## V.

# SOME OBSERVATIONS ON THE BROCHS. By A. GRAHAM, M.A., F.S.A.Scot., F.S.A.

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### SUMMARY OF CONTENTS.



## 1. Introductory.

The main features of the typical broch are very well known, and general information on the subject is not difficult to come by.[1] Further detailed descriptions of individual brochs are to be found here and there

[1] *E.g.* Anderson, *Scotland in Pagan Times: the Iron Age*, pp. 174 ff.; *Antiquity*, vol. i. pp. 290 ff., R.C.A.M., *Inventory of Orkney and Shetland*, vols. i. pp. 31 ff.; ii. Nos. 263, 553; iii. Nos. 1149, 1206, 1246.

in the literature,[1] and the inferences regarding their origin and date that can be drawn in the light of the most recent evidence have been discussed by Professor Childe.[2] But as soon as we leave the realm of generalities we encounter a considerable body of facts which are much less familiar to antiquaries, and these, though they may not lead to important new conclusions, are yet relevant to any attempt to fill in the outline sketch and at the same time possess a certain intrinsic interest. The purpose of the present paper is accordingly to make some of these facts conveniently accessible to future students of the subject; they relate mainly to the distribution and to the physical features of the brochs, while a list of the structures themselves is given in an Appendix.[3]

The material on which the paper is based has been taken for the most part from the published descriptions of the brochs, but these descriptions have been eked out with information gained in some cases by personal visits to the monuments themselves, and in others by discussion with observers whose experience has been wider than my own. And here I desire to express my particular indebtedness to Professor Godfrey Thomson, D.C.L., D.Sc., for the statistical and other calculations that he was good enough to make on my behalf; to Mr A. O. Curle, C.V.O., LL.D., F.S.A., Mr G. P. H. Watson, F.R.I.B.A., R.S.W., F.S.A.Scot., and Mr C. S. T. Calder, A.R.I.A.S., F.S.A.Scot., who have given me the benefit of their intimate acquaintance with a very large number of brochs; to Professor V. G. Childe, D.Sc., D.Litt., F.B.A., F.S.A., Mr J. S. Richardson, F.S.A.Scot., H.M. Inspector of Ancient Monuments, Professor S. Piggott, B.Litt., F.S.A., Mrs Piggott, F.S.A., and others who have given me information on a variety of points; and to the Royal Commission on the Ancient and Historical Monuments of Scotland for permission to make use of certain unpublished data.

## 2. Numbers and Distribution of Brochs.

It will be convenient for the purposes of this paper to regard Scotland as being divided into the following six regions, shown on the map in fig. 1:

[1] E.g. *Archæologia Scotica*, vol. v. pp. 71 ff., where references are given to eighteenth-century notices of certain brochs; *ibid.*, pp. 341 ff. and 365 ff.; Beveridge, *Coll and Tiree*, pp. 73 ff.; *Proceedings of the Orkney Antiquarian Society*, numerous articles on the Orkney brochs; *Proceedings of the Society of Antiquaries of Scotland*, numerous papers, of which the most important are: vols. xxxv. pp. 122 ff.; l. pp. 241 ff.; lv. pp. 83 ff. and 110 ff.; lxviii. pp. 444 ff.; R.C.A.M. County Inventories, especially of Caithness, Sutherland, Orkney and Shetland, and the Outer Hebrides, Skye and the Small Isles. These Inventory articles contain many references to descriptions in *P.O.A.S.*, *P.S.A.S.*, and elsewhere; while for areas which have not yet been inventoried some literary references have been given in the Appendix at the end of this paper.

[2] *Prehistory of Scotland*, pp. 197 ff., and Map IV; *Prehistoric Communities of the British Isles*, pp. 246 ff.; *Scotland before the Scots*, pp. 89 f. and 128 f.

[3] This list brings up to date an earlier one published in *The Antiquaries Journal*, vol. xxiii. Nos. 1, 2, pp. 19 ff., by embodying the results of field-work done since the earlier list was drawn up. It also includes a number of "comparable structures."

I. Shetland; II. Orkney; III. Northern Mainland, *i.e.* the mainland lying north of a line drawn from Gruinard to Tain; IV. West Coast and Inner Islands, comprising the western coastal areas from Gruinard to Kirkcudbright with the islands of Skye, Raasay, Tiree, Mull, Islay, etc.; V. Outer Islands; VI. Central and Eastern Mainland, or virtually the rest of

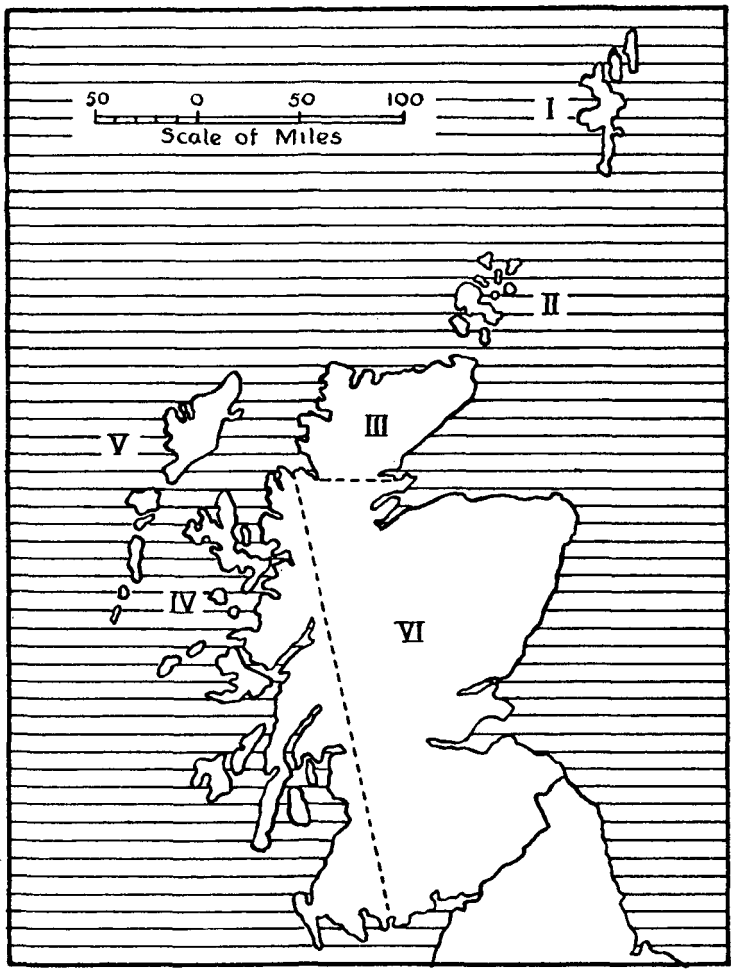


Fig. 1. Sketch-map of Scotland, showing subdivision into Regions.

the country. The quantity of material available, and its distribution among these six regions, is shown in Table I, while detailed information, with references to literature, will be found in the Appendix.

In the table opposite, "brochs" (col. *b*) are structures positively identified as brochs and still showing remains; "broch sites" (col. *c*) are

the sites of vanished structures known to have been brochs; "uncertain examples" (col. *d*) are structures some of which probably are and others may possibly be brochs, though none have been identified as such; and "comparable structures" are not brochs but embody certain features which also appear typically in broch architecture. With the unimportant exceptions noted below under (i) and (ii) the foregoing classification follows the published accounts of the structures, and in particular no attempt has been

TABLE I.—NUMBERS AND DISTRIBUTION OF BROCHS.

| Region. (*a*) | Brochs. (*b*) | Broch sites. (*c*) | Uncertain examples. (*d*) | Totals of cols. (*b*) to (*d*). (*e*) | Comparable structures. (*f*) |
|---|---|---|---|---|---|
| I. Shetland . . | 51 | 30 | 14 | 95 | 2 |
| II. Orkney . . . | 42 | 20 | 43 | 105 | .. |
| III. Northern Mainland . | 169 | 17 | 41 | 227 | 2 |
| IV. West Coast and Inner Islands . . | 28 | .. | 21 | 49 | 28 |
| V. Outer Islands . . | 8 | .. | 20 | 28 | 6 |
| VI. Central and Eastern Mainland . . | 6 | .. | 2 | 8 | .. |
| Totals . . | 304 | 67 | 141 | 512 | 38 |

made to discuss or appraise the distinction at present recognised between the brochs and the broch-like "galleried duns," or to discuss how, if at all, they are related. For this far too little evidence seems to be available as yet, and the most that can usefully be done is to sound some notes of warning.

