a four heddle diagonal twill. On the face, the weft passes under three and over one of the warps. The twill is seen to be divided by sunk lines or rills running in the direction of the warp. These are caused by the presence of the thick warps between which the weft passes in a plain or "tabby" weave, and except for these "tabby" lines the twill goes straight across the fabric. The fine warps are close pressed and beaten up hard, which no doubt contributes to the ridged effect; on the face the weft is little seen. The back gives an impression of plain weave, but the twill, fine and squeezed up, can be distinguished in places between the more prominent thick warps in plain weave.

At first I thought the weave must be a three heddle twill, in which the back simulates plain weave; but the samples in four heddle weave are much closer in character to the actual fabric. The diagram (fig. 21) gives two repeats of the weave, the warps being shown in black, the wefts in white; the pattern repeats on four throws of weft.

The Loom, and Comparable Fabrics.—The twills of Northern origin, belonging to the Iron Age, are believed to have been woven on the warp weighted loom; some rare earlier pieces may have been finger woven. The Crannog textile might have been woven by finger weave, or by means

of four rod heddles, or three rod heddles and a shedro on the warp weighted, or some other primitive loom. I know of no material exactly comparable to throw light on this point.

Diagonals were popular in the Roman period, and many varieties, herring-bone, diamond in three and four heddle weaves, etc., appear in the time of the Vikings (see A. Geijer, Birke III),[1] but none of these have the peculiar lines or rills seen on the Crannog fabric. The only ancient instances of such rills that I know occur among the textiles of Palmyra (1st–3rd cent. A.D.)—two fine diagonal weaves, "serges cannelés,"[2] which according to M. Pfister may be of Syrian origin, but these serges are very different in design and texture. The Crannog textile appears to me to be at present unique in character.

Leather Shoes.—Portions of at least three leather shoes were found, all in one place, beyond the north end of the island, and close to the ladder which gave access to the dwelling space (Pl. XVIII, 1). The shoes were found about 18 inches from the surface, higher than the timber lattice of the outworks and lower than the level of the upper platform. It seems likely that at different times they had accidentally dropped into the water from the feet of people climbing the steps to the island, and had sunk beyond rescue.

I have submitted the fragments to the expert examination of Mr J. McIntyre of Bishop Auckland, and his report upon them is as follows:—

"The two shoes—a right and left though not a pair—are made of leather, and although much perished have sufficient remaining to determine their type and method of manufacture. They are both of the same order: short-vamped tie-bar shoes without heels, which have been made by a skilled shoemaker.

"The upper consists of two parts: the front or vamp is made of one thickness of soft leather, and the back of two thicknesses of firm leather, the nature of which prevented collapse in wear. The sole is made of one piece and is strengthened internally with extra thicknesses at forepart and heel, but not as a continuous inner-sole. The seams which close the upper and secure the latter to the sole are sewn with leather thongs, and all seams are reinforced with strips of leather, in places double and sometimes folded. The thong passes through holes in the seams which have been made with an awl, and in parts of the sole-seam this thong penetrates seven thicknesses of leather, namely two inner-soles, outer-sole, single strip, folded strip and upper. The shoe would be made inside out and turned when finished, the parts being held in a wooden clamp during

[1] A. Geijer, "Die Textilfunde aus den Gräbern," *Birka*, vol. iii. (K. Vitterhets, Historie och Antikvitets Akademien), 1938.

[2] R. Pfister, *Textiles de Palmyre*, 1934. See L. 17, p. 35: "la trame passe en serge 2 dessus 2 dessous, cependant chaque fois après le sixième fil de chaîne il y a un point de taffetas selon schéma fig. 5, il se forme ainsi des rainures dans le sens de la chaîne" (pl. ix, *d*). *Cf.* also *Nouveaux Textiles de Palmyre*, 1937, L. 43, pl. vi, *a*.

stitching. It may be noted, however, that the edge of the vamp of the left shoe has been stitched with needle and thread, doubtless to prevent stretching.

