II.

REPORT ON THE SOCIETY'S EXCAVATIONS OF FORTS ON THE POLTALLOCH ESTATE, ARGYLL, IN 1904–5. By Dr CHRISTISON, Secretary. RELICS described by Dr JOSEPH ANDERSON; PLANS taken by Mr THOMAS ROSS, Architect.

The Council of the Society having resolved that it was desirable to excavate several Forts in the Crinan district which had been described by me at the April meeting last year,[1] a grant was made from the Fund for Excavations on Native Sites furnished to the Society by Mr Abercromby; and leave having been freely given by Colonel E. W. Malcolm, C.B., of Poltalloch, the proprietor of the ground, operations were begun on the 5th May 1904, and continued uninterruptedly till 28th January 1905.

The great distance of the locality precluded superintendence, in our usual manner, by regular visits from Edinburgh, but the knowledge of the sites acquired by me in 1903 made it easy to direct Mr Alexander Mackie, our experienced Clerk of Works, whose weekly reports gave all the information that was required as to the progress of the excavations. Visits were also made in the course of the operations by Lieut.-Col. M'Hardy, C.B., *V.P.*S.A. Scot., by Mr Thomas Ross and his assistant Mr G. W. Tod on three occasions, and finally by Mr Abercromby when the work was completed.

The Report is based on Mr Mackie's Notes and Weekly Letters, and on Mr Ross's Plans; and the Illustrations are from photographs by Mr Mackie.

1. ARDIFUAR.

Three miles W.S.W. of Kilmartin, 500 yards N. of the western bay on the north side of Crinan Loch, this fort is placed on a site

[1] "The Forts of Kilmartin, Kilmichael Glassary, and North Knapdale," *Proc.*, xxxviii. 205.

unique in the county. Instead of being on the top, it is at the bottom of a hillock, whose eastern slopes completely command it from a distance of 35 yards, and it derived no strength from nature unless on one side,

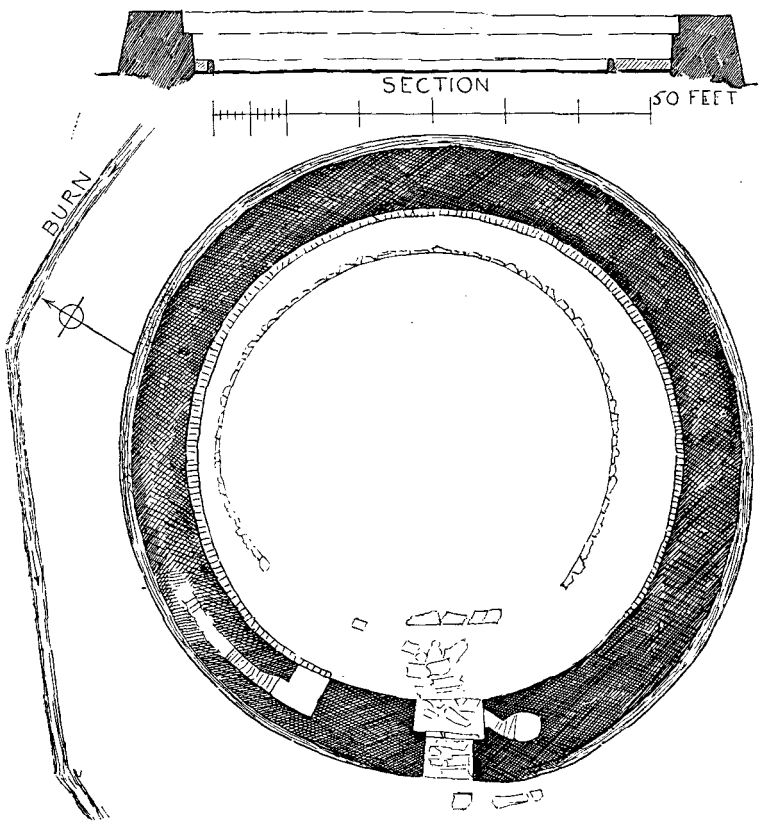


Fig. 1. Plan and Section of the Fort of Ardifuar, by Thomas Ross, Architect, F.S.A. Scot.

where there may have been a marsh before the days of drainage. From the sea the ground rises gently to a height of 100 feet at the site, and the abrupt rocky hillock, Dun an Fheidh, that dominates it, is 80 or 90

feet higher. A brisk little rill runs round the north side of the fort within a few yards of the wall, and would afford an ample supply of water to the inhabitants.

The work, which lasted from 5th May to 13th June, consisted mainly in clearing out debris 4 or 5 feet in depth from the interior, a very disagreeable operation, as the area had been used for fifty years for the burial of dead cattle. Some debris had also to be removed from the outside, but only on the western side, as on the east the wall stood quite unencumbered.

The Wall is almost circular, and is 10 feet thick at the base, but diminishes to less than 7 at a height of 10 feet, owing to the considerable batter of the outer face (fig. 1, Plan by Mr Ross, and 2, 3, General Views). The present height varies from about 3 to 5 feet on the north-east side, and from 6 to 10 on the south-west side. The inner face has a scarcement 5 feet high and 12 to 18 inches wide, which is not built against it, but is an integral part of the wall. According to Mr J. S. Grant Wilson, of H.M. Geological Survey, 95 per cent. of the stones consisted of epidiorite and the rest of pebbly quartzite, the blocks on the eastern side being large and of epidiorite, while on the western side the wall was built of comparatively small and medium-sized blocks.

The single Entrance, which is on the south-west towards the sea, stands to a height of from 3 to 5 feet, and is of superior masonry. It consists of an outer and an inner part (figs. 4 and 5), the first being 6 feet in length and breadth, the second, behind rebates of 18 inches, being 9 feet wide, and only 4 in length. A slab, 6 feet long and 6 inches broad, set on edge, and projecting 12 inches above the floor, forms a sill between the rebates. The floor is irregularly paved with flagstones.

Cell at the entrance.—On the east side of the inner passage a rectangular opening 2 feet above the floor, and measuring only 2 feet 5 inches in height and 2 feet in width (fig. 5), gives access to a descending flight of five steps leading, 3 feet 6 inches lower down, to a very small cell 3 feet long and 2½ wide, and 7 feet high, with approximating sides

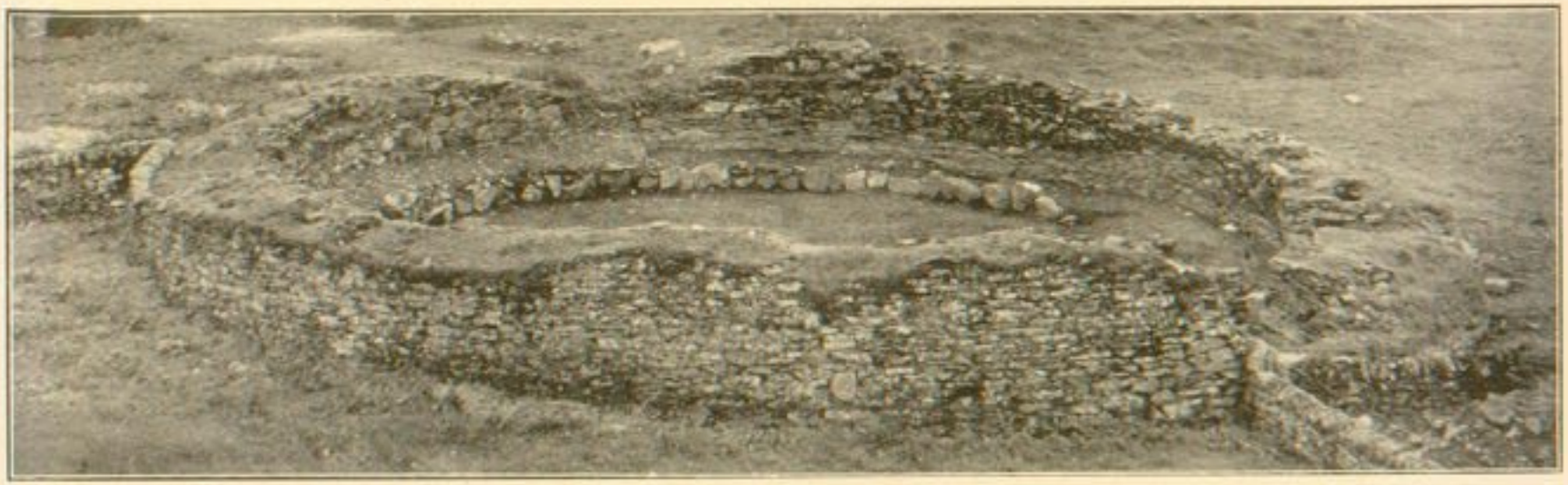


Fig. 2. Ardifuar from the north-west.

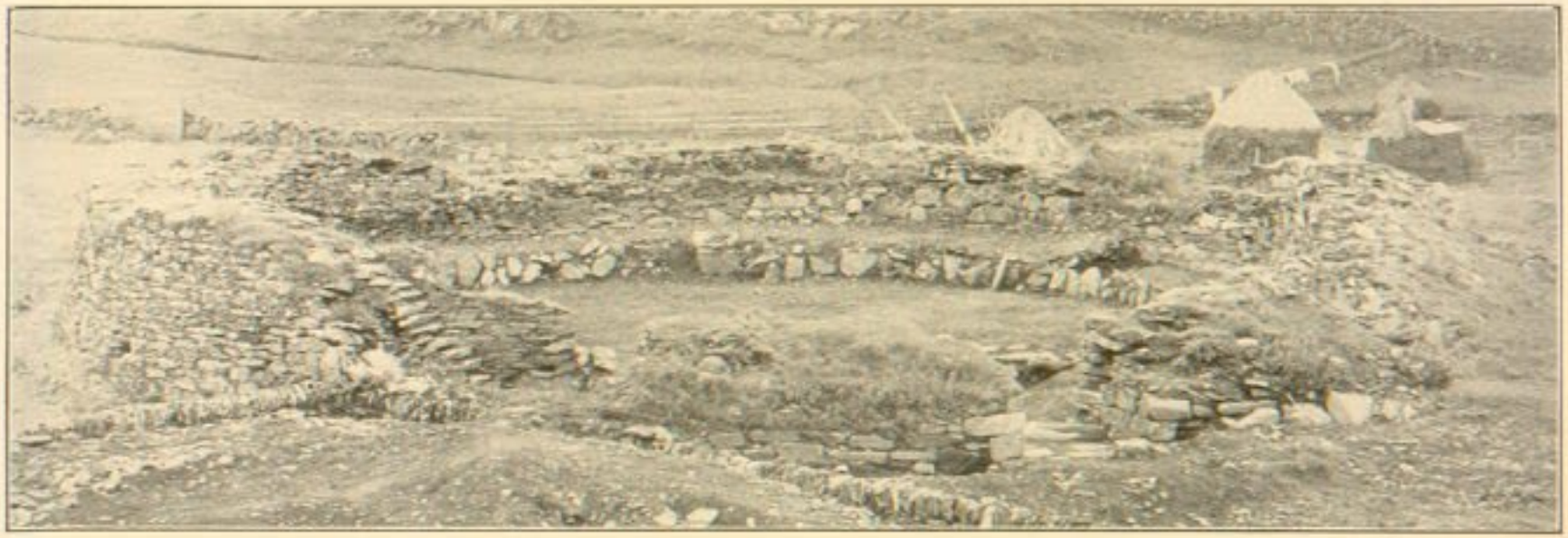


Fig. 3. Ardifuar from the south-west.

Fig. 4. Entrance to Ardifuar from the outside.

Fig. 5. Entrance to Ardifuar from the inside.

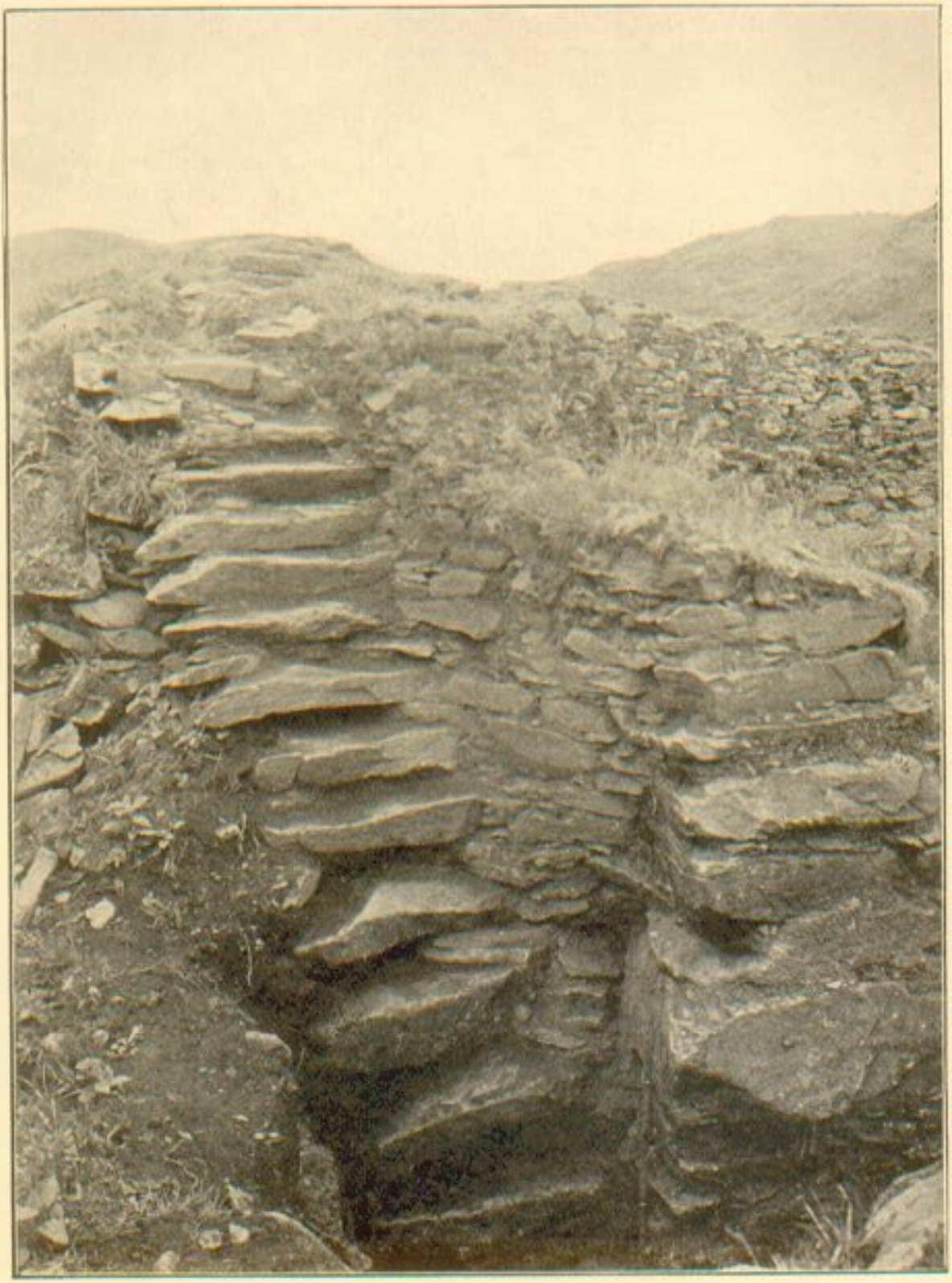


Fig. 6. Stair in the wall of Ardifuar.

and a floor of sand. If this was intended for a guard chamber, it seems to be most inconveniently planned for the purpose.