The following points may be noted in connection with the foregoing table:—

(i) While the figures are not exactly the same as those given by Childe [1] or by the Ancient Monuments Commission,[2] the differences are small and

[1] *The Prehistory of Scotland*, Map IV. [2] *Inventory of Orkney and Shetland*, vol. i. p. 31.

affect only points of detail. As will be explained in the next sub-section, rather more "uncertain examples" have been recognised in the Inner and Outer Islands than were included in the Commission's estimate.

(ii) It would be wrong to pay too much attention to the fact that the figures in columns (*b*), (*c*), and (*d*) do not stand in any regular ratio to one another, or to their totals (col. *e*), in the several regions. This apparent irregularity is probably due in great part to special circumstances that affected the compilation of the records. Thus the comparatively high proportion of "uncertain examples" recorded in Orkney may be due to the possibility—always present to the minds of the Ancient Monuments Commission's officers—of unexplored mounds turning out to be chambered cairns rather than ruined brochs; this was probably felt to be of greater urgency in Orkney than in either Shetland or the Northern Mainland. The proportion of "uncertain examples" is also high in Regions IV and V, but here again possible explanations exist. Region IV, for example, contains the island of Tiree, with a series of monuments which have been so poorly described that their true nature is doubtful, but which are far more likely to be brochs than anything else; and also Mull, where some structures exist which cannot be positively identified without excavation. In Region V, again, discrepancies appear between the Ancient Monuments Commission's lists and data put on record by Captain Thomas.[1] It seems clear that the Commission's surveyor, in certain cases, classified as "duns" ruins which had become quite featureless by the date of his visit but which Thomas, more than fifty years earlier, had seen reason to identify as brochs. Some "uncertain examples," not recognised by the Commission, have accordingly been admitted here. The absence of "broch sites" in Regions IV and V likewise suggests a difference in the methods of the Commission's survey from those employed in Regions I, II, and III. The "total" figures, however, as given in column (*e*), go some way towards evening out these accidental discrepancies.

(iii) All the totals given are likely to be below the numbers that originally existed. For one thing, brochs are particularly liable to destruction by farmers and by builders, as they provide large quantities of useful stone and are often situated on good agricultural lands; for this reason the rate of their destruction will have been exceptionally heavy in the better agricultural districts, such as parts of Orkney and Caithness. Again, no brochs are recorded on the long stretch of coast between Loch Broom and the Kyle of Loch Alsh; this area has not been surveyed by the Ancient Monuments Commission and is also difficult of access to casual antiquaries; it may therefore be that some further examples remain to be discovered in this district.

(iv) While nothing would be gained by attempting to express the density

[1] *Arch. Scot.*, vol. v. pp. 365 ff.

of brochs in any given region on a basis of their numbers per square mile, the heavy concentrations occurring in the Northern Mainland, in Orkney, and in Shetland immediately leap to the eye. The concentration in the Outer Islands will likewise appear fairly heavy if account is taken of the poor quality of much of the land. The West Coast and Inner Islands, however, show a considerable falling-off; while Region VI, which comprises the whole of the rest of the country, is hardly in the picture at all.

(v) If it is assumed that any type of structure is to be found in its greatest numbers and highest development at or near its place of origin, the foregoing facts would be enough to prove that the broch was a product of Regions I, II, or III, or possibly of Region V. They would, however, hardly provide a criterion for preferring any one of these four to the others. But in view of the broch-builders' admitted ability to move about freely by sea, it would clearly be unsafe to be guided by any such assumption in the present case, as the broch might easily have been transferred, by sea-going people, at an early stage of its history, from its place of origin to another accessible locality—in which, again, it might later have enjoyed a long and eventful life. It will therefore be best simply to note the distribution without venturing to define its significance.

(vi) In contrast to what was said above under (iv), nearly all the "comparable structures" occur in Regions IV and V, that is to say on the Western Mainland coast or in the Inner or Outer Islands. Consequently, if any of these structures were assumed to be ancestors of the broch, we should have to suppose that this latter was first evolved in the west, perhaps in the Hebrides, that it was imported thence to the mainland and the northern isles, and that it subsequently attained its greatest numerical development in these localities. This assumption, however, cannot at present be based on any more solid grounds than superficial resemblances in points of structural technique, and in view of the proximity of Ireland, with its own school of galleried building, it would be unwise to draw premature conclusions about the broch's place of origin from mere considerations of typology and distribution.

(vii) The total number of brochs is sufficiently large to make it clear that, in the area and period of their most general use, they must have been an extremely important social factor. It must not, of course, be assumed that all brochs are of the same age—indeed, brochs are sometimes placed so close to one another that the opposite conclusion seems probable, while the technical skill shown by their builders is so great as to argue long experience in dry-stone construction. Mid Howe and West Howe, or Dun Troddan and Dun Telve, might be suggested as cases in point, or the series occurring on the north shore of the Loch of Harray. Moreover, that a broch might collapse in early times was proved by excavation at Gurness; while Mid Howe had to be shored up, though at a late stage in its career,

and rebuilding seems to have taken place at Kintradwell. Oxtro, again, must have already been reduced to the condition of a grass-covered mound by the date at which Norsemen used it as a place of burial; and other similar examples could probably be cited. On the other hand, there is nothing in their respective states of preservation to suggest that, *e.g.*, Dun Telve and Dun Troddan are not more or less contemporary. However this may be—and the answer to the problem can only be given by the spade—it is clear that the broch is not to be regarded as a mere architectural freak but, as Professor Childe has already shown,[1] possesses an historical significance which is comparable, in its way, with that of the mediæval castle.

### 3. Architectural Features.

(i) *Entrances.*—Some sort of information, not always very full, is available about the entrances of ninety-six brochs and "uncertain examples"; but nothing like this number are in good preservation, and the lintels of the entrance-passage are still in position in less than a dozen cases. Normally there is a single entrance only; the entrance-passage passes radially through the wall and has a "guard-cell" on one or both sides; there are checks in the sides of the passage to receive a door, often with stone slabs for door-jambs and a transverse kerbstone for threshold. The door-fittings are frequently double, one set being placed outside the doorways of the guard-cells and the other inside. The doors were evidently secured by massive wooden bars, sliding in holes of which the inner ends sometimes ran back into the guard-cells. The passages are clearly intended for the strict control of entrants, being rarely over 4 feet in width and frequently as narrow as 2 feet 6 inches or less at their outer ends,[2] and being subject to further constriction where the door-jambs project from the passage walls.

The foregoing normal arrangement is, however, subject to modification in certain cases. The first of these consists of the possession of more than one entrance, as two entrances are recorded in each of seven cases, and one broch (Clickhimin) has three. But this departure from the general rule is more apparent than real, as the secondary character of one of the two entrances is certain in two brochs (Ness and Yarrows), and seems to stand to reason in three others (Brounaban, Keiss, and Keiss Road). At Dun Fhiadhairt, too, the second entrance may possibly be secondary, though no trace of disturbance exists, as it is abnormally small and also leads out past the base of the stair where the wall could have been pierced with least difficulty and with least danger of collapse. Nor is it easy to see why a

[1] *The Prehistory of Scotland*, p. 204.

[2] A number of samples taken from the "certain" brochs gave the following average breadths: Shetland, 2 feet 3½ inches; Orkney, 3 feet 7 inches; Caithness, 3 feet ½ inch; Sutherland, 2 feet 11 inches; Outer and Inner Islands, 2 feet 8 inches. The passage at Everley is recorded as having been narrowed to 1 foot 6 inches between the door-jambs.

primary entrance should have been so placed as to render the stair, which was presumably an important defensive feature, so easily accessible to intruders.[1] The remaining example, on Freswick Links, has now completely disappeared, but a photograph[2] preserved in the Library of the Society of Antiquaries of Scotland supports the idea that the entrance at the base of the stair was secondary. Of the two extra doorways at Clickhimin, one, as at Dun Fhiadhairt and in some of the Caithness examples, passes out at the bottom of the stair, while the other opens from a passage where the thickness to be pierced is not great. Both these last are also above ground-level,[3] and neither possesses any of the normal features of a broch entrance. There is therefore nothing in any of these cases to modify the accepted view that the typical broch possesses one entrance only.