"The shoe is held on the foot by means of bars on either side of the upper, perforated for laces which are tied over instep.

"Slight differences between the shoes may be noted. The left shoe is about size 1, by shape of sole probably that of a small woman, has one inner-sole at forepart with grain of leather uppermost, and has tie-bars as separate pieces secured internally to sole-seam and emerging through slots in the upper. The right shoe is about size 13, fitting a young person of ten or eleven years, has a broader shaped sole, with inner-sole at forepart of two thicknesses having flesh of leather uppermost, and has tie-bars cut in piece with the vamp."

In addition to the two shoes described there were several fragmentary pieces, all found at the same place, which Mr McIntyre describes thus:

"(1) Back of upper with heel counter.
I think this may belong to the left-foot shoe. The counter or stiffener appears to have been lightly attached to the inner thickness; the stitch-holes about ½ inch apart round upper margin.

(2) The thin strip belongs to the above shoe and was sewn round the edge of vamp.

(3) The remaining pieces form the back of a third shoe, and show interesting folding of inner piece to effect the purpose of a stiffener."

On one point I am inclined to differ from Mr McIntyre's interpretation of the structure of the shoes. The narrow strips of single or folded leather which he looks upon as having been inserted to reinforce the seams, where sole and upper are stitched together with leather thongs, appear to me to be the remains of pieces which originally covered the whole sole. The sole part of these pieces has been worn away. My reasons for so thinking are these: (1) the inserted strips are not of regular size around a shoe, but at some parts are broader than at others as if the sole had worn away not quite evenly at the margins; (2) the shoes are well worn, suggesting that the original sole surface, where wear is hardest, is unlikely to have remained intact—on my interpretation two sole pieces have been worn away, leaving only those parts where they were held together by stitching, and which could not be worn away without the disintegration of the whole shoe; on Mr McIntyre's interpretation no sole piece has been worn away; and (3) if the shoemaker considered it necessary to have heel-upper composed of two pieces, in one shoe with a stiffener in addition, it seems unlikely that he would make the sole, which had to bear much more wear and tear, of one complete piece only, even if it was strengthened internally by additional discontinuous pieces.

In the accompanying figure (fig. 22) I have shown in composite diagrammatic form the structure of the shoes as if they were cut lengthwise through the centre to show the leather layers. The thick continuous lines indicate the leather pieces as they survive at present, when two thicknesses appear to be inserted as strengtheners in the seam where upper and sole meet (Mr McIntyre's interpretation). The thick broken lines indicate the supposed position and relationship of former sole pieces which have been worn away (my interpretation).

Mr McIntyre concludes: "The outstanding thing about the shoes is the stitching with thong and the reinforcing of seams with strips of leather

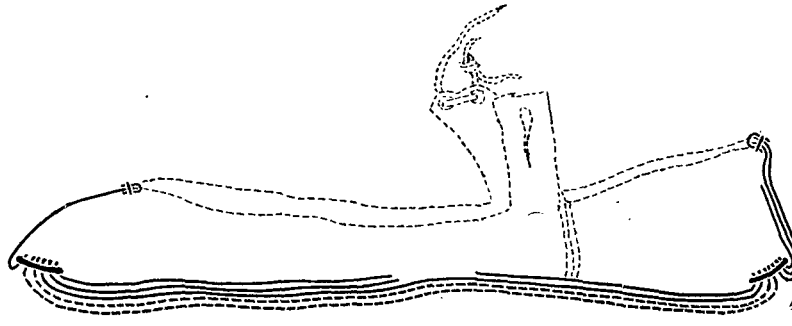


Fig. 22. Leather shoe, showing leather layers as in median longitudinal section. Half natural size.

—thus producing a very strong seam as the remains of the Treig shoes so convincingly show.