Staircase.—Twelve feet west of the entrance a rectangular recess, $5\frac{1}{2}$ feet wide, gives access to a staircase in the thickness of the wall (figs. 3 and 6), which doubtless led to its top. The lower 13 steps lead to a short passage, where a second flight begins, of which only 3 steps

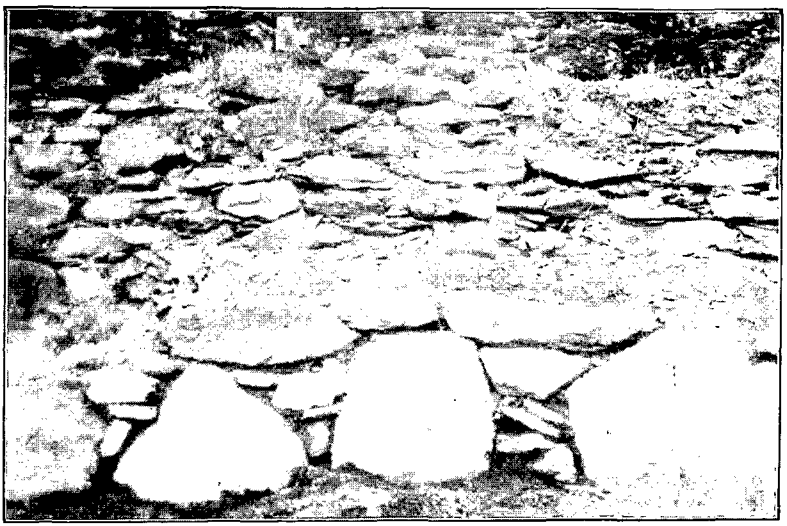


Fig. 7. Part of the Secondary Wall in Ardifuar.

remain. The inner casing of the wall stands to a height of only 6 feet, and the outer casing is quite gone. The steps, as Mr J. Grant Wilson specially remarked, are of undressed epidiorite, carefully laid, with very perfect side-pinning.

The Interior.—The area is very nearly circular, and averages 65 feet in diameter at the base and 68 above the scarcement. The flat floor has a fall of about 1 foot in level southward. Its surface is the natural gravelly soil, except near the entrance, where the flagging is prolonged

for 9 feet into the interior. Nothing was found to confirm Miss Maclagan's supposition that a covered way passed from the entrance through the area (*Hill Forts*, etc., p. 42, and pl. xix.).

Secondary Walls.—A wall of large slabs, set on edge, with small pinning stones (figs. 2, 3, 4, 7), runs round the interior, near the fort wall, but not concentrically, as the interspace varies from 3 to 9 feet in width. This space was filled with small stones and earth, with a few larger stones. The wall is about 2 feet high, and the slabs are 2 to 3 feet long and about 1 foot thick. Mr Grant Wilson estimated that 30 per cent. of the blocks were pebbly quartzite.

Outside, to the east of the entrance, and projecting a little way in front of it, was another wall of slabs on edge, running parallel with the fort wall 2 feet in front of it, and 12 feet in length.

Description of the Relics. By Dr Joseph Anderson.

The relics found in Ardifuar are as follows :—

Polished Axe of indurated clayslate, 6 inches in length by $2\frac{3}{4}$ inches across the middle, part of the cutting edge and about half of the height of one side roughly chipped away.

Four Whetstones of sandstone, one being 6 inches in length by $2\frac{1}{4}$ inches in breadth, another slightly less in size, and the other two broken.

A Polisher of quartzite, measuring $4\frac{1}{4}$ inches in length by $2\frac{1}{4}$ inches in width.

A large Mould of greenish micaceous schist (fig. 8), measuring $13\frac{1}{2}$ inches in length by $10\frac{1}{2}$ inches in width, and 3 inches in thickness, having on one face moulding cavities for (1) a straight bar over 6 inches in length, one end of the cavity being broken away and the other end slightly damaged, the section of the cavity being nearly half an oval, $\frac{3}{4}$ inch in width and slightly over $\frac{1}{2}$ inch in depth; (2) an object like a mill-rind, $7\frac{3}{4}$ inches in extreme length, $1\frac{1}{2}$ inches in width in the middle, the extreme depth of the cavity being about $\frac{3}{4}$ inch, and the extreme width of the projecting horns at the ends being $4\frac{3}{4}$ inches, and the depth and

thickness at the points about $\frac{3}{4}$ inch; (3) an object like a broad curved sickle, measuring about 9 inches along the curve, $1\frac{1}{2}$ inches in width at the one end and slightly less than an inch at the other, the depth of the cavity in the middle not more than $\frac{5}{8}$ inch, thinning to the sides. This mould does not seem to be capable of being used as a closed mould with another half fitted over it; and as the middle parts of the cavities are worn quite smooth, it may have been a mould for shaping malleable-

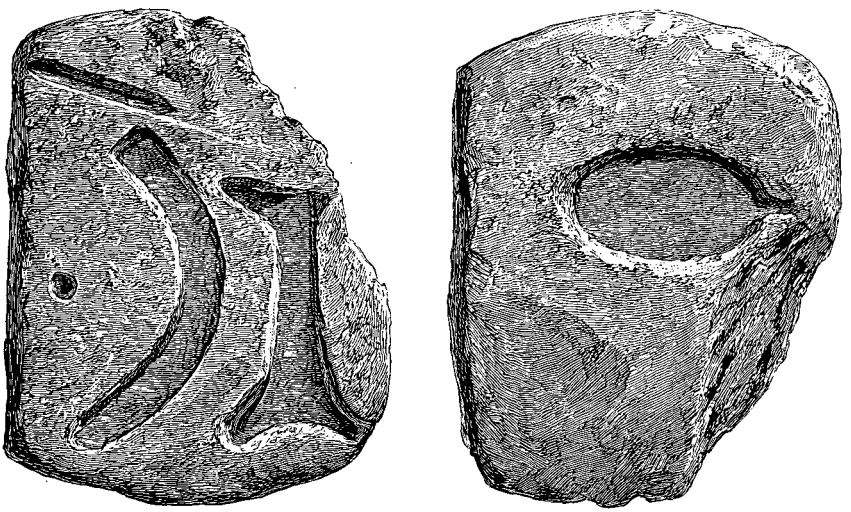


Fig. 8. Obverse and Reverse of Stone Mould found in Ardifuar. ($\frac{1}{2}$.)

iron things in, like the stone moulds for crusies that were till quite recently used in most country smithies. On the reverse side of the stone is another moulding cavity for a flat oval object $4\frac{3}{4}$ inches in length by 3 inches in width, and scarcely more than $\frac{1}{4}$ inch in depth, with the remains of a cavity as if for a straight rectangular handle about $\frac{3}{8}$ inch in thickness in the middle of one end. A similar oval mould is among the relics from Dunadd.

A Whorl of micaceous sandstone, $1\frac{3}{4}$ inches in diameter.

Two thin circular Discs of stone, perforated in the centre, and one more oval than circular.

Fragment of a Crucible, of the same cup-shaped form as the largest one from Dunadd.

Four fragments of Pottery, three of which are coarse, thick, hand-made, and badly-fired vessels with turned-over lips, the fourth of a greyish-white paste, wheel-made, and with a roll-moulded everted lip.

Small fragment of the red lustrous Ware of the Romano-British period, popularly known as Samian, with embossed decoration.

Small Ring of bronze, $\frac{5}{8}$ inch in diameter.

In this collection of relics from Ardifuar we have evidence in the small fragment of Samian ware and the wheel-made pottery that the occupation of the fort came down to the Roman period at least. Although the presence of the polished stone axe may appear to be suggestive of neolithic times, it is an isolated object in the group of relics, of which the general character is certainly not neolithic; and it must be remembered that polished stone axes have not unfrequently been found in the relic-bed in Roman forts, both in Germany and in England.[1] One was also found in the fort at Abernethy, in which all the other objects were of the Iron Age.

Remarks.

This fort was described by Miss Maclagan (*op. cit.*, p. 42) as the Broch of Ardafure. Its claim to be a broch, however, seemed very questionable, even before it was excavated. As formerly explained (*Proc.*, xxxviii. 220), not only did it greatly exceed in size the largest known broch, but the wall was narrower than that of any known broch, and there was no trace of a gallery at a height of 10 feet from the ground. To these reasons we have now to add the size of the entrance. An invariable characteristic of the brochs is a long narrow entrance. In no example in the Highlands, Orkney or Shetland does

[1] *Excavations on the Romano-British Sites at Wilderspool and Stockton Heath*, by Thos. May, p. 22; L. Jacobi, *Das Romerkastell Saalburg*, p. 412.

the width exceed 4 feet; and even in the Lowland *Etinshold*, the largest of all the brochs, it is only 4 feet 9 inches. At Ardifuar the width of the outer and narrowest part is 6 feet, and that of the inner part 9 feet. The total length of the entrance, on the other hand, is only 10 feet—several feet less than in any of the broch-entrances.

A considerable number of the forts in Argyll are circular, but, besides Ardifuar, only one has been excavated—*Suidhe Chennaide*, near Loch Awe (*Proc.*, xxv. 117). Although it was only preserved to a height of 5 feet, the evidence, as far as it went, was entirely against the supposition of its being a broch; therefore, as yet the only known broch in the county is Tirefour, on the island of Lismore.

The Argyllshire fort that seems to resemble Ardifuar most closely is the South Fort of Luing, partially excavated by Dr Allan Macnaughton in 1890 and 1892 (*Proc.*, xxv. 476, xxvii. 375). It differs from Ardifuar in being oval instead of circular, and in its wall being thinner at the sides than the ends, instead of being of equal thickness all round; but these differences evidently depend upon the nature of the sites, the one being on a narrow ridge and the other on level ground; and the two forts agree in their wide entrances, and in having staircases in the thickness of the wall leading to the top.

2. DUNTROON.

The excavation of Duntroon was specially desirable, as it had the reputation of being a vitrified fort, and the greatest variety of opinions have been expressed concerning even the most elementary facts regarding vitrified forts, ever since John Williams first described them a hundred and thirty years ago, as the following brief analysis of the leading opinions will show.

Opinions of various Authorities on Vitrified Forts.

1. Position of the Vitrifaction.

John Williams, mineral engineer (*An Account of some remarkable ancient Ruins lately discovered in the Highlands and Northern Parts*

of Scotland, 1777). From two sections made through the wall at Knockfarril, Williams concluded that it had been completely vitrified throughout, although it had entirely fallen down in ruins. This was the only fort he saw in which the whole wall had been run into a solid mass. At *Craig Phadrig* he observed, without excavating, that two vitrified walls surrounded the fort, the outer one being specially interesting as the only instance he saw of a wall not entirely ruined, some parts 5 feet high still sticking to the bare rock.

Dr John Jamieson (*Trans. R.S. of Literature*, 1827, from observations made about 1790). He saw *Finaven* advantageously, when the tenant was carting away a part of the wall, but his description is vague and contradictory. In one passage the wall is said to be regularly built, 10 to 14 feet high, 20 to 30 broad at the base, and vitrified; in another, it is stated that "the irregular concrete mass formed a buttress on each side for the regular intermediate wall"; also that parts, from top to bottom, afforded no vestiges of fire. At *the Laws* he observed two walls of vitrified matter, as perfect as at Finaven.

James Neish, Esq., of the Laws (*Proc.*, iii. 440–54, 1862), made extensive excavations at the Laws, and says that the vitrified masses were only found as a backing to the wall faces. No actual vitrified walls.

Dr John Stuart (*Proc.*, viii. 145), from observation of many examples, doubts "whether the vitrified portion was in general anything more than a central wall, buttressed by external masses of stone on each side, or in some cases the foundation for a superstructure of ordinary walling.

Dr R. Angus Smith (*Proc.*, ix., xi., xiii., and *Loch Etive and the Sons of Uisnach*, 1879), from excavations at *Dunmacsniochan*, and observation of other examples, concludes that the vitrifaction is only at the bottom to a height of 5 feet, and generally only on the outside of a dry-stone wall.

Mr John Honeyman (*Trans. Glasgow Arch. Soc.*, 1868, and part i. vol. 2, 1879), from general observations, concluded that the vitrifaction is generally less perfect towards the outside than in the centre; and

from excavations at *Caisteal Aoidhe*, found in a wall 5 to 7 feet high, that the vitrifaction at all points was wedge-shaped, widest at the top, and resting at the sides and below on rubble walls.

Dr Edward Hamilton (*Arch. Jour.*, xxxvii., 1880, p. 227) found, by observation and some digging at *Arka Unskel*, that vitrifaction was traceable all round. In a section where the wall was 7 feet high, the lower 3 feet was of waterworn boulders unaffected by fire, and the vitrified mass above was almost untouched by fire in the centre. At *Eilean na Goar* vitrifaction was seen on the wall-face, wherever not concealed by vegetation. One mass *in situ* was vitrified on both sides.

Mr James Macdonald (*Huntly Field Club Trans.*, 1886, Suppt., July 1887) made two sections through the *Tap o' Noth*. In one, where the vitrifaction was most visible, it diminished from above downwards (and only penetrated a few feet, as he subsequently stated to me). In the other there was no vitrifaction at all in the rickle wall, which was 12 feet high and 20 wide at the base.

II. Opinions as to the *modus operandi*.

Williams. The wall was vitrified within a mould, exactly fitting it, of walls of sods, by fusing successive layers of combustibles and stones, the mould being raised *pari passu*.

Hamilton thought that the heat must have been applied at the sides and top of the wall.

Honeyman and *Macdonald* concluded that the heat was applied at the top only.

Dr John Macculloch (*History of the Highlands*, 1824, ii. 237) says that the rocks were brought from a distance in the examples he saw, proving that the builders knew which rocks were fusible.

III. Opinions as to the Intention.

Pennant. Not intentional, but due to volcanic action.

Lord Woodhouselee. Not constructive, but caused by conflagrations at the hand of enemies.

Several Authors. The result of peat fires for cooking or signalling.

Williams. To act as a cement, before the use of lime was known in this island.

Angus Smith. To prevent an enemy from pulling out stones from the bottom of a wall, and so bringing the whole down. Hence the vitrified part never exceeded the height of a man, and the upper part was left loose, so that the stones could be hurled at the foe.

Honeyman. The effect seems altogether out of proportion to the result, as, after all, the wall was weak and easily undermined.