Other divergences are less important. In nine cases the passage is not on a strictly radial line, but either runs somewhat obliquely through the wall or is slightly curved (*e.g.* Coldoch and Tor Wood).[4] Frequently, again, the passage is not of equal width throughout, but expands slightly behind the checks (*e.g.* Netlater), and this plan may be varied further by a contraction at the inner end (*e.g.* Dun Telve). At Dun Ard an t-Sabhail the passage is broadest at its outer end. The apparently pointless arrangement of placing the checks inside the guard-cells, which is noted at the Castle of Bothican and at Dail Langwell, can be explained by supposing that an outer door existed as well, outside the checks, but that its frame was wooden and has perished. This suggestion is supported by there being a cavity for a wooden door-jamb at the Hill of Works, and it would also fit the cases in which there are no checks at all (*e.g.* Dun Ard an t-Sabhail) or only one (*e.g.* Lingro).

Some miscellaneous features of interest are the spaces left between the lintels of the entrance-passage (*e.g.* Mid Howe), perhaps to provide for defensive action from a room over the passage; drains running out from the court, under the passage (*e.g.* Nybster); and the use, as outer lintels, of massive blocks of stone triangular in elevation (*e.g.* Culswick). Four such lintels survive, and a fifth is recorded at the vanished Dun Alascaig;[5] and while no doubt partly ornamental, they may also reflect the idea that a lintel's maximum bending moment is at the centre of its span, and that it

[1] This last consideration will also apply to Brounaban, Keiss, and Keiss Road if the stairs in question are themselves regarded as primary. On this see p. 65.

[2] The position of Freswick House in the background of this photograph proves that the north point has been reversed in the published plan (R.C.A.M., *Inventory of Caithness*, p. 14).

[3] Gordon appears (*Itinerarium Septentrionale*, p. 166) to have entered Dun Telve through "a hole" at the level of the second gallery (*cf.* p. 82); and while this may well have been made by a previous explorer, or have resulted from the decay of the structure, it is just possible that it may have been a subsidiary entrance like those seen at Clickhimin.

[4] This latter feature may be a local peculiarity, as it has not been noted elsewhere than in these two examples, which are only some thirteen miles apart.

[5] The triangular block found outside the broch at Keiss had no doubt originally served as yet another example.

consequently needs to be strengthened at this point. The discovery of socketed stones in some excavated entrance-passages shows that in these cases the doors turned on pintles.

Though broch doorways are of course larger than those of the Stone Age settlement at Skara Brae, it is remarkable to see how they reproduce what is virtually the same arrangement of jambs, sills, and bar-holes.

(ii) *Guard-cells.*—The positions of the guard-cells are known in eighty-four cases, and analysis of these shows that what is often thought of as the normal arrangement of the cells, *i.e.* one on either side of the entrance-passage, in fact occurs in only eighteen cases (21 per cent.); a single cell occurs in forty-four cases (52 per cent.)—thirty-four (40 per cent.) on the entrant's right and ten (12 per cent.) on his left—while in twenty-two cases (26 per cent.) there are no guard-cells at all. Provision is thus made, where guard-cells exist, for engaging attackers on their open or shieldless side in fifty-two cases (62 per cent.) and on their covered side in only twenty-eight (33 per cent.). The geographical distribution of these several arrangements is shown in Table II.

TABLE II.—GUARD CELLS.

| Region. | Cell on | | | Total defence on attackers' | | No cells on entrance-passage. | Totals of cols. |
|---|---|---|---|---|---|---|---|
| | open side. | covered side. | both sides. | open side. | covered side. | | |
| (*a*) | (*b*) | (*c*) | (*d*) | (*b*)+(*d*) | (*c*)+(*d*) | (*e*) | (*b*)+(*c*)+(*d*)+(*e*) |
| I. Shetland . . . | 2 | .. | 1 | 3 | 1 | 4 | 7 |
| II. Orkney . . . | 5 | 1 | 5 | 10 | 6 | 2 | 13 |
| III. North Mainland . | 21 | 2 | 8 | 29 | 10 | 10 | 41 |
| IV. West Coast and Inner Islands . | 4 | 5 | 2 | 6 | 7 | 4 | 15 |
| V. Outer Islands. . | 1 | 1 | 1 | 2 | 2 | .. | 3 |
| VI. Central and Eastern Mainland . . | 1 | 1 | 1 | 2 | 2 | 2 | 5 |
| Totals . . | 34 | 10 | 18 | 52 | 28 | 22 | 84 |

On the shape and size of guard-cells, however, evidence is only forthcoming from thirty-eight brochs, and the impression that it gives is very varied. The cells are in general round, oval, elongated-oval, sub-oval with straightish sides and inner end, or squarish; but there seems to be no ruling system, and two cells of different size and shape may occur in the same broch. Squarish cells, however, seem to occur only in Orkney, with the possible addition of one at Torwoodlee; and in Orkney likewise are the only two certain cases,[1] Gurness and Mid Howe, of guard-cells which end internally in complete mural galleries. One broch in Shetland (Clumlie) has a guard-cell with a second door opening into the court; elsewhere this arrangement occurs only at Dun Beag in Skye, at Ousedale Burn in Caithness, and at East Kinnauld in Sutherland.[2] Otherwise the cells in both Outer and Inner Islands are chiefly oval or round, and are often small; and the oval or elongated-oval plans prevail in the other districts. At Hillhead (Caithness) both cells are long and slightly curved, tapering at their inner ends.

(iii) *Mural Cells and Basal Galleries.*—The arrangement of mural cells, other than those at the entrance, and of lengths of gallery where these occur at ground-floor level, is so varied that it defies summary description. Moreover, many of the brochs in which traces of cells and basal galleries can still be made out are so ruinous that no detailed measurement or planning of these features has been possible, while in addition some of the older descriptions are regrettably imprecise. It must therefore suffice to say that the mural cells are generally of beehive form, and are rarely lintelled; that they are usually round, oval, or elongated to a club-like form; and that a single entrance from the court may often give access to two cells, or to a cell and a staircase, opening to right and left. The cells are unlighted, and a few contain aumbries.

Some details, however, can be given regarding the openings leading to the cells, as these are more adequately recorded than the cells themselves. Thus, if we confine our inquiry for the present to brochs in which cells alone occur at ground-level, or cells with lengths of gallery so short as to be comparable with cells, and postpone discussion of those in which true galleries are found, we can point to fifty-three structures—of which a few are "uncertain examples"—in which the number and positions of openings leading to mural cells can be discovered or confidently inferred. "Position" is here taken as meaning position in the circuit of the wall relatively to the broch-entrance, and accordingly those cases—mentioned in the previous section—in which the original position of the broch-entrance was itself in doubt have been omitted from the count.

The numbers of cell-entrances per broch as they occur in the several Regions are shown in Table III.

[1] Sandray (Barra) may be another case, but the structure is too ruinous for certainty.

[2] It can be paralleled in Ireland, in the fort on Lough Doon, near Ardara, Co. Donegal.