"Shoes of the Romano-British period are usually either hobnailed shoes (in which case the nails hold the shoes together) or lighter indoor shoes with upper and sole made in one piece. Whereas the uppers are invariably closed with needle and thread in Romano-British shoes of first- and second-century dates, the small collection which Birley found in the well of the Theodosian principia at Chesterholme, Vindolana, had the uppers of some shoes closed with leather thongs, though not in quite the same manner as in the Treig crannog shoes. There was also in the Vindolana lot an odd shoe with short vamp covering the toes only, as in the Treig shoes, a type not seen by the writer in earlier collections.

"The Treig shoes, therefore, seem to me made with a later and improved adaptation of the thong-sewn seam, used in this case both for closing uppers and securing them to soles.

"The short vamp, tie-bar fastening, typical Romano-British shape of sole of left shoe, and the adoption of improvement in seam lead me to the rather vague conclusion that the shoes belong to some period later than, say, A.D. 500, though how much later I do not know."

10. Age and Occupation of the Lake-dwelling.

The later stages of the occupation of a site such as has been described are often easier to define than the earlier, and for this reason I shall discuss first the period of the final occupation of the Treig crannog and thereafter examine the evidence of its earlier history.

Final Occupation.—The contemporary references to the island and its use, which occur in the verses of Domhnall MacFhionnaigh, who lived about 1600, and the tradition of Keppoch's Council Island, point to the likelihood that regular occupation of the lake-dwelling had ceased by the early years of the seventeenth century, and that it had degenerated to a place of occasional resort for feasting or more serious discussions.

The period of its final occupation is perhaps indicated by the discovery, almost at the surface, of a silver coin or medalet of Mary Queen of Scots, the date of which is probably about 1542–58. This relic, although found at a different part of the island, was on or above the level of the highest hearth; it may have been dropped by one of the occasional visitors, but it is reasonable enough to suppose that it may have belonged to the last period of regular habitation, which may therefore be regarded as the latter half of the sixteenth century.

It has been stated that evidence exists of the occupation of Scottish crannogs during that century. In a footnote on his work on Irish Lake Dwellings, Wood-Martin writes: "In the year 1508 it is of [*sic* on] record that a Scottish monastery granted a lease of a crannog, one of the covenants being that the occupant was to place a certain quantity of stones outside the piling in each year, to protect the structure from the destructive influence of the waters of the lake" (1886, p. 31). Unfortunately Wood-Martin does not state in what part of Scotland the monastery was, nor does he give his authority for the statement. But the statement, with its inferences that in the early sixteenth century Scottish crannogs were occupied and that their continued use was reckoned upon, is so important that it was desirable to discover its origin. With the help of Mr William Angus and Mr Paton it was traced to a lease, dated 24th July 1508, by the abbot and convent of Cupar in Angus, granting to Sir Alexander Turnbull for life their chaplaincy of St Margaret's Isle in the Loch of Forfar. The lease ordains amongst other things that the lessee is bound "to see to the building and repair of the chapel, and houses," and "to make plantation of trees within and without, and to make works of stone for the defence and safety of the loch and its trees, lest the trees be overthrown by the force and violence of the water" (Trans. in Stuart, 1868, pp. 143, 144).

Now St Margaret's Isle or Inch was a fairly large island with remains of at least two stone buildings; it was not an artificial island as had been supposed, but was a natural elevation strengthened by piles and stones

(Munro, 1882, p. 20). It was a protected island rather than an artificial crannog; the lease calls it simply "*insula*," and there is no evidence that it possessed any of the elaborate wooden frameworks characteristic of the crannogs.

The lease of 1508, therefore, affords no proof that crannogs were in active use and occupation in the sixteenth century. Indeed Dr Stuart (1868, p. 147), after referring to the habitation of four crannogs in the county of Antrim in the beginning of the seventeenth century, says: "No evidence of late occupation of this kind appears in regard to any of our known Scottish examples." And Munro, referring to the Celtic area beyond the limits of the Scottish portion of the kingdom of Strathclyde, admits, "I may at once state that there are no data derived from an examination of its artificial islands, nor any relics of their occupiers, which can give even an approximate notion of their chronological range" (1882, p. 287).