From this extraordinary conflicting mass of evidence and opinions, we can only conclude that there was a great variety in the situation of the vitrifaction, in the position and mode of application of the heat, and perhaps even in the object.

Description of Duntroon, and the Results of our Excavations.

The site is at the head of the eastern of the three bays on the north side of the Crinan Loch, about 100 yards from the sea, on the flat summit of a narrow ridge that rises gradually from the margin of the bay to a height of nearly 100 feet. The ridge continues to run for a considerable distance in a north-easterly direction, after a dip of 15 or 20 feet at the north end of the fort. Eight or ten feet below the summit a natural terrace, varying in width from 10 to 50 feet, passes round on the north, east, and south, but runs out at both ends on the west at the edge of a straight precipice, which falls on a pleasant green valley or hollow, between the ridge and a corresponding one to the west. To the east, the descent is steep to a level field. The approach from the sea along the ridge, although not steep, is much encumbered by projecting rocks. On the whole, the position is very strong, the easiest access being from the north, where, however, an attack could only be made by a very narrow front.

The defences consist of a main work enclosing the summit, a wall surrounding the terrace, an extra wall at the north end and two at the south end (Mr Ross's plan, fig. 9).

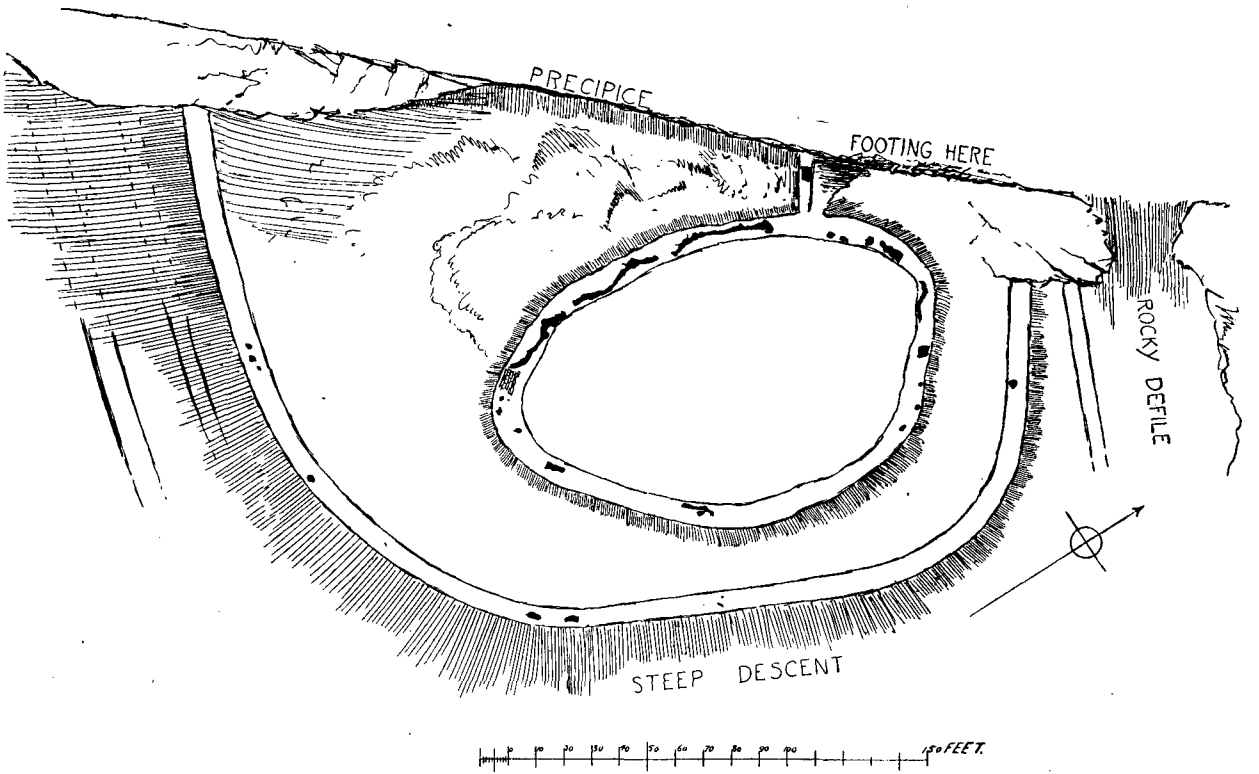


Fig. 9. Plan of the Fort at Duntroon, by Thomas Ross, Architect, F.S.A. Scot.
(The black patches on the walls indicate vitrifaction.)

The main work consists of a single wall, enclosing a nearly level oval area of 140 by 90 feet. The wall, as usual in the hill forts, is built at the edge of the summit and partly down the slope, which has contributed to its ruinous condition. Notwithstanding the great natural strength of the west side, the wall seems to have been as strong there as at the other more accessible sides. It stood here retired

Fig. 10. Remains of the outer face and rubble core of the Wall, Duntroon.

some 20 to 40 feet back from the precipice, at the top of a steep slope down to its edge.

The determining of the structure of the wall was no easy matter owing to its extremely dilapidated condition, but by removing the debris all round and getting down to the foundation, it was ascertained that the wall had consisted of an inner partially vitrified face, an outer built face, and a core of rubble (fig. 10).

Vitrified masses were found nearly all round the inner face; chiefly on the west, where they were several feet in length and height, and averaged 2 feet in depth or thickness, and were almost contiguous. Little remained on the east, somewhat more at the north-east corner, but at the north-west it was again much in evidence. Opposite all the defective points, however, masses were found lying on the slopes, and in such quantity as to leave little doubt that the vitrifaction had been nearly continuous round the inner face. Curiously enough, the vitrifaction seems to have been most extensive on the naturally strong west side. Not only was it best preserved there *in situ*, but considerable quantities had rolled down and lay at the foot of the precipice.

The vitrified masses generally stood upon the solid rock, but there were considerable stretches where they were founded on from 1 to 2 feet of stones unaffected by heat.

That the *central core* had not been vitrified was evident in places where it had not entirely fallen away, and because in the vitrified masses themselves the effects of heat were less and less manifest towards the centre of the wall.

That the *outer face* also had not been vitrified was indicated by one or two courses of an outer facing of masonry remaining round most part of the circuit. At the south-west corner three courses were found in a stretch of 9 feet (fig. 10). This masonry was unaffected by heat.

The width of wall at the base was 8 feet, and it was calculated that only about one sixth or seventh of its whole substance had been vitrified.

The fortified Terrace.—The well-defined terrace, which sweeps round three sides of the main work at a lower level of 8 or 10 feet, varies in width from 20 feet at the north end to 10 on the east side and 50 at the south end, even although it is narrowed there by the projection upon it from the foot of the main fort of a rocky platform. At this western end it terminates by a rough descent to the precipice.

The defence of the terrace consisted of a wall carried round at both ends to the precipice. The great mass of the wall lay in ruins upon the

slope, but here and there remains existed at the edge, which, with traces of the foundation of the outer casing on the slope, enabled a width of 6 feet to be determined. A very few vitrified masses were found either at the edge or on the slope, where they could not have fallen from the main work.

Advanced Walls at the north and south ends completed the defences. That at the north end abutted on the face of a rock above and near the precipice, 10 feet in front of the terrace wall, and diverging outwards till the interval was 20 feet wide, ended, after a course of 50 feet, without trending inward so as to form a closed annex. The two at the south end began at the edge of the precipice and circled round concentrically with the terrace wall for 150 feet, when they were lost on the eastern slope. The inner interspace thus formed was 15 feet wide and the outer one 20, and in their present condition their eastern flanks are quite open. The width of all these walls was only 4 feet 6 inches, and there was no trace of vitrifaction about them. They were all completely ruined.

Probable Entrance.—At the point where the main wall comes nearest to the cliff a difficult zigzag ledge leads from the green hollow up the precipitous face to the wall. No passage could be traced through the wall, but a large vitrified mass, apparently *in situ*, 12 feet in front of it, may have had to do with the defence of an entrance here. No sign of an entrance could be seen anywhere else.

The Interior.—The area of the main work is fairly level, with a slight fall at the north end. It was excavated everywhere down to the rock, which crops out in many places, and is nowhere more than a foot or two below the surface. No sign of a well, cistern, or building of any kind was to be seen.

Chief dimensions.—The extreme length of the fortress, including the walls, is 360 feet; the width about the middle 120 feet, and towards the south end 190 feet. The area of the main work measures 140 by 90 feet, but the habitable space would be about doubled by including the terrace.

Reports on the Vitrifaction, by Mr Grant Wilson, H.M. Geological Survey, *and on its Chemical Composition*, by Mr Boston Harley, chemist, Carron Ironworks, have added materially to our knowledge, and are given in full at the end of the paper.

By the kindness of Dr Horne, Director of H.M. Geological Survey for Scotland, Mr Grant Wilson visited the fort, and ascertained by repeated sections that the rock in the area was affected by heat to a distance of at least 12 feet from the wall all round, while on the outside it was only affected for 3 feet. These facts confirm the results of our excavation, showing that the heat was applied mainly, if not entirely, from the inside, for the comparatively small signs of heat outside might be due to the combustibles falling over. Besides, it was not likely that any attempt would be made to vitrify the large blocks forming the outer face. It seems to be proved also, from the mode in which the heat was applied, that the vitrifaction was intentional.

Mr Boston Harley's analysis, which was obtained at the suggestion of Mr J. R. MacLuckie, F.S.A. Scot., is also of great value, as it proves that no flux was used, contrary to the general belief on the subject.

Conclusions.

It is remarkable that while the early authorities found the vitrifaction of the walls in the various examples to be complete in one case, and in the others to be either at the bottom, or at the top, or on both sides, or on the outside only, our investigation, instead of confirming any of these, proves that at Duntroon it was only on the inside.

Other interesting results are, the proof that a vitrified wall may have an outside casing, well built, of good-sized blocks unaffected by fire, that the heat was applied from the inside of the fort, that it was intentional, and that no flux was used. A decided advance has therefore been made in our knowledge of the subject, although much remains to be learned. The purpose of vitrifaction, considering that it was applied in so many different ways, remains a mystery, which perhaps excavation cannot be expected to solve. At Duntroon it is specially difficult to understand

why men who could build a good stone face on the outside, should not have done the same on the inside, where the height was much less, and the quality of the masonry did not require to be so good.

But our work at Duntroon has contributed somewhat to the solution of the perhaps more interesting question:—Can the vitrified forts be differentiated in point of date from the ordinary hill forts? That there may be a difference seemed to be possible from their distribution. Williams supposed that they were confined to the counties of Perth, Forfar, Inverness, Nairn, and Ross, but they have since been met with in Argyll and Bute; and it is specially noteworthy that a group of six forts on the confines of Argyll and Inverness, quite isolated from other forts, are all marked "vitrified" on the O.M. Unfortunately no description has yet been published of these.

But the relics found at Duntroon are perhaps more suggestive. It is certainly remarkable that in the four forts in the district excavated by us, flint articles, three of them of neolithic type, were found only at Duntroon; and that, while all the thirty-six querns (fig. 11) discovered there were of the saddle type, of the fifty found at Dunadd, only three were of that kind, and all found at Ardifuar and Druim an Duin were rotary querns.

It is eminently desirable that some of the more completely vitrified forts should be excavated, such as the two at Arisaig and the one at Carradale, where there is a thoroughly vitrified wall, 70 feet long and 5 feet high. Knockfarril might even be profitably re-excavated, as it is reputed to be the most completely vitrified of them all; and Williams' excavation, confined to a single section across the fort, cannot be regarded as sufficient.

Description of the Relics. By Dr Joseph Anderson.

Besides the saddle querns above mentioned, the relics from Duntroon consist of the following:—

Scraper of grey flint, $1\frac{7}{8}$ inches in length, $\frac{3}{4}$-inch in width at the worked end, and tapering to less than $\frac{1}{4}$ inch at the butt end.

Scraper of pale grey flint, $1\frac{1}{4}$ inches by $1\frac{1}{8}$ inches, with semicircular edge and thick butt.

Scraper of bluish grey flint, $1\frac{3}{4}$ inches by $1\frac{1}{8}$ inches, with rounded edge and slightly convex sides, one having the original chalky surface of the nodule.

Core of flint of conical shape, $1\frac{3}{8}$ inches in diameter and an inch in height.

Fig. 11. Grain-rubbers or Saddle Querns, Duntroon.

Ten unworked flakes and chips of flint.

These flint implements and flakes were found here and there in the pockets of soil retained in the hollows of the uneven rocky floor of the fort.

Piece of coarse jet or lignite, about $1\frac{1}{2}$ inches square and $\frac{3}{8}$ inch in thickness. One of its sides shows marks of having been cut partially through and then broken off, and another retains traces of having been rubbed smooth.

Hammer-stone or Pounder of granite, $3\frac{3}{4}$ inches by $3\frac{1}{8}$ inches, abraded

by use on three of its sides; another of greyish quartz, 4 inches by $3\frac{1}{8}$ inches, abraded by use on five sides; another of similar stone, $3\frac{1}{2}$ inches by $2\frac{7}{8}$ inches, abraded by use on three of its sides; another of grey quartzite, $2\frac{3}{4}$ inches by $2\frac{1}{2}$ inches, abraded on two sides only; another of white quartz, smoothed on one side.

Six oval or oblong water-worn Pebbles, abraded by use on one side, or showing use on one edge or surface, varying from about 5 inches in length to about 3 inches in length, and about the same in breadth.

Four Whetstones or Polishers of sandstone and quartzite, from $5\frac{1}{2}$ to 4 inches in length.

Flattish oblong Pebble of sandstone, $8\frac{3}{4}$ by 3 inches, with a notch in each side nearer one end than the other, and a picked out hollow midway between the notches, probably a Sinker.

One specimen of the vitrifaction from Duntroon is interesting, as it has run down upon a shell-heap at the base of the wall and licked up a number of limpet and cockle shells, of which very perfect casts remain in the solidified mass.

Report on the Vitrifaction at Duntroon Fort.

By J. S. Grant Wilson, H.M. Geological Survey.

What remains of the original wall of the fort—now in a fragmentary condition—is wholly composed of blocks of epidiorite, resting on the mass of epidiorite on which the fort stands. This epidiorite is of the vesicular slaggy type which will melt at a comparatively low temperature. Both inside and outside the wall the rock *in situ* has been under the action of fire, and its usual dull green tint has been altered to a dull red brown. In cross-section, this discoloration, due to the oxidising of the iron in the rock, extends from $\frac{1}{2}$ inch to 3 inches from the surface, as tested by breaking the rock in many places all round. These blocks of epidiorite in the wall of the fort are more or less subangular, and vary in size from small pieces up to blocks 8 inches by 3 inches by 4 inches. The cementing material is a porous, light to dark grey slag, which is not very evenly distributed through the wall now left. This slag, however, was never liquid, but when most mobile, had only reached a stage of fluidity resembling that of a ropy lava. This is well seen in many instances, where it has only partially filled interstices between the built

stones, and has left *pendent* tongues lining the roofs of the cavities. In the vitrified portion of the remaining wall some of the stones retain their angular shape, with the slag binding them together. Others, and chiefly the smaller ones, are partly fused on their outside and incorporated with the slag. This evidence seems to prove that the heat which produced the vitrification must have been variable, such as would result from wood fuel.