TABLE III.—NUMBERS OF ENTRANCES TO MURAL CELLS.

| Region. | Number of cell-entrances per broch. | | | | | Number of brochs considered. |
|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | |
| I. Shetland . . . | 2 | 1 | 1 | 1 | .. | 5 |
| II. Orkney . . . | 2 | 1 | 2 | .. | .. | 5 |
| III. Northern Mainland. . | 15 | 10 | .. | 1 | 1 | 27 |
| IV. West Coast and Inner Islands . . . | 4 | 3 | 3 | .. | .. | 10 |
| V. Outer Islands . . | .. | 1 | .. | 1 | .. | 2 |
| VI. Central and Eastern Mainland . . . . . | 2 | .. | 1 | 1 | .. | 4 |
| Totals . . | 25 | 16 | 7 | 4 | 1 | 53 |

From this table a few miscellaneous facts appear. In the first place, it is clear that the most usual arrangement is a single entrance; this very commonly leads to a little lobby off which the stair opens to the right and a cell of some sort to the left. This arrangement accounts for 47 per cent. of all the cases shown in the table. Another common arrangement is that which provides two entrances, as this accounts for a further 30 per cent. of the total number of cases. It will be noted, too, that the weight of these figures lies in the Northern Mainland, as either one or two entrances occur in twenty-five out of twenty-seven examples drawn from this region, while the West Coast and Inner Islands, with a total of ten cases, show this arrangement in only seven. Other arrangements of entrances are fairly evenly distributed, though the five cells found at Feranach, which leave only an aggregate length of 47 feet of solid walling in a circuit of 155 feet, seems to be something of a freak. The fact that three openings occur in only seven cases deserves to be noted, as this sometimes tends to be regarded as the normal arrangement in consequence of its occurrence in the much-described Broch of Mousa.

The manner in which the cell-entrances are disposed about the courts is shown diagrammatically in fig. 2, the number of cases in which each

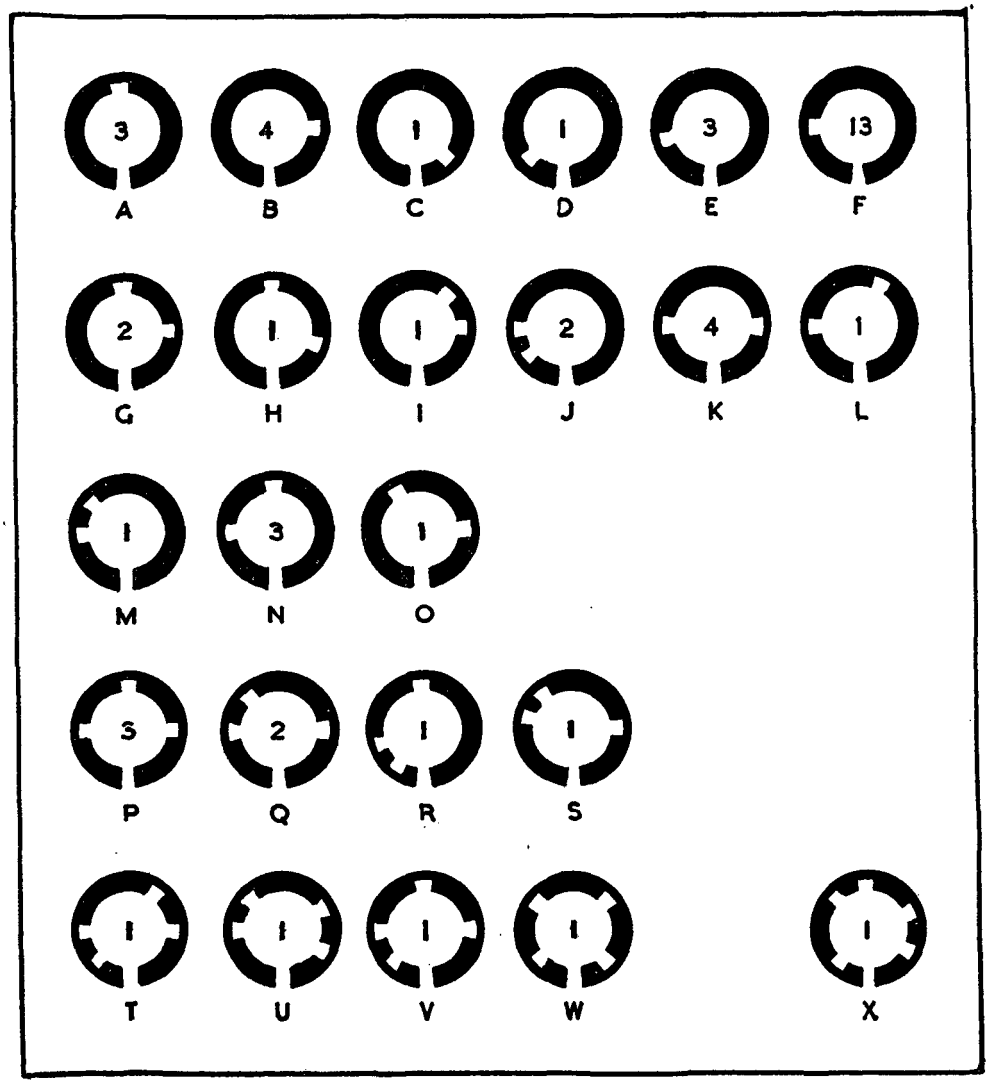


Fig. 2. Disposition of cell-entrances. The figure in the centre of each diagram indicates the number of cases in which the corresponding arrangement is found.

arrangement is found being indicated by the figure in the centre of the corresponding diagram. These diagrams and the inferences to be drawn from them are subject to a certain degree of inaccuracy, as a published description will often state simply that an entrance is "on the left,"

"opposite," or "on the right," and when such records are not accompanied by plans the reader is apt to interpret them more formally than the writer may have intended. This tendency may result in the exaggeration of the numbers of entrances given as in the "IX o'clock," "XII o'clock," and "III o'clock" positions.[1] Subject, however, to such errors as may arise from this cause, the figures suggest that, except in the case of diagram F, there is little to choose between one arrangement and another in respect of frequency of occurrence. That one-half of the twenty-five single entrances (A to F), and one-third of all the ninety-nine entrances considered, should occur in the "IX o'clock" position is, however, worth noting; and if a simpler comparison were made of all the single "left-hand" with all the single "right-hand" entrances, the resulting proportion of seventeen of the former to five of the latter would be even more striking. The preponderance of "left-hand" entrances is of course tied in with the common practice of placing the foot of the stair in this part of the circumference. To allude once more to Mousa, the arrangement of cells found there and represented by diagram P occurs in three cases only, Edinshall and the East Broch of Burray being the other two. The "III o'clock" position occurs twenty times and the "XII o'clock" position fifteen times, with the result that the "IX o'clock," "XII o'clock," and "III o'clock" positions, taken together, account for 67 per cent. of all the openings noted.

For basal galleries the evidence is at once less plentiful and less easy to interpret, owing to the difficulty of determining whether lengths of gallery observed in a ruinous structure are really fragments of an originally continuous gallery, or separate lengths of gallery, or even long, gallery-like cells. As a result of these uncertainties any classification is bound to be somewhat arbitrary, but, subject to this qualification, the material may be distributed among the several Regions as in Table IV—a distinction being made between galleries which are known to have been complete, *i.e.* continuous all round the circuit, those which may or may not have been complete, and those which are known to have been partial, whether associated with cells or not. A number of uncertain examples have had to be ignored altogether.

Scanty as they are, the figures in the table suffice to show that cells and basal galleries are not, as is sometimes thought, regular alternative features; basal galleries are, in fact, a much less common arrangement. They further suggest that basal galleries, whether complete or partial, were chiefly in favour in the Inner and Outer Islands, where fifteen out of a total of twenty-five examples occur—a point to which attention has already been drawn by the Royal Commission on Ancient Monuments.[2] Of the galleries known to have embraced the whole circuit of the court, the one at Gurness was entered at either end from one or other of the guard-cells; the one at Mid

[1] In the diagrams the broch-entrance is placed in the position of VI on the clock-face.

[2] *Inventory of the Outer Hebrides, Skye and the Small Isles*, p. xxviii.

TABLE IV.—BASAL GALLERIES.

| Region. | Galleries known to be complete. | Galleries which may or may not be complete. | Partial galleries, with or without cells. | Totals. |
|---|---|---|---|---|
| I. Shetland . . . | 1 | 2 | 1 | 4 |
| II. Orkney . . . | 3 | .. | 1 | 4 |
| III. Northern Mainland . | .. | 1 | 1 | 2 |
| IV. West Coast and Inner Islands . . . | 1 | 4 | 4 | 9 |
| V. Outer Islands . . | .. | 1 | 5 | 6 |
| VI. Central and Eastern Mainland . . . | .. | .. | .. | .. |
| Totals . . | 5 | 8 | 12 | 25 |

Howe ran from the end of one guard-cell not quite as far as the other, and could also be entered by an opening from the court slightly above ground-level; the one at Redland has been demolished, and no details are known except that an "encircling gallery" was found by the excavators; for Houbie we are dependent on Low's plan,[1] which shows the gallery in a diagrammatic style; and for Kingsburgh details are likewise lacking, but the gallery was entered from the court in the "II o'clock" position.