The evidence, then, is of more than ordinary interest which suggests that the Treig crannog was occupied during the sixteenth century and fell out of use as a place of regular habitation towards the end of that century or the beginning of the following century.

Earlier Occupation.—We must now ask whether there is any evidence to indicate either the period when the crannog was constructed or the stretch of time during which it was occupied. There are three lines of inquiry available—information derived (*a*) from the relics found, (*b*) from the architecture of the crannog itself, and (*c*) from the timber of which it was built.

(a) *The Evidence of the Relics.*—Apart from the silver coin of Mary Queen of Scots, found within 9 inches of the modern surface, the only other relic from the upper layers was the fragment of an iron blade which Mr A. J. H. Edwards identifies as part of a backsword, probably of the sixteenth or seventeenth century. This was found about 1 foot below the humus surface amongst ashes in the middle of the island, where the greatest amount of subsidence had taken place. Its position indicated that it belonged to the late occupation of the island and its date agrees with the suggestion that this must probably have been in the late sixteenth or early seventeenth century.

Beneath one of the hearths which lay on the exposed stone-covered surface at the north-west corner of the island and which belonged to the late occupation lay another at a depth of about 1 foot, and this overlay another a few inches deeper, while the deepest hearth was 2 feet below the stone surface. The hearths mark successive periods of occupation, and since they also indicate the gradual subsidence of the original structure (see p. 28) they may be taken to indicate in all a considerable lapse of time. Now just above the lowest hearth were found several relics: (*a*) fragment

of earthenware jar, (*b*) iron fragment with square collar, (*c*) bronze tweezer-like object, (*d*) fragment of woollen fabric.

Unfortunately none of these relics is definitive as regards period: (*b*) and (*c*) are undatable; the earthenware may well belong, according to Mr R. B. K. Stevenson, to the seventeenth century, but the fabric, the weave of which appears to be unique, seems to belong to a considerably earlier period; in neither case is there any certainty.

The bronze brooch is of eighteenth-century date, but so slight an object may have worked its way from the surface through the foot and a half of loose stones to the brushwood layer where it was found. And of the shoes all that can be said is that they seem to be an improvement of the Romano-British type and therefore later than A.D. 500, but that there exists no shoe of exactly similar fabrication with which they could be correlated.

The relics are not very helpful, but such as they are they point in a general and vague way to occupation, even of the lower inhabited levels, about the sixteenth and seventeenth centuries, although the woollen fabric is probably much earlier.

(b) *The Evidence from the Architecture of the Crannog.*—From what has already been said it is clear that the Treig crannog belongs to that peculiar type, of mixed timber and stone construction, which has been found only in Scotland and Ireland. Irish crannogs, and the lake-village of Glastonbury, were inhabited as early as the second or third century B.C., and some of the former may have been built still earlier, but the Scottish lake-dwellings which have been excavated up to the present, mainly in the south-west, belong to the early centuries of our era.

Although it bears a family resemblance to these Scottish structures, the Treig crannog is distinctive. Thus Munro states that prominent structural features characteristic of the Scottish crannogs which had been described up to the period of his account were "(1) upright piles in the form of one or more circles; and (2) the remains of flat beams containing large square-cut holes at their extremities" (1882, p. 260). Now the Treig crannog presented neither of those features. It had none of the scattered piles which sometimes formed prominent outworks of the southern crannogs, and even if the semblance of a palisade was created by the projection above water of the posts holding the upper platform in position, the outline was rectangular and not circular. Indeed the rectangular arrangement was a basic feature of the design of the Treig crannog, and this clearly differentiates it from the southern type, with its circular mounds and radiating timbers.

The working of the timbers is equally distinctive, for square-cut holes in flat beams were absent at Treig, and the timbers were held together by the interlocking of square-cut half-checks (see Pl. VII, 2, 3). Even the

character of the timbers is different, for except in the basal framework squared beams were not found, and the structure was of natural tree-trunks, a few of which had been slightly dressed.