Towards the S.W. corner of the fort the recent excavations disclose a portion of a wall 9 feet long by 3 feet high, built of epidiorite blocks which average 1 foot 6 inches long by 9 inches thick.

This wall lies about 3 feet 6 inches in front of and below the vitrified portion, with a mass of loose rubble between (fig. 12).

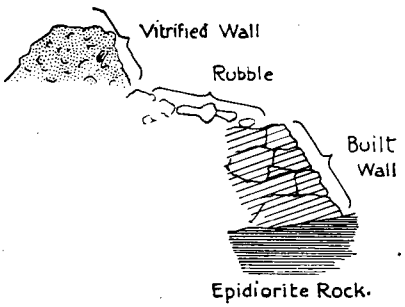


Fig. 12. Diagram of section through the Wall, Duntroon.

This wall is well laid in rough courses (not disturbed by tree roots) and properly banded, a very good example of rough rubble building.

On account of the large size of the stones employed to build this wall and their close-fitting joints, this portion was evidently never intended to be vitrified. It was probably a foundation wall to carry the vitrified wall across the gap which occurs here on the natural rock surface.[1] The lower courses in this wall show no trace of the action of fire, the upper courses only faint indications, while the loose rubble between the top of this wall and the base of the overlying vitrified portion is discoloured by the action of fire.

The present surface of the rock *in situ* all over the centre of this fort shows no signs of having been subjected to the action of heat. The action of fire on the epidiorite on which the wall is built extends to about 3 feet on the outside of the wall. Inside the fort, this dis-

[1] Mr Wilson was not aware that traces o this outer built face were found all round the wall.—D. C.

coloration by heat extends to about 12 feet at least from the base of the interior wall. From these facts we may infer that, in order to produce vitrification, more heat was applied from the inside of the fort wall than from the outside, the ratio being about one to four. Wood was evidently the source of heat, as a large quantity of charred wood has been dug up inside these walls.

Analysis of the Vitrifaction at Duntroon Fort.

By Mr Boston Harley, Chemical Department, Carron Ironworks

None of the specimens submitted to me were absolutely raw; all of them had got more or less of a scorching. I took, however, a piece which seemed to have got least heat, and have given that in the table as raw.

No. 1. *Fused Stone.*—This resembled irony slag from a blast furnace, dark bluish-gray in colour. It was not quite honeycombed, but it had a considerable number of cavities, which must have been formed when the stone was in a liquid state, and retaining the imprisoned gases when cooled. The piece weighed about 30 lbs., and measured roughly 10 inches by 6 inches by 6 inches.

Specific Gravity (water unity).	No. 1, 2·712.	No. 2, 2·751.	No. 3, 2·802.
	Per cent.	Per cent.	
Silica	57.28	52·60	53·97
Alumina	14·70	22·57	17·96
Lime	3·12	1·38	3·50
Magnesia	2·08	1·60	2·76
Iron Protoxide	3·76	3·74	5·76
Soda	4·89	3·70	4·32
Potash	·57	1·71	·05
Manganese oxide	1·80	1·53	1·93
Iron peroxide	9·92	8·56	7·36
Phosphoric acid	·55	·53	·56
Sulphuric acid	·30	·22	·19
Combined water and organic matter	·60	1·48	·50
Water at 212° F.	·05	·44	·73
	99·62	100·06	99·59
Iron in protoxide	2·91	2·91	4·48
,, ,, peroxide	6·95	5·99	5·15
Total Iron	9·86	8·90	9·63

No. 2. *Roasted Stone.* — The sample selected for this was only a few lbs. in weight; it was yellow on the outside and dark green in fracture. It was very much softer than either No. 1 or No. 3, which was probably due to moderate calcination and to its more aluminous character.

No. 3. *Raw Stone.*—This was also a small piece, and had a general appearance of trap rock.

The specific gravity of No. 1 in the piece was only 2·303, due to the unsoundness already referred to, but on grinding it up to a fine powder the above gravity was obtained. The sulphur is all shown as sulphuric acid, but doubtless some, at least in 2 and 3, will be in the form of pyrites.

Before the stones were examined I had the impression that the fusion has been brought about by the addition of kelp before ignition, but this had not been the case; there are no more alkalies, alkaline earths, or any kind of fusible materials in the fused than there are in the unfused stones; and further, the quantities of these constituents are quite consistent with composition of basaltic rock.

I believe that there would be little difficulty in fusing stones of this character. Theoretically very little fuel is required; but, making allowance for heating up the wall, loss by radiation, heated gases going off, incomplete combustion, etc., 4½ cwts. of air-dried wood per ton of stones would be ample, or half that quantity of charcoal, assuming that some protection would be afforded to the side of the wall, to form a kind of kiln, which would concentrate the heat and give proper draught for combustion. The analysis of the fused stone also indicates that there was a kind of smothered combustion, as quite a number of minute pellets of iron (included in the protoxide) were found, and part of the oxide had been reduced, either by solid carbon or by carbonic oxide, in either case showing insufficiency of air, which I think would not have been the case with an open fire.

I have been fortunate in getting several small "pendent tongues" in a crevice of the fused piece, and have estimated the principal constituents in them, which are as follows:—

Silica	58·50
Alumina (approx.)	15·70
Lime	4·00
Magnesia	1·90
Soda	3·37
Potash	·70
Iron Oxides Manganese Oxide, etc.	15·30

I think this is conclusive proof that no foreign material has been introduced to increase the fusibility of the native stone; some of it may have been ground up into a finer state of division in order to fill up the interstices, which would at the same time make them fuse more readily, but I think the proof is entirely against anything else being used.

The mass of fire material in the inside of the fort would play the most important part of the heating by contact at first, but ultimately it would get so dense that the bulk of the liberated gases would find their way to the wall, and there would probably meet with oxygen in quantity coming through the fire outside and produce internal heat. The depth of vitrification would be determined by the regulation and direction of the air-currents.

But in whatever way the fusion has been actually accomplished in the present instance, I have no doubt that it has been done solely and absolutely with heat.

3. FORT ON DRUIM AN DUIN.

The Druim an Duin (Ridge of the Fort) begins at the head or north end of the long narrow arm of Loch Sween called Caol Scotnish. It runs N.N.E. for about half a mile, gradually rising to 300 feet above the sea, when it ends by a short descent, about 50 feet high, upon the top of the pass from Loch Sween to Crinan Loch. The fort is on the summit of the ridge, in a position of strategic importance, commanding the top of the pass and the road, which takes a sharp bend below the fort, and is visible for a considerable distance in both directions.

The crest of the ridge is almost a knife edge, as the rise from the eastern side ends abruptly on the edge of a precipice to the west. Just at the summit, however, there is a little expansion of the crest, which is completely occupied by the fort. The position, therefore, is of great natural strength.

In form the fort is oval, with straight sides and rounded ends, but it is broader at the south than at the north end (Mr Ross's plan, fig. 13). The dimensions are well defined by the wall on the south, east, and west, but it seems doubtful whether there had been a wall to show the limit on the west side, where the precipice formed an ample defence. The plan shows, however, remains at both ends which indicate pretty clearly

that there had been a wall on this side also, although it has almost entirely vanished with the decay of the face of the precipice.

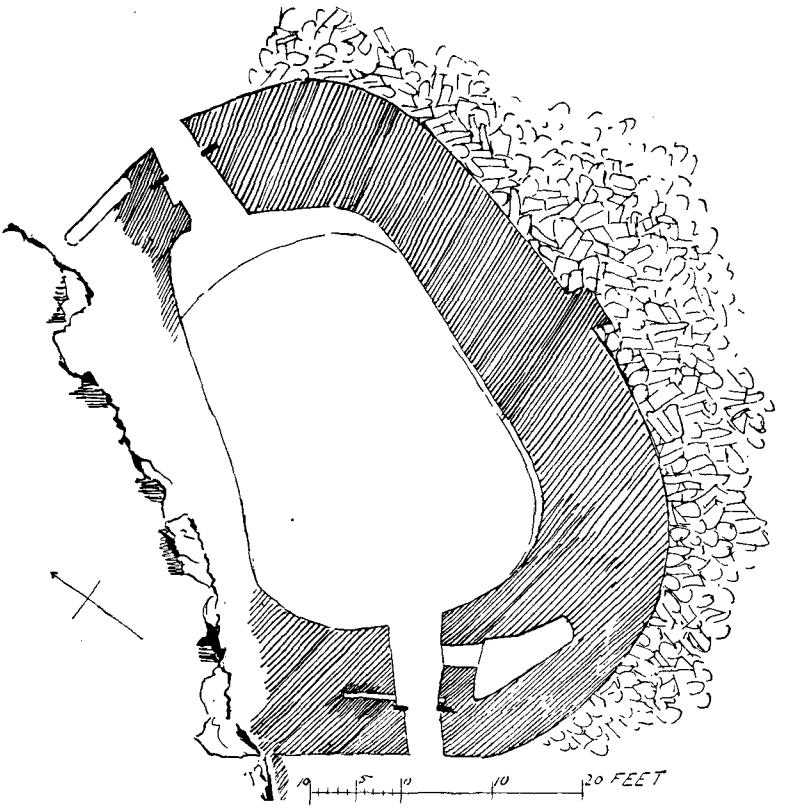


Fig. 13. Plan of the Fort of Druim an Duin, by Thomas Ross, Architect, F.S.A. Scot.

The present dimensions of the interior, as shown in Mr Ross's plan, are 48 feet in length, by 33 feet in width at the south and 25 feet at the north end.

The Wall.—The shaded part in the plan represents the base of the wall, and a tendency to lessen in width is shown on the east side, where the width was probably still more contracted originally at the top, as the outer face of the wall, now almost entirely fallen down, appears to have had a considerable batter, necessitated by the steepness of the slope on which the outer part of the wall stood.

The wall at the south end is 14 feet thick, and still stands about 6 to 7 feet high, outside and inside. The inner face on the east is about 7 feet high at most, and has a scarcement 5 feet high and $1\frac{1}{2}$ wide; the outer face has entirely fallen down the hill. Advantage was apparently taken of a little flat projection of the rock on this side to build a buttress.

At the north end the width of the wall is 14 feet where it joins the east wall, but gradually diminishes to $9\frac{1}{2}$ near the precipice. Neither in it nor at the south end of the wall was there any scarcement. About 6 feet within the north wall the remains of a secondary wall were found.

Entrances.

The south entrance consists of an outer and inner part: the outer one, (fig. 14) straight, 5 feet long and 4 feet wide, ends at the projecting checks for the door, which reduce the width to 3 feet. Behind the checks was a rectangular bar-hole, 7 inches high and 5 wide.

The inner portion (fig. 15) is 9 feet long, and behind the rebates formed by the door-checks is 5 feet high and 5 feet wide, expanding in the middle to 5 feet 9 inches, as the wall on the east side is slightly curved. On the same side a doorway (fig. 17), still roofed, 2 feet 9 inches wide and 4 feet high, leads by a passage 4 feet long to the guard chamber, 12 feet in length, measured along the straight south wall, and 10 along the slightly bent north wall. It is 7 feet in breadth at the near end, narrowing to 3 at the far end. One or two roofing slabs remain *in situ* at the far end, giving a height of 4 feet 8 inches for the chamber.

The west side of the inner part of the entrance is straight. An apparent entrance in it to a guard chamber proved to be a mere break in the wall.

Fig. 14. South Entrance to Fort on Druim an Duin, from the outside.

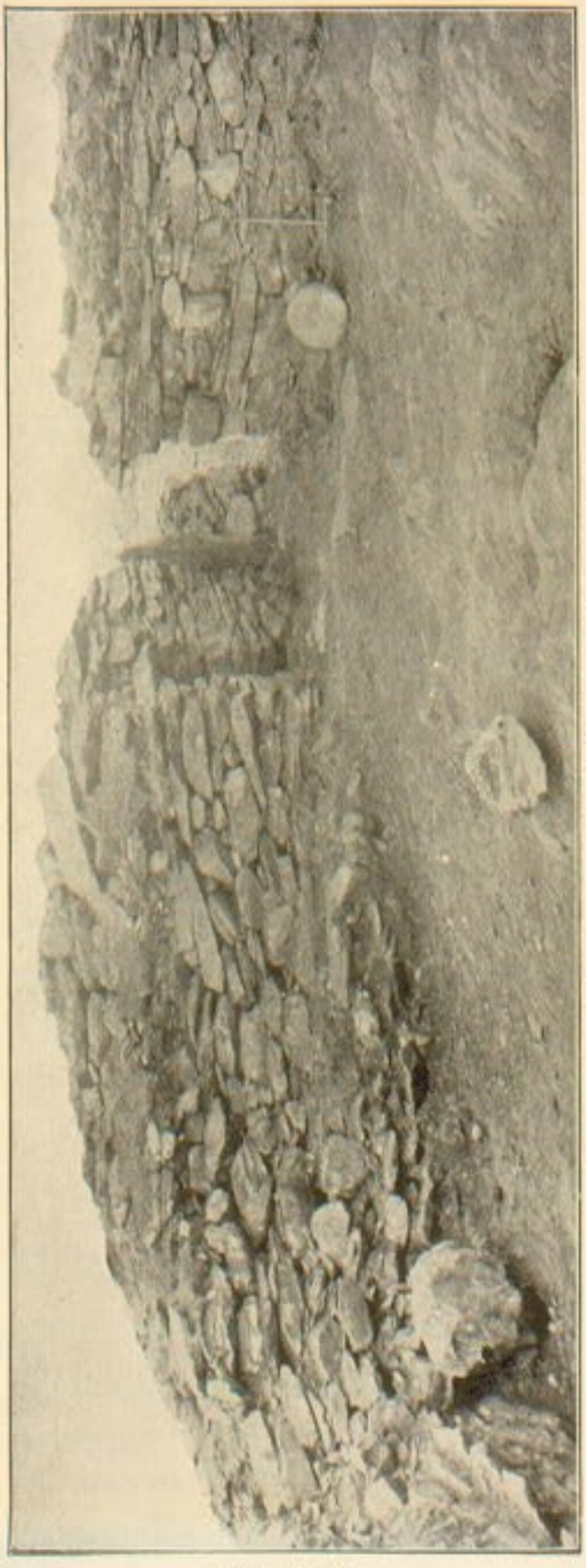


Fig. 15. South Entrance to Fort on Druim an Duin, from the inside.