It is perhaps worth noting, in conclusion, that three of the foregoing five brochs appear to have lacked stability—Gurness fell down at an early stage in its history;[2] one sector of Mid Howe had to be buttressed and thickened, and the basal gallery filled up;[3] while Redland had to be propped up with an outer facing-wall, though not apparently until long after its first

[1] *A Tour through the Islands of Orkney and Schetland*, p. 169.
[2] R.C.A.M., *Inventory of Orkney*, No. 263.
[3] *Ibid.*, No. 553.

construction.[1] If, therefore, the Royal Commission on Ancient Monuments is right in suggesting [2] that the hollow wall may have been a structural device rather than a provision for sheltering the broch's inhabitants,[3] the inference might possibly be drawn that the device proved to be a bad one when used in the basal storey, and that the comparative rarity of complete basal galleries was due to a timely recognition of this fact by builders.

(iv) *Upper Galleries and Stairs.*—The upper storeys of nearly all the brochs have suffered so much damage that our knowledge of the galleries and stairs that they once contained,[4] as well as of the other features originally existing in the upper parts of the walls, has necessarily to be inferred from comparatively few examples, as shown in Table V.

TABLE V.—SURVIVAL OF UPPER GALLERIES.

| Highest storey of which any traces survive, not counting ground-floor . | 1st | 2nd | 3rd | 4th | 5th | 6th | Total |
|---|---|---|---|---|---|---|---|
| Number of brochs . . | 23 | 1 | 3 | .. | 1 | 1 | 29 |

Actually the material is even scantier than the table suggests, as fewer than half of the examples in the lowest class provide any useful evidence. We really depend on the following structures alone: Mousa (to 6th floor), Dun Telve (to 5th), Dun Carloway and Dun Troddan (to 3rd), Clickhimin (to 2nd), and Burray (E.), Carrol, Caisteal Grugaig, Dun Cromore, Knowe o' Burristae, Levenwick, Loch an Duna, Mid Howe, and Yarrows (to 1st). Our present-day accounts of Dun Telve [5] and Dun Troddan [6] can, however, be eked out with the descriptions recorded by Gordon in 1720 [7] and by Pennant in 1772,[8] from which some facts—or at least some strong probabilities—can be extracted by critical reading.[9]

The comparatively perfect condition of the Broch of Mousa and the frequency with which it has been described combine to create the impression that its arrangements constitute the norm, any divergences from which are to be classed as exceptional. It is true that at Mousa the stair does not

[1] R.C.A.M., *Inventory of Orkney*, No. 320.
[2] *Inventory of the Outer Hebrides, etc.*, p. xxxix.
[3] On which point see also p. 71.
[4] The reasons for believing that all brochs originally stood high enough to contain several galleries are considered on pp. 80 ff.
[5] *P.S.A.S.*, vol. l. pp. 241 ff.
[6] *Ibid.*, vol. lv. pp. 83 ff.
[7] *Itinerarium Septentrionale*, pp. 166 f.
[8] *A Tour of Scotland*, vol. ii. pp. 339 ff.
[9] The special importance of these accounts in their bearing on the former height of the towers will appear when this subject is discussed in Section 4 (iii).

begin on the ground but in the first-floor gallery, while other stairs beginning markedly above the ground are noted in only six other cases; [1] but, in so far as the main constructional features are concerned, a single stair rising regularly [2] to the top through a series of galleries which remain, even at the top, large enough to serve for passage [3] is ordinarily accepted as typical of brochs as a class. The rest of the evidence can consequently be best studied by means of comparisons with Mousa.

A first point of divergence occurs at Dun Telve and Dun Carloway. It has been suggested [4] that the rough condition of the inside of the Mousa galleries, which is paralleled in a single length of passage at Clickhimin,[5] points to their not having been intended for use as passages; [6] but however this may be, the galleries, as has been said, are in fact large enough for such use. At the same time they do not show a regular diminution in size from below upwards, as the first gallery has the least headroom of all, and the fourth and fifth are both narrower, in places, than the sixth. At Dun Carloway and Dun Telve, however, different conditions obtain. At Dun Carloway the batter of the outer wall is so pronounced that while the first gallery is 2 feet 6 inches wide at the level of its floor, the third measures only 12 inches and 8 inches in width at floor and roof respectively. The third gallery is also obstructed by two bonding-slabs which span it at about half its height. Similarly at Dun Telve, the intra-mural space narrows markedly between the floor of the first gallery, which is 2 feet 6 inches broad, and the roof of the second, which is only 1 foot 6 inches.[7] The second gallery is still large enough to have been used as a passage, and the faces of both are neatly finished, but the upper three galleries are only about 12 inches wide and have their inner faces rough—facts which suggest that the galleries above the second were not meant for ordinary use but were primarily structural features. And while Gordon's statement that the walls "closed" at the top of the fourth gallery at Dun Troddan, just as they "joined together" at the top of Dun Telve, is very unlikely to be true seeing that the third gallery is to-day over 2 feet wide at about half its height,[8] it does suggest that the vanished portion of this tower must, like

[1] Clickhimin in Shetland; Burrian (Russland), Gurness, and Mid Howe in Orkney; Carrol in Sutherland; Wester Broch in Caithness.

[2] The sections appearing in R.C.A.M., *Inventory of Shetland*, figs. 533 and 534, show that neither of the two minor landings that do in fact interrupt the even rise of the stair is more than about 4 feet in length.

[3] They actually vary in breadth from 1 foot 6 inches to 3 feet 6 inches, and in height from 4 feet to 5 feet 6 inches.

[4] R.C.A.M., *Inventory of Orkney and Shetland*, vol. i. p. 33.

[5] R.C.A.M., *Inventory of Shetland*, p. 70.

[6] *Ibid.*, p. 52.

[7] *P.S.A.S.*, vol. l. p. 247. The photograph on p. 249 shows how noticeable the contraction is in the second gallery.

[8] *P.S.A.S.*, vol. lv. p. 86, fig. 3. But the debris of a ruined fifth gallery piled on the lintels of a considerably narrowed fourth might well create this impression in an inexperienced observer's mind. On this question see also p. 81.

the upper galleries of Dun Telve and Dun Carloway, have been very difficult of access. From all this it seems to emerge that the upper galleries at Mousa, notwithstanding their internal roughness, lend themselves to use as passages in a way that those at the other three brochs do not; and a question consequently arises as to whether this difference is something more than an accident, and actually marks a distinction between two different varieties of structure.

A subsidiary but connected problem may be mentioned here. Gordon states that at Dun Troddan the stair went "to the top," but he does not explain how it was carried through the continually narrowing galleries—let alone out on to the wall-head above the supposed convergence of the walls. This could perhaps have been provided for by a local widening of the intra-mural space along the spirally ascending course of the stair; or else we must suppose that, notwithstanding Gordon, the stair actually ended somewhere much lower than the wall-head and that its functions were taken on by a ladder or wooden steps affixed to the face of the wall. The difficulty suggests a further distinction from Mousa, where it would presumably not have arisen, resulting from the difference in the treatment of the upper galleries that has been mentioned in the preceding paragraphs.