Finally, the mechanical construction, while in a general way agreeing in the succession of its layers with that of other Scottish crannogs, develops several distinctive features. These are apparent in the open framework of the basal timbers and of the upper platform, and particularly in the arrangement of the intermediate timbers, in regularly spaced ranges set at right angles to the current of the loch, in place of the usual succession of layers of beams or trunks of trees set so as to cross or intersect each other. Moreover, the frameworks, instead of being held in position by piles penetrating the timbers, were fixed by posts placed in opposite angles at their intersections. The method of gaining access to the crannog by a ladder projecting from the bed of the loch, and leading presumably to a short gangway, appears not to have been noticed hitherto in Scottish crannogs.

From these facts the conclusions may be drawn: (1) That the builders of the Treig crannog were familiar with the general scheme of construction of the Scoto-Irish type of crannog; (2) that their woodwork is more crude than that of the builders of other known Scottish crannogs, since they made more use of the natural trunks of trees, and except in the basal timbers did not use dressed squared beams; and (3) that they modified, and I think improved, in their island the mechanical design of crannog construction.

These conclusions suggest that the Treig crannog was built at a period later than the crannogs of the south-west of Scotland, and by people to whom rough-and-ready joinery appealed more than skilled carpentry.

(c) *Evidence from the Timbers of the Crannog.*—The main timbers of the island, with the exception of the basal framework, were natural trunks of pine and birch, cut as a rule to a length of 30–32 feet. The pine-trunks were straight and of regular growth, generally about a foot or a little over in diameter and showing practically no taper along their whole length. In one tree the annual rings were counted and numbered 106. It is more remarkable that the birch stems of the intermediate timbers, usually about 7 to 10 inches in diameter, were as straight and almost as regular in growth as the pine, and one of these, 20 inches in diameter, had 118 annual rings. Another was 21 inches in diameter. Johns in his *Forest Trees of Britain* states that the birch prefers soil in which turf overlies sand and "in such situations it attains maturity in about fifty years; but it seldom exceeds 50 feet in height, with a trunk from 12 to 18 inches in diameter."

The crannog was built, therefore, at a time when a close forest of pine and of exceptionally fine birch clothed the neighbouring hills. At present

there are no natural pine-woods about the loch, and the scattered birch-trees are small and of very scraggy growth.

Is it possible to say when the Treig watershed possessed a forest such as would supply the timber of the crannog? There is little more than tradition to guide us. Bishop Lesley, writing in 1578, refers to the "Tor Wod" *Caledonia Silva* "Quhais boundis war sa large, that frome the Callendar and Caldir Wod to Lochquhaber war extendet" (Dalrymple's translation, 1596), and the brothers Stuart mention the tradition of a great pine-forest which extended from the western braes of Lochaber to the Black Water and the mosses of Rannoch, and which was burned to expel the wolves. Loch Treig lies within the area covered by both references, and the latest period when wolves proved generally troublesome and when the forest burnings for their extirpation took place in this and other regions may be put down roughly as about the middle of the sixteenth century.

The most then that can be safely deduced from the timbers of the crannog is that they must have been cut in a forest that existed probably from prehistoric times till the sixteenth century.

Conclusions regarding the Age of the Crannog.—According to tradition the crannog was visited and used in a casual way as late as the seventeenth century, but the skill and labour expended upon its creation would not have justified its use solely for occasional visits, and its regular occupation probably came to an end, judging by the relics, in the sixteenth century. At that period it would still have been a serviceable refuge-place from wolves as well as from wandering marauders.

Were we to judge by the relics alone, it might also be argued that the crannog was built in the sixteenth century, for none is demonstrably of earlier date, although the leather shoes appear to have affinities with a Romano-British type, and the woollen fabric might well be of a similar age.