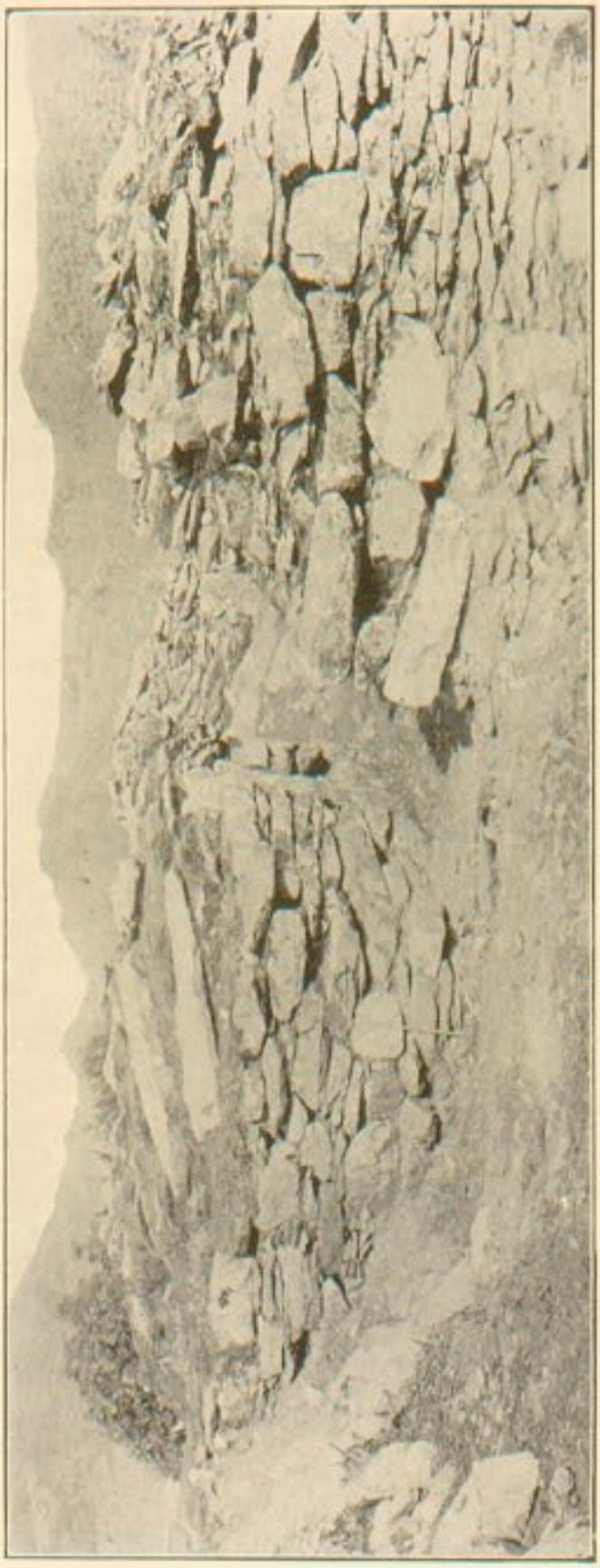


Fig. 16. North Entrance to Fort on Druim an Duin, from the outside.

Fig. 17. Doorway of passage to Guard-room of Fort on Druim an Duin.

As shown in the *Proceedings*, xxxviii. 240, fig. 30, one roofing slab remained in position at the inner part of the entrance, proving that the height could not have exceeded 5 feet. Several other roofing slabs lay in the entrance, but no stone door remained.

The north entrance (fig. 16) is not in line with the other, being nearer the cliff. It is 12½ feet in length on the east side, and only 10 on the west, a difference due to the rapid narrowing of the wall towards the precipice. It is 6 feet wide at the inner end, narrowing to 3½ at the outer end, and is slightly recessed on the west side, behind the rebate for the door. It has no guard chamber. A large stone slab, suitable for the door, lies a little to one side, outside the entrance.

Description of the Relics. By Dr Joseph Anderson.

Portion of a Cup of steatitic stone, showing 2½ inches of the curve of the rim, which is flat and smooth and ½ inch in thickness, and 2¼ inches of the depth of the side of the cup, which is carefully smoothed inside, the outside being left rough, and showing the marks of the tool. A handle, 1⅛ inches in thickness and 1⅞ in greatest breadth, projects for 1½ inches from the upper part of the cup, ⅝ inch below the rim. The handle is perfectly flat above and below; the sides are straight for about an inch, and then rounded towards each other. It is pierced perpendicularly by a circular perforation ⅝ inch in diameter. Such stone cups with handles have been found in the brochs. The fractured edge in this case shows that the break is old, and three small holes on the upper side apparently indicate an attempt to mend the vessel by clamping the broken parts together.

Three oblong water-rolled Pebbles of quartzite, one of which, 2¾ inches diameter and almost circular, has one face rough, and on the other an oblong groove or depression, produced as if by point-sharpening; the other two, slightly longer, have oblique depressions on both faces. They are quite similar in form and character to fig. 28 found in Dunadd. Such pebbles of

quartzite, with oblique depressions on one or both faces, have also been found in the brochs.

Four thin flat Discs of slaty stone, varying from $3\frac{1}{2}$ to $1\frac{3}{4}$ inches in diameter.

Disc of sandstone, $3\frac{3}{4}$ inches in diameter, with rough surface, having a perforation in the centre.

Half of the upper stone of a small Quern of greenish micaceous schist, which has been about 15 inches in diameter.

Another Quern-stone, unperforated, is shown against the wall in fig. 14.

4. DUNADD.

The excavation of Dunadd was of unusual importance, because of its reputation as the capital of Dalriada, the primitive kingdom of the Scots, and because it is one of the very few hill forts mentioned in the earliest annals of our country. William F. Skene and other authors have attributed a still higher antiquity to the site by connecting it with the *Tale of the Children of Usnach*, in which they are called "the three Dragons of *Dunmonadh*," a name for Dunadd believed to be derived from the *Monadhmor*, or Great Moss, on which the fortress stands so conspicuously. This would carry back our traditional knowledge of the place probably to the beginning of the Christian era.

But, however little reliance we may place on this identification, or the further one by the same authorities with the *Dunmonaidh* of "*the Tale of the Battle of Magh Rath*," which records events of A.D. 637, there is no reason to doubt that it was the Dunadd or Duinatt besieged, A.D. 683, by Fearchar Fadha, chief of Cinnel Baeden, allied with Bredei, king of the Picts, in an attempt to deliver Dalriada from the thraldom of the Britons and Angles.[1] The attempt failed, but two years later the independence both of Scots and Picts was secured by the destruction of King Egbert and his army at Dunnichen by Bredei (*Celtic Scotland*, W. F. Skene, vol. i. *passim*). The only other historical event relating

[1] A.D. 683. Obsessio Duinatt et Duinduirn.—*An. Ult.*

to Dunadd was its siege and capture [1] by Angus MacFergus, king of the Picts, A.D. 736; but probably it would lose much of its importance after 843, when Forteviot became the capital of the united Picts and Scots.

Position.—The site of Dunadd was well chosen for the capital or chief fortress of a kingdom so long drawn out as almost to exemplify the brief definition of a line—length without breadth. It was placed at the junction of the two provinces into which Dalriada was divided—Lorn and Kintyre; it stood in the way of invasion by the only easy access to the kingdom from the east, and its natural strength was very great.

The Monadhmor upon which the fortress stands is a dead flat, raised but a few feet above the sea-level, and upwards of 2 miles square, through which the river Add meanders to discharge itself into the Crinan Loch. Near where the river enters the moor, on its N.E. border, and on the S.W. side of the stream, the isolated rocky eminence of Dunadd rears itself to a height of 160 feet above the moor and 176 above the sea (fig. 18, view from the north-west).

In a direct line, the position is 2 miles from the sea, but the influence of the tide extends to it up the river, which, approaching from due east, bends immediately below it at a right angle due north (fig. 18, view from the north-east), and it seems not unlikely that small galleys may have been able to reach below the fortress in primitive times.

The rocky mass is a parallelogram of 1000 by 650 feet, trending in a N.N.E. direction (plan from the 25-inch O.M., *Proceedings*, xxxviii. 227, fig. 17). From the northern, eastern, and particularly the southern sides the rise is not at first generally steep, though it is everywhere broken by little cliffs and projecting rocks, and all the slopes from these three directions terminate at a height of about 140 feet above

[1] A.D. 736. Ængus MacFergusa rex Pictorum vastavit regiones Dailriatæ et obtinuit Dunad et combussit Creic et duos filios Selbaiche catenis alligavit id est Dongal (*King of Dalriada*) et Feradach.—*Tighernac.*

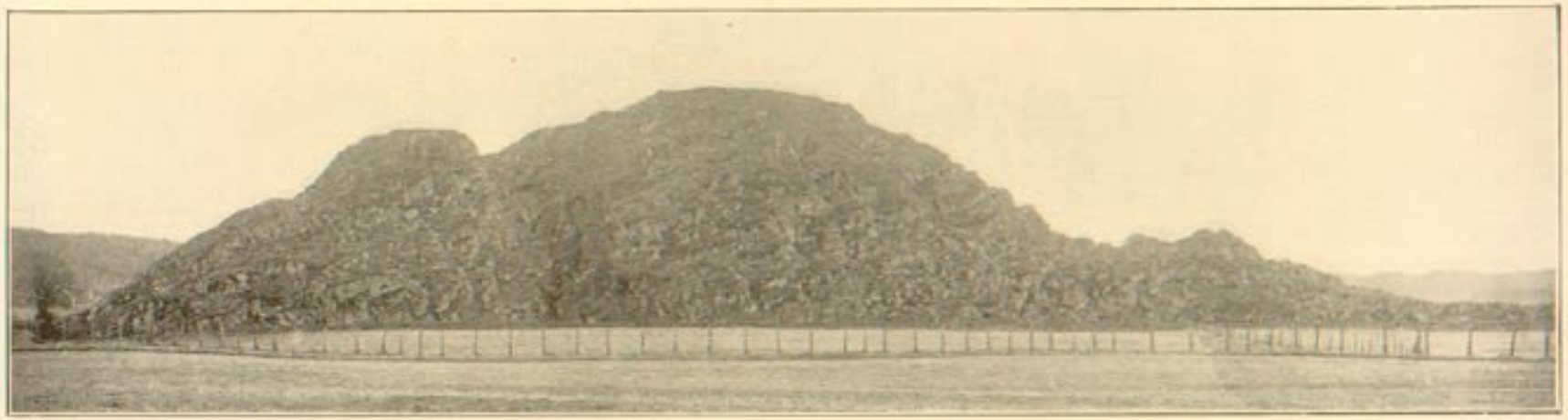


Fig. 18. Dunadd from the north-west.

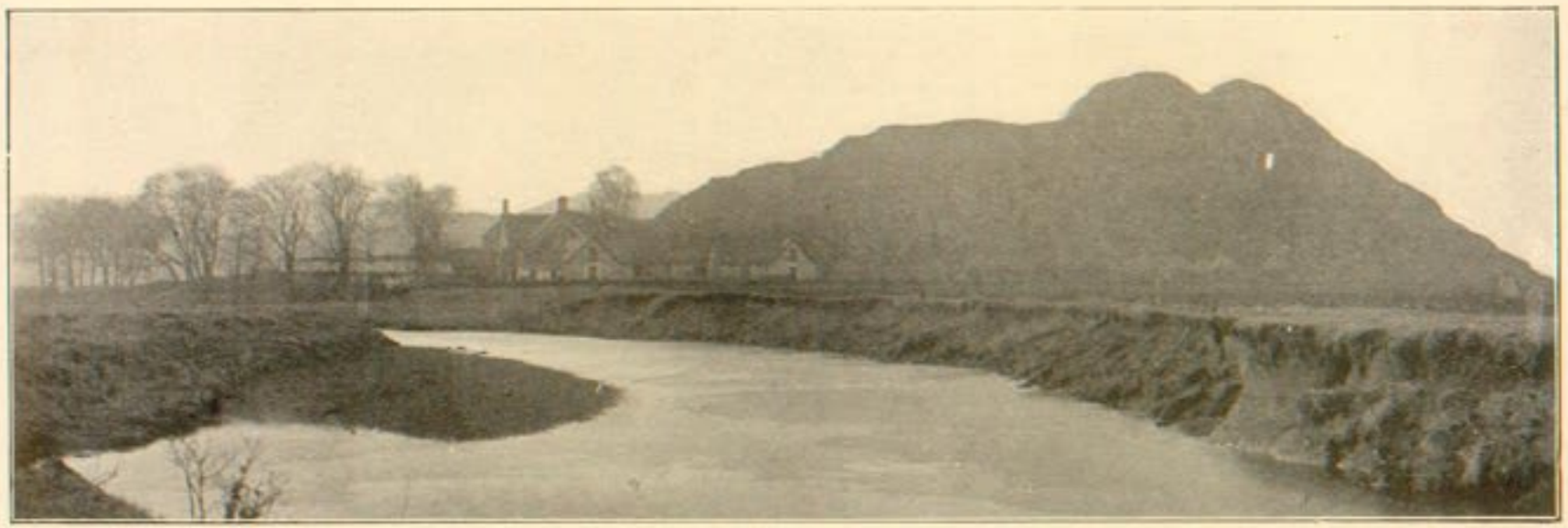


Fig. 19. Dunadd from the north-east.

the plain, on the rim of a hollow plateau, which has a considerable fall to the N.E. The background to this plateau on the west is a very steep rocky ridge, 30 to 40 feet high, which forms the hog-backed summit of the hill. Immediately to the north of the ridge a precipitous, conical, almost inaccessible mass forms a second top, 25 feet lower than the summit of the ridge. In fig. 19 the plateau is seen on the skyline; above it is the conical head, and beyond that the ridge, in profile. From this ridge the descent to the plain on the west is so precipitous that the fortress was practically unassailable on that side (fig. 18).

The fortress was thus naturally divided into a lower part on the plateau and an upper one on the ridge, the latter completely dominating the former.

The conical top does not appear to have been fortified, although it closely commands a great part of the upper fort, and looks down on the north end of the lower one, but the difficulty of the ascent from the moor is so great that a few men on the top could easily repulse any attack, without artificial protection.

Dunadd may be not inaptly compared to Dumbarton Rock. They both rise abruptly—in the one case from the level surface of the sea, in the other from a flat moor—to a double-headed top, one of which is conical.

The Fortifications.

I. The Upper Fortress.

The summit of the ridge is 250 feet long (Mr Ross's plan, fig. 20). Beginning in a sharp point at the S.W. end, it gradually widens by a gentle ascent, 80 feet long, to a breadth of 60 feet at the actual top. The width then gradually contracts to 25 feet at the north-east end by a gentle slope, broken by two steep but short rocky descents. At this end the level is 50 feet below the top of the ridge and 25 below the conical top, which is only about 30 feet off, and rises from the ridge-end by a straight mural cliff 10 or 12 feet high. The configuration of the ridge led to its being fortified by three works, in line with each other.