A third point of difference between the Broch of Mousa and certain other examples is perhaps to be seen in the logical simplicity of the former's structural arrangements. At Mousa all parts of the intra-mural space are immediately accessible from the stair, the galleries being open and unobstructed. Some other brochs, however, are designed in a less straightforward manner. At Dun Telve, for example, the first gallery is blocked off by a solid wall from the space above the entrance-passage, its terminal portion being also divided from the remainder by transverse slabs and having to be entered from the gallery above by two openings in its roof. At Mid Howe, although the arrangements have been obscured by dilapidation, there seems to have been a kind of entresol gallery in the south-south-east sector, intermediate between the ground-floor and first-floor galleries. At Dun Carloway, in Thomas's time, the second gallery, or according to his numbering the third, seems to have been stopped by a sloping wall of transverse lintels, which he mistook for a blocked stair,[1] instead of opening on to the back of the stair as at Mousa; the third gallery is also barred by two slabs extending across it. At Dun Cromore Thomas appears to have found an inaccessible space between the under-side of the stair and the sloping, lintelled end-wall of one of the guard-cells [2]—unless, indeed, this end-wall was in fact, as he stated it to be, a flight of stairs descending from the first-floor gallery. At Dun Baravat he noted even more complicated arrangements,[3] but these need not be dealt with here as Dun Baravat is

[1] *Arch. Scot.*, vol. v. p. 385.
[2] *Ibid.*, vol. v. p. 380 and pl. xlix.
[3] *Ibid.*, vol. v. pp. 391 f. and pl. xlviii.

listed as a "probable" broch only.[1] At Levenwick, at Dun Troddan, and at Caisteal Grugaig the stair does not rise steadily, as it does at Mousa, but it is interrupted by a level stretch of gallery at first-floor level; while at Caisteal Grugaig, further, a section of the first-floor gallery must have been blind at either end, one being under the stair and the other blocked by a chamber overlying the entrance-passage. Finally at Clickhimin the arrangements are entirely abnormal, being correlated with the exceptional system of entrances. Here a stair rises from a passage which pierces the north-west sector 5 feet above the level of the court and leads out through one of the two subsidiary entrances; while from the other subsidiary entrance, in the north-east sector, a passage slopes gradually upwards, levels off into a gallery, and ultimately opens on the back of the stair above the passage in the north-west sector.

As providing another important variation of the arrangement familiar at Mousa, attention must be called to four brochs, all in Caithness, which possess two stairs, one on either side of the court. The fact that, in three of these cases (Brounaban, Keiss Road, and Keiss), one of the stairs rises from beside a duplicated entrance has raised a doubt as to whether both stairs are primary in all or any of these structures. A re-examination of the sites, made in 1946, cast no fresh light on this question; but as the insertion of a secondary stair in a standing broch would seem to be technically impossible, it is safe to assume that both stairs are primary in every case—the more so as a double stair is in itself a very reasonable arrangement. Thus ample evidence exists to show that the supposed "norm" of Mousa was in fact frequently varied, and to give grounds for believing that brochs were less fully standardised, at least in matters of detail, than may appear from summary descriptions. There is no good reason, however, for supposing that a broch was ever constructed without any stair at all, as a stair was necessary not only for access to the wall-head but also, most probably, for the supply of stone to the builders during the process of construction.[2] Nor can the absence of stair-treads from the ruins of a broch be regarded as negative evidence, in view of the ease with which these can be destroyed, or covered up by debris.[3]

To conclude this section something must be said as to how the bases of the stairs are disposed about the courts, and, as the base of the stair may be visible even in quite a ruinous broch, a fair number of examples are available. The figures are given in Table VI.

This table shows that by far the largest number of stairs—thirty-one

[1] The peculiar features noted by Thomas at Dun Cromore and Dun Baravat before 1890 were no longer visible when the officers of the R.C.A.M. visited these sites in 1921, but Thomas's descriptions and sketches are too positive to be ignored entirely. Compare his descriptions as referred to above with R.C.A.M., *Inventory of the Outer Hebrides, etc.*, Nos. 38 and 71 respectively.

[2] See R.C.A.M., *Inventory of Orkney and Shetland*, vol. i. p. 32.

[3] *E.g.* at Brounaban, since the published plan was prepared.

TABLE VI.—DISPOSITION OF STAIR-BASES IN COURTS.

| Region. | Positions of Stair-bases. (Entrance to broch is in "VI o'clock" position.) | | | | Totals. |
|---|---|---|---|---|---|
| | Left VI–X. | Opposite X–II. | Right II–VI. | Left and Right. | |
| I. Shetland . . | 1 | 1 | 1 | .. | 3 |
| II. Orkney . . . | 5 | .. | 2 | .. | 7 |
| III. Northern Mainland . | 14 | 1 | 2 | 1* | 18 |
| IV. West Coast and Inner Islands . | 7 | 2 | .. | .. | 9 |
| V. Outer Islands . | .. | 4 | .. | .. | 4 |
| VI. Central and Eastern Mainland . . | 4 | .. | .. | .. | 4 |
| Totals . . | 31 | 8 | 5 | 1 | 45 |

* The three doubtful examples mentioned on p. 65 are omitted.

out of a total of forty-five—rise in the left-hand segment,[1] while the other two-thirds of the circuit contain less than half that number between them. And that this is due, in some degree, to the deliberate choice of the builder, and is not simply a result of the preponderance of "left-hand" cells that was noted above (p. 60), is shown by the fact that in fourteen of the thirty-one cases cells existed elsewhere than in the left-hand segment, from any of which the stairs could presumably have risen as easily as from a position between VI and X o'clock. It is possible that this arrangement was designed to expose the unshielded side of an intruder making his way to the opening at the foot of the stair. No further inferences can, however, be drawn with safety from the table, as the rest of the figures are too scanty.

[1] Between VI and X on the clock-face, the broch-entrance being at VI (*cf.* p. 60).

A final point of interest connected with the stairs is that, in seven cases out of the foregoing forty-five, the entrance to the stair is either at the level of the scarcement or, if below the scarcement, well above the level of the court. This is necessary at Gurness and Mid Howe, where the whole of the ground floor is occupied by a continuous gallery, and natural enough at Mousa, where the ground floor is a good deal taken up by large mural cells. At Burrian (Russland), again, the stair is so placed in the circuit that if it had started from ground-level it might have had difficulty in clearing the top of the right-hand guard-cell. At Clickhimin, Burray (E.), and Wester Broch, however, no reason for this arrangement suggests itself.

(v) *Scarcements.*—While it is naturally impossible to be certain that every broch originally possessed a scarcement, it is true to say that virtually no broch can be proved never to have had one at all. Possible exceptions are at Burrian, North Ronaldsay, where a peculiar but probably analogous arrangement exists (p. 68); at Yarrows, where the secondary reducing-wall does not in fact appear to have covered up a scarcement; and at Allt an Duin and Burness, where reducing-walls and scarcements seem to have been confused in the published descriptions. Apart from these cases, scarcements have been recorded in something like forty brochs and, while a number of others in which no scarcements have been noted still stand to a sufficient height for the scarcements to have been preserved, when these apparent negative examples are analysed it is found that in every case some circumstance exists which upsets their value as evidence. For example, the interior may be blocked with fallen masonry or the inner face may be masked by secondary building, while at Acharole the whole record is suspect. Scarcements must consequently be given an important place among the broch's constructional features.

Some details of twenty-four scarcements are forthcoming from twenty-two brochs, two of the brochs in question, Mousa and Dun Telve, possessing two scarcements apiece.[1] Gordon records an upper scarcement at Dun Troddan, and Pennant shows it in his engraving but in a position where it certainly does not exist; it is possible that he may have depicted it at too low an elevation, and that it was once carried on a part of the wall which has fallen since his time (p. 81), but it is also conceivable that Gordon confused the features of Dun Troddan and Dun Telve, and that Pennant followed him in transferring the latter's high-level scarcement to the former. The probability of an upper scarcement having existed at Dun an Ruigh Ruadh, perhaps some six feet above the existing one, is mentioned on p. 72. The commonest type of scarcement is probably an intake in the wall-face somewhat broadened by corbelling,[2] but the published accounts

[1] A ledge which appears about 12 feet above the ground in part of the circuit at Clickhimin (R.C.A.M., *Inventory of Shetland*, fig. 558) is not regarded as a true scarcement.

[2] I am indebted for this piece of information to Mr C. S. T. Calder.

do not always make this clear, as they frequently allude to an intake without further particularisation. Another arrangement, an intake with corbels set upon it at certain points, is found at Culswick, Mousa, Sallachaidh, and Ousedale Burn; at Culswick and Mousa the corbels are four in number, and are equally spaced out around the circuit, while at Sallachaidh corbels are found on two of the three surviving portions of the scarcement.