It has to be remembered, however, that a crannog is unlike a land dwelling in the sense that when once it has been built its method of construction is entirely hidden from observation. If our crannog, therefore, was made in the sixteenth century, or about that time, it must either have been an independent invention, which is unlikely, or the building of crannogs in Scotland must have been an art practised without serious discontinuity from the time of those south-western examples which date from the Roman occupation of Scotland. For there can be no doubt that the general plan of the Treig crannog is founded upon the established type of the Scoto-Irish examples.

There is at present no evidence of this long tradition of crannog-building in Scotland, though it may be revealed by the excavation of the very numerous crannogs of the Highland lochs. It seems more likely that

the Treig crannog-builders lived at a period in closer contact with the construction of the crannogs of Romano-British times, and the modifications and improvements which they introduced into the design suggest that they lived at the end of or soon after those times.

The idea that the origin of the crannog belongs to a period before the sixteenth century is supported, vaguely, by the assumption of the Gaelic poet that the island had existed for a long time before 1600, at which date, obviously, no tradition of its creation had survived. But it is more definitely supported by the presence of at least three superimposed hearths, indicating a subsidence of 4 feet in one part of the island. This must have taken place over a prolonged period, unless we assume, and it would be a rash assumption, that all the precautions taken to prevent the sinking of the structure had been ineffective and that it had subsided rapidly after being built.

There is another possibility that deserves mention. In the typical Scottish crannog the general rule is that the basal supporting timbers are squared dressed beams sometimes associated with natural trunks, and that the platform or pavement bearing the dwelling-surface is of squared dressed beams. It is odd that in the Treig crannog the arrangement is reversed and that the only squared beams in the structure were found amongst the basal or foundation timbers, whereas the platform, both as regards its framework and the "flooring" which covered it, was of natural trunks. That is to say, the workmanship of the foundation timbers is different and more finished than that of the upper platform and its pavement. This suggests the possibility that the two series may belong to different periods; that while the basal timbers represent the original woodwork of the crannog, the upper platform and its pavement may have been reconstructed at a later date because of the destruction of the original platform by subsidence or decay. In that case the stone-and-earth superstructure of the crannog would date from the period of reconstruction, and the relics it contained would give no pointer to the period of the original construction of the island.

The photographs of the relics in the plates which follow were made by Mr R. J. Fant, Technical Assistant in the Department of Zoology, University of Edinburgh, to whose skill and assistance I am greatly indebted; the photographs of the crannog and its structures were made by me in July 1933. To the Carnegie Trust for the Universities of Scotland I record my thanks for a generous grant contributed towards the defrayment of the cost of reproducing these plates and the text-figures.

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EXPLANATION OF PLATES.

PLATE IV.

1. Side view of the exposed crannog from the west, before excavations had begun. The white band in the background is the new embankment built to raise the West Highland Railway above the water-level of the Treig Dam.

2. End view of the crannog from the south, showing the laminated mound upon which it was built.

PLATE V.

1. Hearth No. 1 of schist slabs in left background, and in foreground part of circular setting of large pebbles, probably the foundation of another hearth.

2. Post-hole in centre of island, probably to carry central support of dwelling.

PLATE VI.

1. Excavation at north end of upper platform, showing

   (*a*) superstructure of stones and earth,
   (*b*) cross-beams of framework of upper platform, the nearest being the outermost beam, succeeded by half-beam with wedge-shaped end,
   (*c*) bedding of platform, and
   (*d*) some of intermediate timbers.

2. Framework of upper platform at centre of island, seen from east, showing two inner longitudinal beams and under them two cross-beams; the end of the spade is resting upon one of these. The two short lengths of trunks above the platform are part of the stringers or "flooring."

PLATE VII.

1. Excavation proceeding between beams of framework shown in Plate VI, 2; gives an impression of the massiveness of the construction of a single rectangle of the frame (*cf.* fig. 11). The men are standing upon the intermediate timbers.

2. End of a cross-beam showing square-cut check for securing an outer longitudinal beam in position.

3. A cross-beam, fallen from its original position, which shows two checks to interlock with longitudinal beams and a notch upon which a buttressing beam bore. This was probably the outer beam on the south of the platform framework.