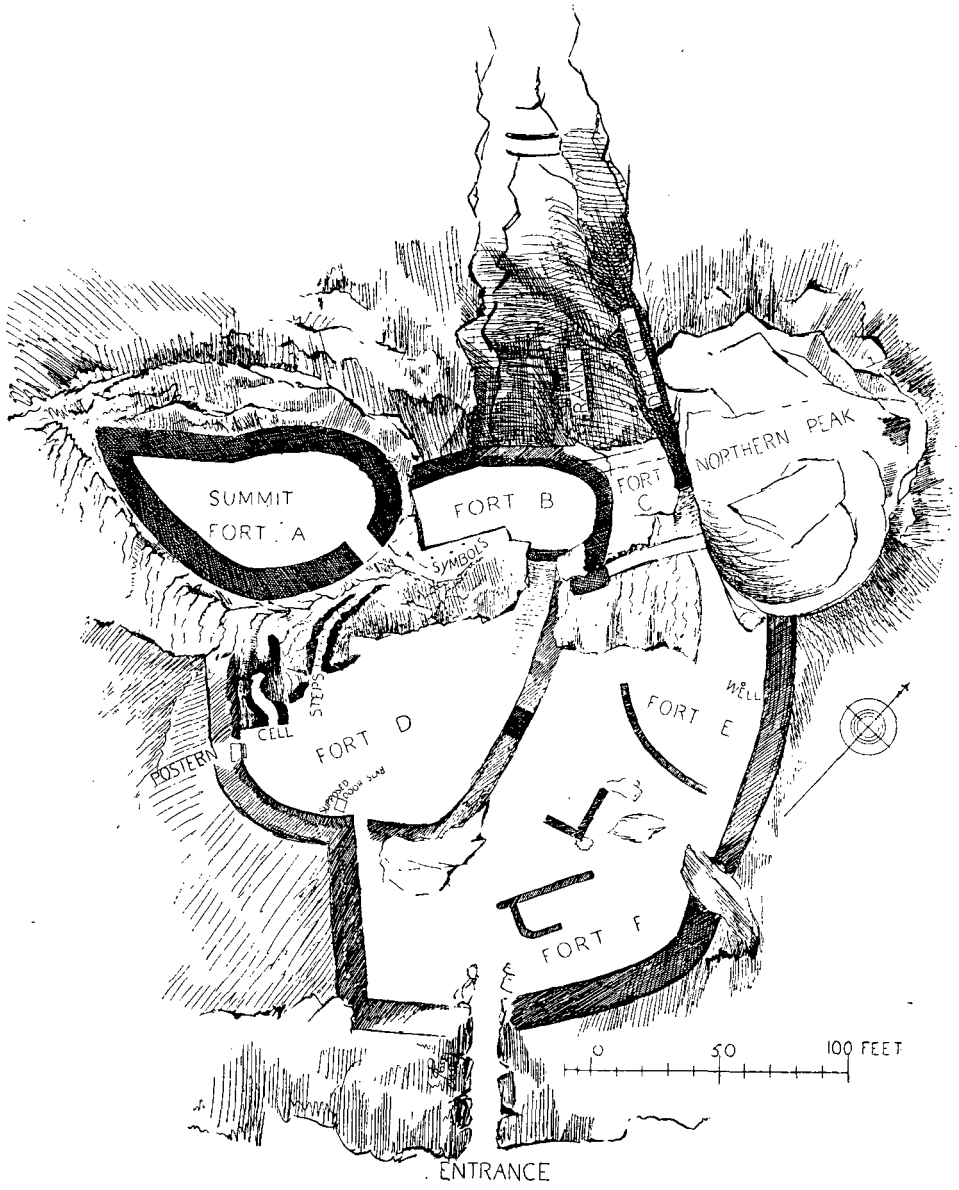


Fig. 20. Plan of the Fort of Dunadd, by Thomas Ross, Architect, F.S.A. Scot.

A. *The Upper Ridge-fort.*

The wall of this fort, adapting itself to the edges of the ridge, encloses a space 100 feet long and 45 wide, of a sharp-pointed obovate form, and including the nearly level summit of the ridge. For the most part buried under the earth, this wall was traceable all round, on excavation, still

Fig. 21. Inner face of Wall at entrance of Upper Fort, Dunadd.

standing 3 or 4 feet high in some places. The width was 12 feet. It was well built, as is well seen in a view of the inner face at a part close to the entrance, fig. 21. The entrance, 10 feet in width, was at the north-east corner, and was approached from the fort on the plateau by a steep narrow passage, which had apparently been cut into steps.

The interior was covered with several feet of friable earth, partly blackened, and mixed with small stones, and it contained many relics, but no remains of stone buildings.

B. *The Middle Ridge-fort.*

A short rocky slope, 15 feet in height, falls directly on the middle fort, which is irregularly oval, and encloses an area of 75 by 35 feet. *The wall*, of which scarcely a sign showed on the surface, had mostly fallen down the slopes, and, on excavation, could be traced only on its inner face, except at the north-east corner, where a part of the outer face remained, as the foundation here was on a flat rock, which extended beyond the wall. On the outer rock-platform thus formed, 12 feet in length and 6 in breadth, a buttress seemed to have been constructed.

Little remained of the wall further south on the eastern side, where the defence was greatly helped by little cliffs, but one distinct part, several feet high, still barred what appeared to be the natural approach from the lower fortress. The precise position of the entrance could not be ascertained, though probably it was near the S.E. corner.

The Interior.—The accumulated soil was as much as 4 or 5 feet deep in some parts, and was a heavy black mould, unmixed with stones. Relics abounded, but the only building was the fragment of a wall springing from the south-west corner of the main wall, not bonded into it, and running a short distance obliquely into the area. It was of inferior masonry, and in all probability of secondary origin.

Outside the south-east corner of the fort the figure of a boar, incised on the rock, was uncovered. The back, from exposure to the weather, was worn away, but the rest was well preserved, and the lines could not have been drawn with greater spirit and truth (fig. 22). Its length is 21 inches, and it is placed between the previously known footmark and cup; and if the king, at his inauguration, stood in the footmark, he would face north, with the figure of the boar behind, represented as if advancing towards him.

Fig. 22. Figure of a Boar incised on the rock in the Fort of Dunadd.

C. *The Lower Ridge-fort.*

Another short rocky slope leads to the lower fort, which had not an independent wall to the south like the middle fort, but was tacked on to it. The only distinct trace of the side walls was at the S.W. corner. They seem to have been straight and parallel, and abutted on the straight mural cliff of the conical top. The interior is only about 25 feet square, and is completely commanded from the conical top, the very summit of which is not 30 feet off, and is 25 feet above the fort. But as the separating cliff is only 10 or 12 feet high, short ladders would give an easy access to the top when it was necessary to defend it, which a few men could do, as it is almost inaccessible from the moor. The only accesses were from the moor on the west, by a steep narrow cleft separating the two summits of the hill, and from the plateau fort on the east, by a continuation of the same cleft. Both these very narrow passages were barred by cross-walls.

II. The Plateau Fort.

The hollow plateau on which the lower fort is situated is rudely semicircular (plan, fig. 20); the base, 205 feet long, is formed by the foot of the ascent to the ridge; the semicircle, with a radius at the widest part of 135 feet, is marked by the well-defined rim of the plateau. From the nature of the ground, however, the curve is indented on the S.E. by a re-entering right angle. At the southern end the area is fairly level, but there is a pretty rapid fall thence to the northern end.

The Wall at the north end abuts on the precipitous face of the conical summit, and circling round the rim, after climbing over a flat rock, reaches the entrance on the east, beyond which it makes the angled intake, and then resumes its curved course, to end against the precipitous face of the ridge-summit.

Completely buried under its own ruins, it was found on excavation to stand 3 or 4 feet high outside (fig. 23) and 2 or 3 inside in places, and to be 12 feet wide. The faces were well built of fair-sized stones, pinned

with small ones, and with rubblework between. Fig. 24 shows the inner face, at a point where the natural rock was used to eke out the defence.

The Entrance was approached from the east up a rather steep natural gap in the hill, 60 feet long, 10 wide, and 8 or 10 in depth, with sides mostly mural, but not continuously so (fig. 25, and *Proceedings*, xxxviii., fig. 24). This gap is traceable some distance into the area (fig. 26), and appears again on the ascent to the ridge, and once more on the descent from it on the western side.

Fig. 23. Outer face of Wall, Lower Fort, Dunadd.

Captain Thomas (*Proceedings*, xiii. p. 24) suggests that the entrance had been bridged across, and that the wall was continued over it, which probably was the case.

The nature of the ground favoured a subdivision of the plateau fort into three parts, each more or less capable of separate defence.

Subdivision D.

The higher and comparatively level nature of the ground at the southern end of the plateau led to a wall being drawn across (plan, fig. 20) so as to cut off this space from the rest of the area, which

descends rather rapidly to the northern end. This wall is practically continuous with that of the ridge-fort B, a precipitous rock alone separating them. Descending to the plateau, it curves round to the main wall at the re-entering angle, and thus forms a quasi-semicircular enclosure, with a base at the ridge-foot of 125 feet, and a longest radius of 75 feet.

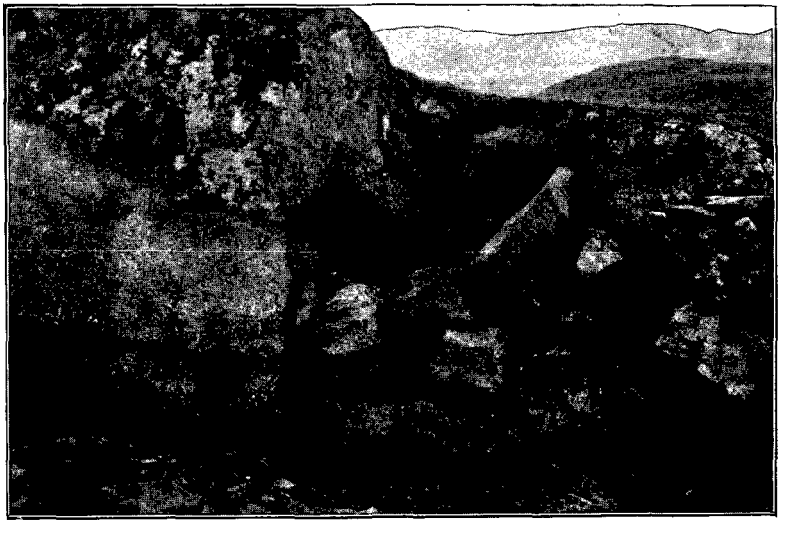


Fig. 24. Inner face of wall, partly of rock, Lower Fort, Dunadd.

At the point of junction with the main wall there is a deficiency, probably indicative of a passage from D to the lower subdivision F, and a stone slab, 4 feet by 3 feet 6 inches, lying near, may have been its door. There was also a narrow exit (marked "postern" on the plan) to the outside of the fortress in the south wall. The sides are gone, but a slab 5 feet by 4, lying in the gap, had apparently been the door, as 18 inches behind the inner line of the wall another slab, set on edge, affords just the space required for the "door" to slide between it and the wall.

Fig. 25. Entrance to Lower Fort, Dunadd, from the outside ; the ascent to the Upper Fort seen through the gap in the background.

Fig. 26. Entrance to the Lower Fort, Dunadd, looking out.

This subdivision covers the approaches to the forts A and B on the ridge, and dominates subdivisions E and F on the plateau.

In *the interior* the soil closely resembled that of the middle upper fort in its depth, blackness, and the abundance of the relics it contained. The only structure found was a winding passage or chamber, opening from the area about 14 feet from the south entrance, and retiring towards the hillside. It is 24 feet long and 4 feet wide, expanding suddenly to 6 feet at the end, where it is closed by a rock. The sides are partly of rock, partly of well-built converging walls, still 3 feet high. The structure seemed to be original, from the style of the masonry, and as several relics were found in it. A short curved wall 18 inches high, with three courses of masonry remaining, proceeds from the north side of this structure to the foot of the rocks, on the south side of the approach to the upper fort A, and there were unmistakable remains of another short wall running directly from it to the foot of the rocks under the same fort.

Subdivision E.

Another quasi-semicircular space, with a base of about 50 feet and greatest radius of 55 feet, at the north corner of the plateau, was found to be cut off by a curved wall originally 80 feet long, the central 60 feet of which survive, and of which there was no sign on the surface. It was carefully built of large flat slabs, with a scarcement to the outside; and although the present width is only 4 feet, it must have been considerably wider originally, in order to bring it to the top of the slope on which it is founded. Its present height is from 9 inches to 3 feet 6 inches.

In *the interior* the rock was either on the surface or so near it that very few relics were found. The only structure within was the "well," 30 feet from the north end of the main wall, and close to a gap, said to have been made by a farmer to give access to the well, which, however, has long been covered with two heavy slabs. According to repute, it was of such depth that the water in it rose and fell with the tidal influence on the river below, but it proved to be rather a cistern than a well,

being a mere cavity in the rock 6 feet deep, and containing little water and no relics.

It was circular, 4 feet in diameter, well built, and surrounded by a pavement of thin flat stones set on edge and radiating outwards (*Proc.*, xxviii., fig. 25, p. 234).

Subdivision F.

Wedged in between D and E this division is of an irregularly curved form. It is only 20 feet wide where it lies against the hillfoot, while the circumference of the outer curve at the rim of the plateau is as much as 180 feet, with 60 more for the straight south-west end. The inner curve is 100 feet long. Measured straight, the area is about 130 by 120 feet.

The same conditions of rockiness and paucity of relics prevail here as in E. Remains of two secondary structures were found. One is 25 feet in from the entrance, and appears to be the S.W. end of a rectangular building or enclosure which had run parallel with the fort wall. The remaining side walls are 30 and 15 feet long, and the end wall is 13 feet long. One angle is rounded. The walls stand upon 18 inches of black earth and are of inferior masonry, proofs of their secondary character. Fifteen feet west of this, two walls, 20 and 15 feet in length, meet at a right angle; they also are poorly built and stand on black earth.

General Remarks on the Results of the Excavation.

The abundance of relics and particularly of querns found within the fortress indicates very clearly that it was no mere temporary refuge, but was permanently occupied. Regarded as a capital, the population, if it was entirely confined within the walls, must have been small, according to our modern ideas, as the enclosed space was only, roughly speaking, 220 feet square, from which a deduction must be made of the uninhabitable rocky hillface falling from the higher on the lower fort. Although it is interesting to have found that the Scots of the day, at least in their capital, did not live in stone houses, this deficiency deprives us of the

best means of estimating the population; but if we take the number of men required to man the whole wall of enceinte, allowing 3 feet of space for each defender, the strength of the garrison would be about 250 men. As, however, the upper fortress was impregnable till the lower one had fallen, a few men would suffice to guard it until the men below were driven back to reinforce them, so that a strength of 150 might have sufficed for the garrison, and the place could not well have held more if the wives and families had also to be accommodated. In that case the population might have amounted to about seven hundred souls. Whether it was augmented by a settlement outside the walls is a question which, in the absence of stone buildings, could hardly be settled by excavation.