Consideration of the heights of scarcements is somewhat complicated by the fact that two occur at Mousa and at Dun Telve, as mentioned above, even if Dun Troddan be ignored; and also by some uncertainty as to the original ground-levels in unexcavated brochs. High-level scarcements like the one seen at Dun Telve may originally have existed in almost any broch except perhaps Dun Carloway, disappearing with the dilapidation of the upper parts in the manner already suggested in the possible case of Dun Troddan; comparisons will consequently be valid only as between the single scarcements and the lower members of the pairs.

The twenty-one scarcements that are available for this purpose range in height from 4 feet 6 inches at Clickhimin to 12 feet 6 inches at the Knowe o' Burristae; the largest number of examples (six) are in the 7-foot class and the average height is 8 feet. It seems unlikely that this average would be raised by more than perhaps a foot if the original floor-level was laid bare in every case. The examples are too few in number for valid comparisons to be made between the various Regions. The two scarcements at Mousa are 7 feet and 12 feet 4 inches high respectively, and thus seem to be in a different class from those at Dun Telve, which are at 6 feet 6 inches and 29 feet 6 inches respectively. If an upper scarcement ever existed at Dun Troddan it must have been more than 25 feet above the ground—the greatest height of the surviving part of the structure—and would consequently fall to be compared with the one at the neighbouring Dun Telve rather than with the one at Mousa.

The exceptional arrangement that was mentioned above as existing at Burrian, North Ronaldsay, has been described as follows: "At 3 feet above the floor is a scarcement 5 inches in depth, above which the wall is gradually intaken for a height of 4 feet 2 inches, and then projects abruptly for 4 inches, thereafter rising vertically." [1] This is clearly not the same thing as the scarcements described above, but its function, like theirs, may have been to provide a support for some construction projecting from the wall; it is possible, for example, to imagine the recessed zone of the wall-face as serving as an anchorage for struts or triangular trusses. If so, the height of the supported construction would have been rather more than 7 feet.

Any discussion of what structures the scarcements supported must

[1] R.C.A.M., *Inventory of Orkney*, No. 193.

proceed in the light of Dr A. O. Curle's report on his excavation of Dun Troddan, where he found a ring of post-holes roughly concentric with the wall-face and set some 6 feet within it.[1] Dr Curle was satisfied that the post-holes belonged to the broch's earliest period, and inferred that the posts supported the roof of a corridor encircling the court, the inner edge of which was borne by the scarcement on the wall-face. This conclusion, in fact, seems certain, and the corridor, which Dr Curle found reason for believing was divided from the court by a light partition, thus probably formed the inhabitants' ordinary dwelling-space, while also perhaps serving to obstruct the approach of intruders to cells and stair. But two important questions still remain to be considered. In the first place it may be asked whether the roof of the corridor was a roof and nothing more, or whether it also served as a balcony or gangway for traffic;[2] and in the second place whether the arrangement that obtained at Dun Troddan was necessarily the same in all brochs everywhere.

To the first question Dun Troddan itself provides no direct answer, but it is to be noted that the scarcement is only 6 feet above the ground, and that consequently a roof sloping down from it at even so gentle a pitch as 1 in 3 would leave headroom of little more than 4 feet on the side of the corridor towards the court. This point tells somewhat against the idea of a sloping veranda-roof though without disproving its existence; again, if the hypothesis of the broch being itself roofed is favourably regarded, the need for roofing the corridor appears less urgent. Some more positive evidence is forthcoming, however, from nine brochs[3] in which doorways or large voids are found to open on to or just above the scarcements.[4] These openings must pretty certainly have led not on to sloping roofs but on to horizontal balconies or stagings on which the inhabitants could live, or at least move about. Again, a veranda-roof at the height of the upper scarcement at Dun Telve (29 feet 6 inches) would not have been effective as a shelter; while at Mousa, where two scarcements occur within a few feet of one another, the lower one at least must have supported a balcony and not a roof. In this case, in fact, there would seem to have been two corridors set one above the other in much the same way as are the galleries within the broch-walls, and this analogy seems to increase the likelihood of the roofs of other corridors as well as having been available to the inhabitants for movement. Finally, at Clickhimin, Mousa, and Mid Howe,

[1] *P.S.A.S.*, vol. lv. (1920–21), pp. 90 ff.

[2] That the structure carried on the low-level scarcement was a roof for the whole court, as suggested by Sir W. Lindsay Scott, D.S.C., F.S.A. (*Proceedings of the Prehistoric Society*, New Series, vol. xiii. p. 10), seems quite unlikely, as this theory makes no provision for the structural features discussed in the next paragraph.

[3] Burray (E.), Burroughston, Caisteal Grugaig, Clickhimin, Dun Telve, Gurness, Knowe o' Burristae, Mid Howe, Mousa.

[4] At Mousa a doorway gives on to each of the scarcements. A third opens 4 feet 6 inches above the upper scarcement from a landing on the stair.

and perhaps elsewhere, there has been a space above the entrance-passage accessible only through the void by which its inner end opens on the court; if these spaces were put to any use they can only have been reached by ladders or from a balcony at scarcement-level, and of these two alternatives the latter seems to be preferable in view of the inconvenience of a ladder, as this would inevitably have obstructed the opening of the entrance-passage. There is thus good reason for supposing that the structure supported by the scarcement was often, if not always, something more than a simple roof for the corridor below.

For the second question, as to whether a gallery of the Dun Troddan type necessarily existed everywhere, a negative answer suggests itself, as some evidence can be quoted against the idea that the structure resting on the scarcement was invariably of the veranda type, whether sloping or flat. It is difficult, for example, to imagine that Dun Telve contained a high balcony supported on 30-foot poles; and if high-level scarcements are supposed to have been commonly constructed, we should be faced with the further difficulty of the supply of long timbers in the treeless regions of the north. On the other side can be set the fact that a scarcement's normal function is to support the ends of beams and, while timbers long enough to span a broch diametrically would have had to be as long as or longer than props for a high-level balcony, support for a balcony or partial floor could have been readily obtained by laying shorter timbers chord-wise round the circuit. Thus four timbers each about 21 feet 3 inches in length would have made a square framework within a broch 30 feet in diameter, the radial distance of their centres from the face of the wall being about 4 feet 5 inches. A six-sided or eight-sided frame could have been constructed of correspondingly shorter timbers. And evidence that frames of this kind were used at Mousa and at Culswick may perhaps be seen in the corbels set in the scarcements of these two structures—six at Mousa and four at Culswick—it being supposed that these corbels were principal supports on which the corners of the frame rested. The fact that no post-holes similar to those at Dun Troddan have been reported from any other brochs might be quoted as suggesting that supporting posts were, in fact, exceptional; but no dependence can be placed on such negative evidence seeing that (1) such a point would hardly have been noticed in the older excavations; (2) the only three brochs excavated since Dr Curle's discovery (Gurness, Mid Howe, and Kilmster) were full of secondary structures, in the building of which all evidence of an earlier circle of posts might well have been obliterated. Moreover, if the function of the Dun Troddan posts had been performed in these cases by stone supports, as might well have happened in a region where trees were rare, the masonry of their bases would almost certainly have been large enough to require demolition in order to clear the ground for the secondary structures.

(vi) *Voids.*—Examples of the characteristic window-like voids, either single or forming vertical flights, survive in more than twenty brochs. They were probably a regular feature of broch-architecture in general, and it is no doubt only on account of the dilapidation of the upper parts of the structures that many more examples are not on record. There seems to be no reason to question the usual theory that these voids were designed to reduce the weight on lintels; but in cases (*e.g.* Dun Telve, Dun Troddan, or Dun Carloway) where the flights of voids are not based on doorways leading into court or cells they may be supposed to have performed the function of lighting or giving access to the galleries—the latter, perhaps, by a ladder or wooden steps. The lowest member of a similar flight at Mousa is large enough to have been a door, and may have been approached by a ladder from a scarcement balcony 4 feet 6 inches below. This question possesses some interest as it bears on the function of the galleries; provision for lighting would indicate that some parts at least of the galleries were intended for use by the inhabitants and were not purely structural—as is also suggested by the distinction between rough and smooth finishing of the internal faces (p. 63).

Mousa alone shows the peculiar feature of a flight of dummy voids. A normal void occurs above the entrance of the stair, but from this there rises a flight of small aumbry-like hollows which do not penetrate the wall. These may be merely decorative, and it is difficult to suggest any practical purpose that they could have served unless, perhaps, to provide points of support, at varying heights, for timbers forming part of a roof (*infra*).