PLATE VIII.

1. Brushwood packing (mainly heather and bracken) beneath outer cross-beam at north end, part of which is shown at top of photograph.

2. Excavation showing two cross-beams of platform and, at right, one of the upright "wedging" posts. An upper birch trunk of the intermediate timbers is just exposed, and a large boulder lies upon it. Between boulder and trunk, and elsewhere, remains of brushwood layers can be seen.

PLATE IX.

1. Intermediate timbers shown in relation to a cross-beam of platform (at top); here also large boulders rest upon the trunks. On right compressed layers of decayed vegetable matter appear beneath the cross-beams and above the timbers. The tip of the shovel is resting upon a timber of the basal platform.
2. Intermediate timbers; several ranges of natural trunks, usually of birch, lying parallel to the cross-beams, one of which is partly shown at the top of the photograph.

PLATE X.

1. Basal framework at north-west corner of island.
2. Part of basal lattice of birch branches at south-west corner of island.

PLATE XI.

1. Part of basal lattice at north end of island.
2. Key-point of crossed and wedged timbers at north end of island, viewed from the island (*cf.* fig. 16).

PLATE XII.

1. Key-point of crossed and wedged timbers, viewed looking towards the island (*cf.* fig. 16).
2. Birch posts deflected by pressure of island; at north end beyond outermost cross-beam.

PLATE XIII.

1. An early stage in excavation of north end; at right heavy squared timbers lying at an angle and supporting the lateral thrust of the island.
2. Remains of ladder at north end giving access to island, showing the relation of its slope to that of the surface of the island.

PLATE XIV.

1. Wooden dowel-pins and pegs. *a*, *b*, simple dowel-pins, cut from natural timber; *c*, eight-sided dowel-pin; *d*, portion of eight-sided dowel-pin, extracted from beam of upper platform; *e*, headed pin. About $\frac{2}{7}$ natural size.
2. *a*, *b*, Chips of oak, cut by adze; *c*–*e*, rolled up strips of birch-bark found upon brushwood layer under upper platform. About $\frac{1}{3}$ natural size.

PLATE XV.

Wooden vessels.—1, 2, Views in elevation and in plan of dug-out vessel of oak, probably for transport of material. About $\frac{1}{13}$ natural size. 3–5, remains of single-piece canoe of oak; 3, end view showing shape of keel and under surface, about $\frac{1}{10}$ natural size; 4, upper surface, showing raised knobs; and 5, under surface, showing keel, about $\frac{1}{9}$ natural size.

PLATE XVI.

1. Drawing of dug-out vessel of oak, showing dimensions.
2. Cross-section of above.
3. Sample of brushwood layer (mainly heather) which lay under the wooden upper platform.
4. Sample of deposit consisting largely of needles of Scots pine, which formed the mound on which the island rested.

PLATE XVII.

1. Implements, etc., of metal: *a*, portion of blade and tongue of iron back-sword; *b*, portion of tang, cylindrical collar, and curved blade of iron knife; *c*, *d*, *e*, hand-made iron nails; *f*, iron object with square collar; *g*, thin sheet of bronze with rectangular perforations; *h*, bronze tweezer-like article with riveted arms. All about $\frac{1}{3}$ natural size.
2. Wooden points, mostly hollow, of unknown use. About $\frac{1}{3}$–$\frac{1}{4}$ natural size.

PLATE XVIII.

1. Two leather shoes showing (*a*) shoe for left foot, with toe-cap, and (*b*) shoe for right foot, with straps laced over instep by thong and toggle (*cf.* fig. 22). About $\frac{3}{8}$ natural size.
2. Fragment of woollen fabric; arranged with the warp up and down, the weft horizontal. Slightly under natural size.

PLATE XIX.

Reconstruction of Loch Treig crannog as it may have appeared when in use, showing the landing-place, the appearance of the posts fixing in position the upper platform, if they projected above the water, and a hut of which the only trace discovered was the post-hole for central supports.