The only clues we have to the nature of the dwellings are the abundance of deep black soil and the number of iron articles found in the interior, the one suggestive of the use of sods, the other of wood in the construction of the habitations.

As to the weapons used by the garrison, some half-dozen iron spear- or lance-heads speak for themselves, but no arrow-heads were found, to prove a knowledge of archery, and there was only one fragment of a sword.

The suggestion of Captain Thomas that the kings of Dalriada were inaugurated standing with one foot in the footmark cut near the top of the rock receives some confirmation from the discovery of the carved boar, between it and the cup-like cavity. The great courage of the wild-boar no doubt was the cause of the adoption of that animal as the device of the Twentieth Roman Legion, and the same reason may have commended it to the early kings of Scots. Only two other incised representations of boars have been found in Scotland, both in Inverness-shire,—one, complete, at Knocknagael (*Early Christian Monuments of Scotland:* Descriptive list, fig. 108); the other, incomplete, at Dores (*op. cit.*, fig. 100). The latter, Mr Romilly Allen hesitated to identify as a boar, but the remaining part resembles the corresponding part of the Dunadd boar far more than in the Knocknagael example, so that the claim of the Dores one to be a boar seems now to be established.

Not the least in point of interest among the finds were the cross carved on a quern and the *In* [*n*]*omine* incised on a disc of slate, being the first proofs of Christian influence discovered in the native forts.

Altogether it appears to me that the Society may be congratulated on the results of the investigations at Poltalloch. They do something to elucidate a very obscure period in early Scottish history; they form a basis and encouragement to the further pursuit of comparatively new lines of inquiry; and they have added a large number of interesting relics to the Collection in the National Museum. Finally, it should not be forgotten that these results are due to the liberality of the Hon. John Abercromby in putting the Society in possession of the necessary funds, without which the excavations could not have been undertaken.

DESCRIPTION OF THE RELICS FROM DUNADD, BY DR JOSEPH ANDERSON.

Implements of Stone.—Twenty-two Whetstones of sandstone, clayslate, and quartzite, varying from $10\frac{1}{2}$ inches in length and $2\frac{1}{2}$ inches in breadth to less than half that size, some being squarish in section and used on all four sides, others thinner and used only on their broader faces, while three of the smaller ones are perforated at one end.

Fig. 27. Whetstone of quartzite. ($\frac{2}{3}$.)

Slender and finely-shaped Whetstone (fig. 27) of brownish-red quartzite, tapering equally to both ends, $3\frac{1}{2}$ inches in length.

Thirty other stones of irregular shape, which have been used more or less as Whetstones or Polishers.

Six Polishing Stones, mostly of quartzite and naturally shaped, but bearing marks of use on one or both sides or edges, varying from

6 inches to $2\frac{1}{2}$ inches in length, and from 4 inches to 2 inches in breadth.

Seven quartzite Pebbles of oval shape and naturally rounded, but bearing an oblique groove on one or both faces, and in some cases also with marks of use on one or both edges. They vary in size, but are on the average little more than 3 by 2 inches, and scarcely more than an inch in thickness. One of them is shown in fig. 28.

Three Hammer-stones or Pounders, with ends or sides abraded by use, one having a picked hole near the centre.

Nine Discs of slaty stone, from about $3\frac{1}{2}$ to 2 inches in diameter, mostly rough, but one with smooth edge, another smooth and with a

Fig. 28. Pebble of quartzite with oblique groove. ($\frac{2}{3}$.)

notch on each of its opposite edges, and three with central perforations, roughly made.

Two nearly circular discs of reddish-brown quartzite with rounded edges, about an inch in diameter, somewhat similar to the quartzite discs from Waulkmill, described on p. 215 *antea*.

A circular rotatory Grindstone, of sandstone, $10\frac{3}{4}$ inches in diameter, with central hole for an axle 2 inches square. The stone has been used on one side as a mould for a bar 7 inches long and $1\frac{1}{4}$ inches broad. Half of another Grindstone and part of a third are of smaller size.

About fifty Quern-stones (upper or under) were found, of which the best examples are shown in fig. 29. One of these, of micaceous sandstone, $15\frac{3}{4}$ inches in diameter, with a moulding round the central hole, and a handle-slot on one side, is remarkable in having a small cross-

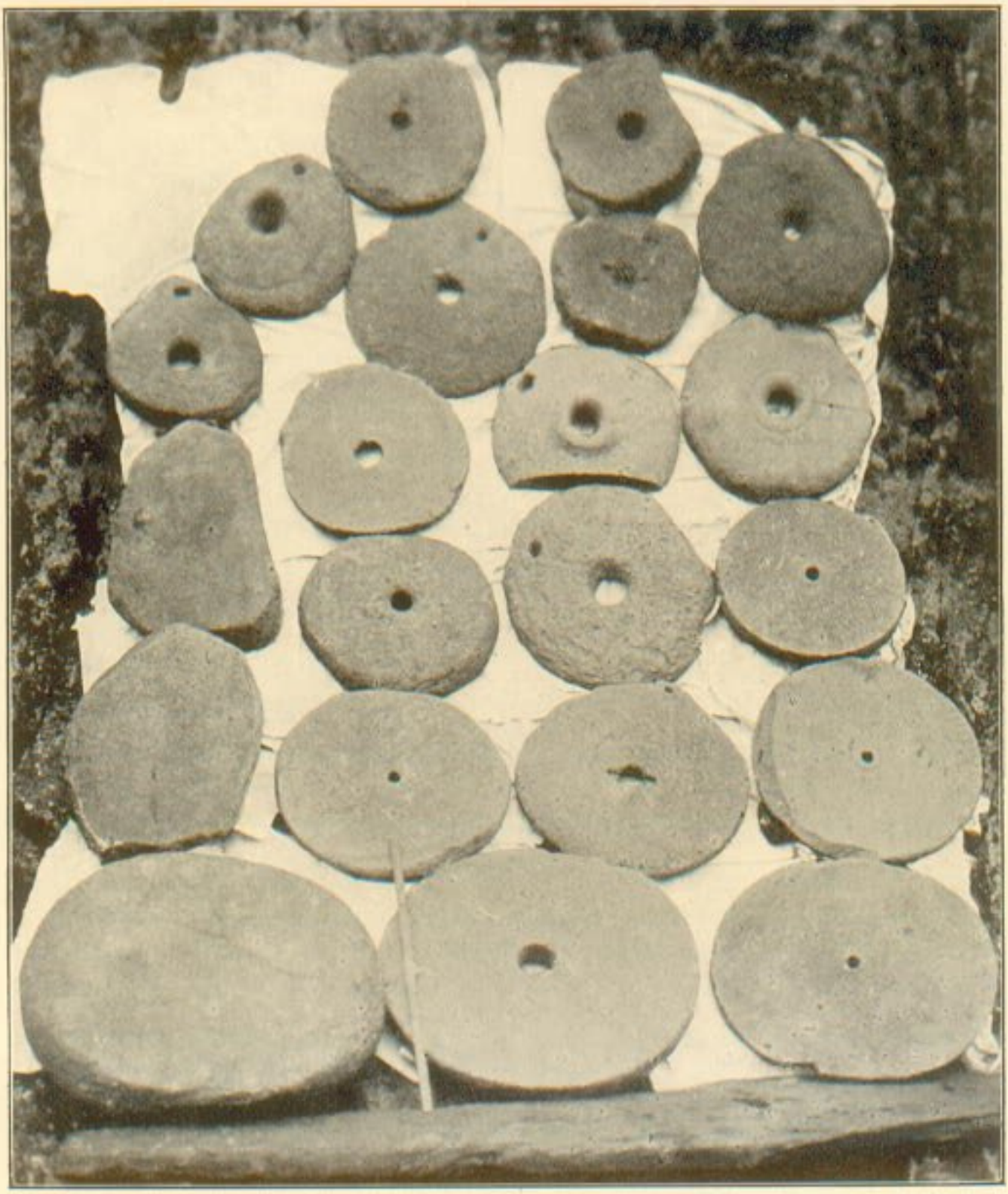


Fig. 29. Eighteen of the Quern Stones and the three Grain-rubbers found in Dunadd.

potent incised near the circumference. It has been reserved for the Museum, along with an incomplete upper Stone, 15¾ inches in diameter, with raised moulding round the central hole and a vertical handle-socket.

Three Stones of Saddle-querns or Grain-rubbers, one being a lower stone and two upper stones.

Two Whorls, one of steatite, 1⅞ inches in diameter, and one of micaceous stone, 1⅜ inches in diameter.

Small lump of hæmatite.

Three Socket Stones, viz., (1) of reddish sandstone, 6¼ by 2¼ inches, having on one face a cup-shaped depression and half of a deep socket-hole, the other part broken away, and on the other face two moulding cavities for bars 3¼ and 2¾ inches in length, and what seems to be a small ring-mould; (2) small angular broken fragment of sandstone, 4¼ inches by 2 inches, showing half of a socket-hole and several grooves made by sharpening; (3) block of stone, 10 inches by 6½ inches, with a socket-hole in the centre; (4) another, 9 inches by 7 inches, with a deep socket-hole.

Three Stones with cup-shaped cavities, one of whinstone, about 9 inches square, with a cup 3½ inches in diameter; another of soft white sandstone, and about the same size, having a large cup-shaped cavity on each face; the third of indurated sandstone, 7¾ by 3 inches, with a deep cup ⅝ inch in diameter, surrounded by a ring 2 inches in diameter, and showing marks on the opposite face of sharpening tools.

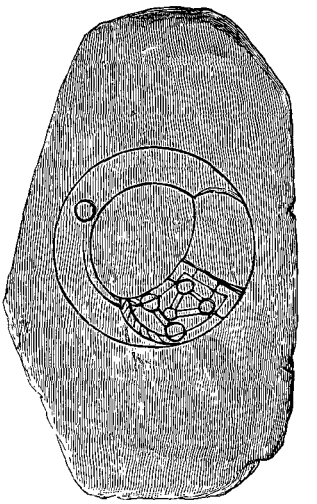
Portion of the side and bottom of a steatite cup, exceeding 4 inches in diameter, and having a raised moulding underneath the rim.

Oblong naturally-shaped piece of greenish slate (fig. 30), 3 inches in length by ⅞ inch in breadth, with one of its surfaces scratched over with irregular scrolls, and a figuring resembling a cross-shaft bearing a square-shaped head. It was found in the fort D.

Oblong piece of smooth fine-grained slaty stone (fig. 31), having the outline of a penannular brooch, with five bosses carefully traced upon it. One half of the brooch has the detail drawn in, the other half is merely outlined. This stone was also found in the fort D.

Small circular Disc of greenish slate (fig. 32), $1\frac{5}{8}$ inches in diameter, having the words I[N] NOMINE incised across the centre in letters somewhat resembling Irish minuscules. It was found in the fort D, close by the roadway leading to the fort A.

Carved Ball of greenstone (fig. 33), $2\frac{3}{4}$ inches in diameter, with six projecting discs. It was found on the rock close to the inside of the

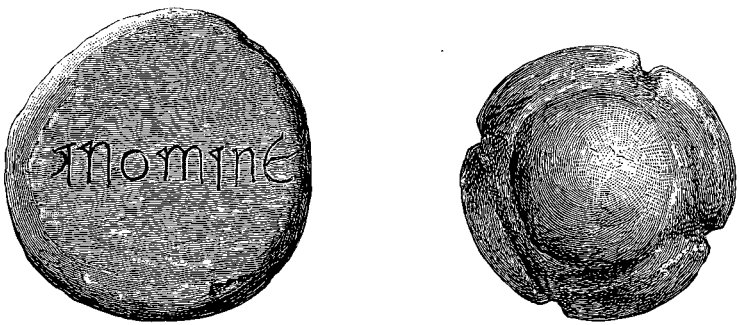


Figs. 30 and 31. Stone with scratched ornament ($\frac{1}{4}$); and Stone with engraved outline of penannular brooch ($\frac{3}{4}$).

wall of the fort A, on its south-east side, and about 12 inches underneath the surface.

Moulds of Stone.—Undressed slab of dioritic stone, 14 inches in length by 5 inches in breadth, with a moulding cavity for a bar 12 inches long; slab of greenstone, $11\frac{1}{2}$ inches in length by $6\frac{1}{2}$ inches in width, with a moulding cavity for a bar 10 inches in length; slab of stone, 9 inches in length by $5\frac{3}{4}$ inches in width, with a moulding cavity for a bar 6 inches

in length; thinnish slab, 8 inches in length by 5 inches in breadth, with a moulding cavity (imperfect) for a bar $5\frac{1}{2}$ inches in length; slab of



Figs. 32 and 33. Stone Disc with inscription ($\frac{1}{1}$); and Stone Ball with projecting discs ($\frac{1}{2}$).

sandstone, $5\frac{1}{4}$ by $4\frac{3}{4}$ inches (fig. 34), with a circular cavity $\frac{5}{8}$ inch in diameter and slightly over $\frac{1}{4}$ inch in depth, and a cavity with its sides

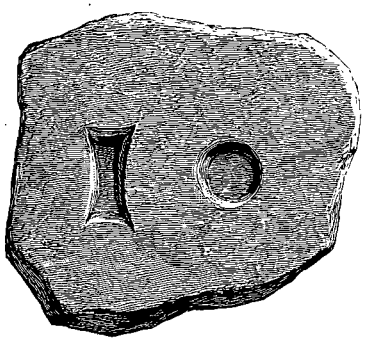


Fig. 34. Stone Mould with two cavities. ($\frac{1}{2}$.)

curved slightly inwards, $1\frac{3}{8}$ inches in length by $\frac{3}{4}$ inch in width at the ends and $\frac{5}{8}$ inch in the middle, the depth not exceeding $\frac{3}{8}$ inch in the centre, and shallowing slightly to the sides and ends; rough flat slab of greenstone, $5\frac{1}{4}$ by 5 inches, with a bar-mould $3\frac{1}{4}$ inches in length, and

a moulding cavity 3 inches in length, of oval shape, with handle at one end, like that on the reverse of fig. 8 (p. 268), from Ardifuar.

Mould of Clay.—Mould of clay (fig. 35) for a small penannular brooch, $\frac{3}{4}$ inch in diameter.

Crucibles of Clay.—Crucible, cup-shaped (fig. 39), with rounded bottom, 3 inches high, and $3\frac{1}{2}$ inches in width at the mouth, which has a slight lead in the lip at one side for pouring; traces of bronze adhere to the inside.

Three fragments of smaller Crucibles of a rounded cup-shape.

Crucible of clay, of deep cylindrical form (fig. 38), rounded off below, somewhat like the bowl of a tobacco-pipe, $2\frac{3}{8}$ inches in height and $1\frac{3}{8}$ inches in diameter at the mouth, having a short, flat handle projecting obliquely upwards from the middle of its height.

Crucible of clay, of broader form and thinner fabric (fig. 36), $1\frac{7}{8}$ inches in height, slightly imperfect at the mouth, and bulging outwards below to an extreme width of $1\frac{5}{8}$ inches, with a short, broad, flat handle, projecting almost horizontally from about the middle of its height. Traces of bronze are visible, adherent to the interior of the vessel.

Crucible of clay, small and cylindrical-shaped (fig. 37), and narrowing below like the bowl of a tobacco-pipe, $1\frac{1}{2}$ inches in height, and $\frac{3}{4}$ inch diameter at the mouth, with a short, flat handle projecting obliquely upwards from about the middle of its height.

Crucible of clay (fig. 40), small and almost saucer-shaped, with flat bottom, the sides only $\frac{3}{4}$ inch in height, the mouth slightly oval, and $1\frac{5}{8}$ inches in greatest diameter.

These crucibles were all found in the fort D.

Pottery.—Portion of the lip of a large jug-like vessel of coarse reddish wheel-made ware (fig. 41), showing a wide shallow spout.

Several fragments of rims and handles of vessels of similar ware.

A portion of a basin-shaped vessel of coarse grey ware, blackened by fire.

Two pieces of wheel-made, salt-glazed ware, and a number of fragments of rude, unglazed pottery not made on the wheel.

Fig. 35.

Fig. 36.

Fig. 37.

Fig. 38.

Fig. 39.

Fig. 40.

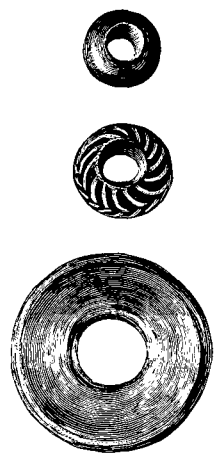
Figs. 35–40. Mould of clay, three Crucibles with handles, and two without handles, from Dunadd. (Figs. 35 and 40 are actual size, the others $\frac{3}{4}$).

Glass or Vitreous Paste.—Flat ring of clear green glass (fig. 42), 1 inch in diameter. It was found in the fort D.

Bead of dark blue vitreous paste with whitish stripes (fig. 43), ½ inch in diameter.

Bead of dark blue vitreous paste (fig. 44), plain, ⅜ inch in diameter.

Fig. 41. Fragment of large Jug of red ware. (⅜.)



Figs. 42–44. Beads of glass. (1.)

Jet, or Cannel Coal.—Disc, 3⅛ inches in diameter, cut out in the process of making an arm-ring.

Five portions of finished arm-rings, and a portion of one in the rough, flat and unpolished.

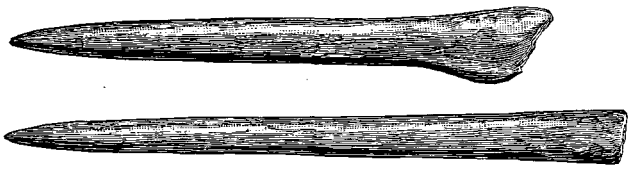
Bone Implements.—Punch of bone, 3½ inches in length, the point showing signs of use.

Pin or bodkin of bone (fig. 46), 6½ inches in length, well rounded, and the point end polished by use.

Pin of bone, with flattish head (fig. 45), $5\frac{1}{4}$ inches in length, apparently made from the wing-bone of a large bird.

Bone handle for a tool, with a hole for the tang, $3\frac{1}{2}$ inches in length, cylindrical and roughly made.

Portions of antlers of red deer, cut and sawn across.



Figs. 45 and 46. Pins of bone. ($\frac{1}{2}$.)

Comb of bone (fig. 48), $2\frac{1}{2}$ inches by 2 inches, double-edged, and nicely ornamented. It is made, in the usual way, of small sections toothed at each end, the binding slips on either side secured by iron rivets. It was found on the subsoil in the fort B.

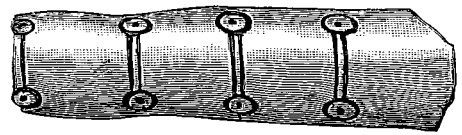


Fig. 47. Bone with incised ornament. ($\frac{1}{1}$.)

Narrow section of a cylindrical piece of bone (fig. 47), $2\frac{1}{4}$ inches in length, with an ornamental pattern of two circles, with central dots, connected by two parallel lines. It was found under the surface layer, on the subsoil, in the fort B.

Bronze Pins.—Pin $3\frac{1}{2}$ inches in length (fig. 50), with projecting head of squarish form, the front slightly sunk, and showing incised markings, surmounted by three bars, with ends projecting forwards. It was found under the debris of an interior building in the fort F.

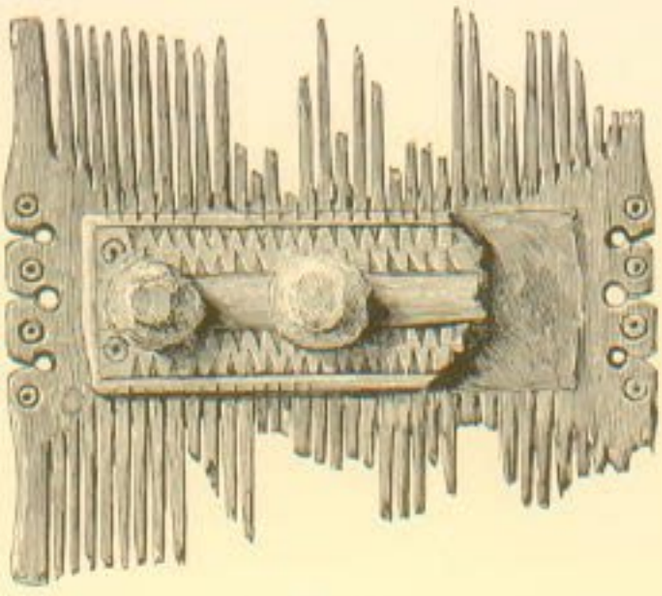


Fig. 48.

Fig. 49.

Fig. 50.

Fig. 51.

Fig. 52.

Figs. 48–52. Comb of bone (½); two bronze Pins (½); long-handled Comb of iron (½); and Comb of iron with loop handle (½), from Dunadd.

Pin, $3\frac{1}{2}$ inches in length (fig. 49), with open circular head, carried on a projecting neck almost at right angles to the stem. It was found in a cleft of the rock, just under the surface, in the passage leading into fort A.

Iron Implements.—Comb of iron (fig. 51), with long handle, $6\frac{1}{4}$ inches in length, the upper part of the teeth covered with oxidation.

Comb of iron (fig. 52), single-edged, 4 inches in length and $2\frac{3}{4}$ inches in width, with open curved handle at the back, the body of the comb and upper part of the teeth also encrusted with a mass of oxidation.

Eight tools, all of the same form (fig. 53), and almost of the same size, $5\frac{1}{2}$ to 4 inches in length, and $\frac{1}{2}$ to $\frac{3}{4}$ inch at the widest part, with a long slot in the upper part, and tapering to a point below.

Nine Knife-blades with tangs, from $4\frac{3}{4}$ inches to $3\frac{1}{2}$ inches in length, of which one is shown in fig. 59.

Seven Spear-heads, with sockets more or less complete, from $7\frac{1}{2}$ inches to $3\frac{1}{2}$ inches in length. Four of these are shown as figs. 55–58. They were all found in the fort D.

Portion of the point end of a double-edged Sword-blade, $7\frac{1}{2}$ inches in length, and $1\frac{1}{2}$ inches in width.

Two thin convex Discs, 3 inches in diameter.

Penannular Ring (fig. 54), 5 inches in diameter, with recurved ends.

Flattened Ring, $4\frac{1}{2}$ inches in diameter, with flanged edges, and two other flattened rings, also $4\frac{1}{2}$ inches in diameter, corroded together.

A Knife-blade still in its handle of wood is shown in fig. 60; total length of blade and handle, 7 inches.

A large iron staple, and a number of broken and corroded fragments of various iron implements of indeterminate use.

Undoubtedly the most interesting objects in this group of relics from Dunadd are the crucibles and moulds, testifying to the proficiency of the occupants in the art of casting in bronze. The crucibles are of two kinds: a large cup-shaped variety (fig. 39), capable of holding a considerable quantity of metal, and a smaller size (figs. 36–38), shaped like the bowl of a big tobacco-pipe, and having a side-handle for lifting it by. Of the

Fig. 53.

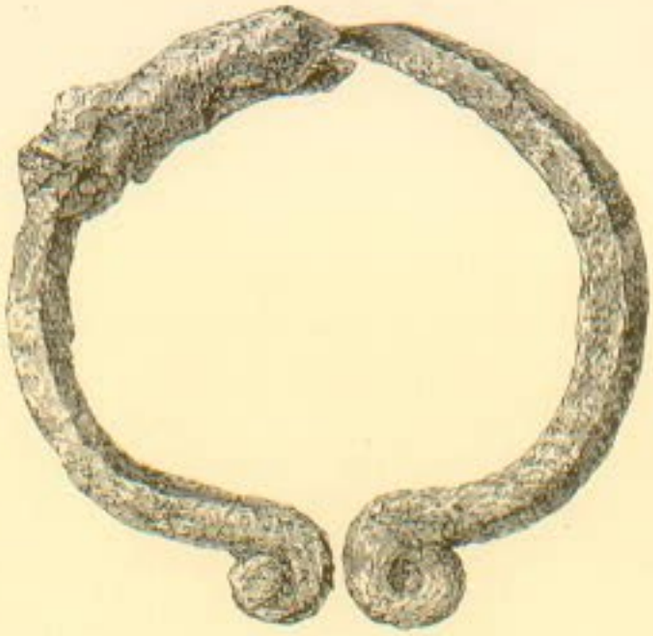


Fig. 54.

Fig. 55.

Fig. 56.

Fig. 57.

Fig. 58.

Fig. 59.

Figs. 53–59. Iron Implement with longitudinal slot ($\frac{1}{2}$); Knife-blade ($\frac{2}{3}$); four Spear-heads ($\frac{1}{2}$); and penannular Ring of iron with recurved ends ($\frac{1}{2}$).

larger size there is one example entire, and several fragments which may belong to two or three more vessels. Of the smaller size there are four examples. Two have the remains of the bronze still adhering to them. The moulds are of two varieties, the larger sizes in stone and the smaller in clay. The most common form of mould in stone is that for a straight bar, varying from $2\frac{1}{2}$ to over 10 inches in length. There is a dainty little clay mould (fig. 35) for a small penannular brooch, less than an inch in diameter. There is also on the smooth surface of a very fine-grained stone an outline drawing (fig. 31) of a penannular brooch with expanded ends, ornamented with five bosses. It is of the nature of a working sketch, the details being filled in for one-half of the brooch only. Of the manufactured bronze there are two fine pins (figs. 49, 50), each about 4 inches in length, both carrying their heads projected forward.

Fig. 60. Iron Knife still in its handle ($\frac{1}{2}$).

There is evidence, too, of the working of the coarse variety of jet or lignite, or cannel coal, so often employed in Scotland for the making of such ornaments for the person as necklaces and arm-rings or bracelets. We have here evidence of the whole process, from the crude fragment with the blocking outlines roughly drawn on the surface, to the flat disc cut out of the opening of the bracelet and the flat ring which was to be ground down to the proper shape, and portions of the finished bracelets, more or less complete. Of bone, there is a double-edged comb (fig. 48) about $2\frac{1}{2}$ inches in length, made in the usual way of several pieces fitted together and kept in place by a band of bone about half an inch in breadth, which passes along the centre of the comb on each side and is secured by iron rivets. This comb is prettily ornamented by dots and circles, alternating with circular pierced openings at either side, and the central band has a double row of zigzag

carving. A part of a cylindrical piece of bone (fig. 47) is ornamented with pairs of circles with central dots, each pair being connected by two parallel lines less than a tenth of an inch apart. The only other bone instruments are two stout pins (figs. 45, 46) and a punch.

Among the most interesting of the stone objects are the small Disc (fig. 32) with the words IN [N]OMINE incised in lettering bearing a strong resemblance to Irish minuscules, and the Stone with the drawing of the penannular brooch already mentioned. There is another stone with a drawing (fig. 30). It is a splinter of soft slaty rock, somewhat waterworn, and bears on two different levels of its broader side a design like a square-headed cross and a nondescript scribble of scrolls. A rather surprising item among the stone implements is the stone ball (fig. 33) with six circular projecting discs. Of all the many examples we have and know, this is the only one that has hitherto been found with definite associations. There is also one of those small whetstones of quartzite (fig. 27) which have been hitherto found singly and with no definite associations. Among the polishing stones, of which there are a great many of various shapes and characters, there is one which may have been used to give the finishing polish to the jet bracelets of semicircular section; and the same may be said of a thin piece of sharp sandstone, the edges of which have been worn into semicircular hollows of different diameters, probably in the same operation. There are also well-made and well-used circular rotating grindstones of sharp sandstone.

Of the oval-shaped quartzite pebbles, with narrow oblique hollows worn in the middle of their flatter faces (as in fig. 28), there are no fewer than seven. These are a well-known type of Iron Age implement, though their exact purpose is not well understood. They are not uncommon in Norway in the first division of the Iron Age, and we have them also occasionally from the brochs. Of whetstones, with a perforation for suspension at one end, there are three. A few stone whorls testify to the use of the spindle and distaff; and there is a portion of a steatite cup with a moulding round the circumference underneath the brim, which is analogous to the steatite cups found occasionally in

the brochs. Two upper quern stones of elegant shape have been selected from the many found. One of these is specially interesting, because it is signed near the edge with a small cross-potent. Although some of the pottery is hand-made and unglazed, the bulk of it is wheel-made and glazed, the unglazed appearance of some of the wheel-made vessels being due to the glaze scaling off, as happens with much of the older pottery of this description.

Taking the iron articles as a group, they show a very considerable exercise of the smith's industry. There are eight or ten spear-heads (figs. 55-58), and about the same number of knife-blades, one of them (fig. 60) still in the handle. Of three large rings, one has the peculiar section of a bronze caldron ring. Another large iron ring (fig. 54) is penannular and has the ends turned back circularly. The most curious things, however, are the implements (fig. 53) shaped like the legs of a pair of adjustable compasses, of which there are seven or eight. They are nearly all about the same size, 5 to 6 inches long, and I am unable to offer even a suggestion as to their probable purpose. The occurrence of combs in iron is also a new feature. Here we have the round-backed comb (fig. 52) with the back forming a loop-handle, and the long-handled comb (fig. 51), in iron for the first time. The round-backed comb of this form and of largish size occurs in Denmark and Norway in their Older Iron Age, but I have not met with any example of the long-handled comb in iron.

The results of the excavation of these four forts are certainly the most interesting and important that have hitherto been obtained from any exploration of native sites as yet undertaken by the Society. They not only present a considerable number of new types of objects, but they have also greatly extended our knowledge of the associations of objects of previously known types which, however, had not hitherto been found in associations assigning them to any well-defined period. We have now obtained a large group of objects which are definitely associated with the group of forts, and from which the relations of the forts themselves to the later period of the Iron Age, in post-Roman and Early Christian times, are conclusively demonstrated.