(vii) *Roofing and Wall-heads.*—Brochs are commonly supposed to have been completely open at the top, but this is hard to believe in view of the obvious desirability of excluding rain, wind, and enemy missiles [1]—or at least of reducing the size of any aperture by which these could enter. The positive evidence for the existence of any kind of roof is, however, very meagre.[2] One item is forthcoming at Mousa, where it is on record that "the inner face of the wall of the lowest portion is vertical, while in the upper or galleried part the courses of masonry converge to some degree as they rise to the summit of the tower. The convergence is very marked in the uppermost 10 feet." [3] This convergence hardly appears in the published sections,[4] but Mr G. P. H. Watson, who surveyed the building for the Royal Commission on Ancient Monuments, assures me that it is fully apparent to the eye at the level of the sixth gallery, and has shown me a sketch in his

[1] It should, however, be remembered that neither sling-stones nor arrow-heads have yet been reported among the relics found in excavated brochs.

[2] Boece's comparison, quoted in *Arch. Scot.*, vol. v. p. 192, of two ancient buildings in Ross-shire, which were presumably brochs, to bells, can hardly be stretched to mean that low-pitched roofs, corresponding with the crowns of the bells, were present in his time. Ubaldini, writing sixty years later (1588) and pretty clearly referring to the same structures, states that they were open at the top (*ibid.*).

[3] R.C.A.M., *Inventory of Shetland*, p. 50.

[4] *Ibid.*, figs. 533, 534.

field-notebook which brings this out quite clearly. This convergence of the interior might be taken as suggesting that the tower ended in a false dome, formed by encorbellation, but something will be said shortly about the difficulties that attach to this theory. Evidence of similar convergence might also be held to exist at Dun an Ruigh Ruadh, where the inner face comes in markedly just above the scarcement; but, as the wall is broken down on its inner face to a height of 5 feet 9 inches above the scarcement, it is impossible to say whether the encorbellation was intended to support a false vault or merely to form an upper scarcement, perhaps some 6 feet above the existing one. The latter alternative, however, seems preferable in view of the low elevation—the ruined wall-head standing only 7 feet 9 inches above ground-level on the outside.[1]

Another item comes from the Broch of Gurness, of which Mr J. S. Richardson, who conducted the excavations for H.M. Office of Works, has written as follows: "Owing to the bad quality of the stone and poor construction, a downward and outward thrust, presumably from a heavy roof, forced the walls outwards, causing the passages to be crushed and the upper part of the building to collapse."[2] He adds in a footnote that similar displacement occurs to a greater or less extent in some other broch towers—the one that he has particularly in mind being Mid Howe—and that the most reasonable explanation for it is pressure from a roof-construction;[3] though he does not rule out the possible intervention of other contributory causes. It is probable that a roof of timbers covered with turf would have been heavy enough to produce the amount of thrust demanded by Mr Richardson's suggestion, particularly if the effect was enhanced by wind-pressure, or by poor construction which permitted movement; but the thrust developed by a massive masonry dome, such as is suggested by the signs of incipient contraction at Mousa, would naturally have been very much greater. In the absence of more definite evidence[4] the question must remain an open one; but it is to be hoped that, when next a ruinous broch is explored, care will be taken to examine the fallen material, for the sake of elucidating the circumstances of the structure's collapse and of estimating the original nature of its upper portions.

On the supposition, however, that a massive false dome was a normal feature of all brochs, it is interesting to consider its probable size and features. That the dome, if it existed, was completely closed at the top is inherently most improbable, as this would imply that the whole of the interior of the tower was in permanent darkness, or at any rate received

[1] I am indebted for this information about Dun an Ruigh Ruadh to Mr C. S. T. Calder.

[2] R.C.A.M., *Inventory of Orkney*, p. 77.

[3] *Ibid.*, p. 79.

[4] The object depicted on Sueno's Stone, even if it is actually a broch, as has been suggested by Dr J. S. Richardson, throws no light on this point. Its top is flattish rather than domed or pointed, but the carving is too small and the stone too badly weathered to provide grounds for any inference.

no more daylight than could find its way in by the door—a proposition which will hardly accord with the known facts of the broch-builders' material culture even when allowance is made for the indifference of primitive people to the nuisance of smoke, and for the poor illumination tolerated, for example, in many mediæval buildings. On the other hand, a partial dome, which diminished the opening to a diameter of perhaps as little as 6 feet, would have allowed the inhabitants a reasonable amount of light [1]—much more, at any rate, than the same area of void distributed among, say, seven small vertical windows arranged in a kind of clearstorey—while providing a most difficult target for high-angle archery, if archery was in fact practised by the brochs' inhabitants.[2]

The height and curvature of a false dome of the kind suggested would depend on the average length and thickness of the stones used in its construction—the length of face of the stones determining the amount of overhang or projection obtainable at each course and their thickness the corresponding rise. Professor Thomson has kindly undertaken the laborious calculations involved, and has found that, in theory, a false dome 15 feet in radius at the point of springing, and constructed of stones averaging 3 feet in length, could not be completely closed in less than about a hundred and seven courses, or reduced to an aperture 6 feet in diameter in less than a hundred and three.[3]

The foregoing dimensions were chosen as a kind of theoretical optimum, but Professor Thomson has also made a similar set of calculations to meet the special conditions obtaining at Mousa—a radius of 12 feet and an average stone only 2 feet in length.[4] In this case it appears that theoretically the dome would not contract to a 6-foot aperture in less than about a hundred and fifty courses.

The rate of contraction in each case is given in Table VII.

If in the hypothetical case, where the diameter was 30 feet, the average stone was supposed to be 4 inches in thickness, the height to the apex would amount to 35 feet 8 inches, while the diameter would have decreased to 6 feet at a height of 34 feet 4 inches. At Mousa, however, the greater thickness of the average stone would give a height of at least 75 feet for the point of contraction to 6 feet. These heights, and particularly the one calculated for Mousa, are so great that they seem to rule out the possibility

[1] Mr G. P. H. Watson has pointed out to me that the Pantheon, which measures 142 feet 6 inches in internal diameter at ground-level and nearly 74 feet in height to the springing of the dome, is adequately lit by an aperture of this kind which is only 27 feet in diameter (Gwilt, *An Encyclopædia of Architecture* (1899), p. 916). An aperture of proportionate size in a 30-foot broch would be about 5 feet in diameter.

[2] These considerations naturally apply to any type of roof. In the case of timber construction, the apex could simply be left without its covering.

[3] The amount by which the radius is reduced at each course is found by multiplying it by the cosine of half the angle subtended at the centre, in that course, by the average stone.

[4] R.C.A.M., *Inventory of Shetland*, p. 49.

of masonry domes, even if contraction began well below the wall-head as has been suggested above; but before this inference is drawn a further possibility must be considered—namely that the rate of contraction may in fact have been more rapid than theoretical calculations suggest. It is assumed for the purposes of these calculations that the forward corners of

TABLE VII.—CONTRACTION OF FALSE DOMES.

| No. of course above springing. | Hypothetical case: average stone 3 feet long. Radius (ft. ins.). | Broch of Mousa: average stone 2 feet long. Radius (ft. ins.). |
|---|---|---|
| 0 | 15 0 | 12 0 |
| 5 | 14 8 | |
| 10 | 14 3 | 11 7 |
| 15 | 13 10 | |
| 20 | 13 5 | 11 2 |
| 25 | 13 0 | |
| 30 | 12 7 | 10 9 |
| 35 | 12 2 | |
| 40 | 11 9 | 10 3 |
| 45 | 11 3 | |
| 50 | 10 9 | 9 10 |
| 55 | 10 3 | |
| 60 | 9 9 | 9 4 |
| 65 | 9 2 | |
| 70 | 8 7 | 8 9 |
| 75 | 7 11 | |
| 80 | 7 3 | 8 3 |
| 85 | 6 6 | |
| 90 | 5 8 | 7 8 |
| 95 | 4 9 | |
| 100 | 3 9 | 7 0 |
| 105 | 2 5 | |
| 110 | 11 | 6 4 |
| 120 | | 5 7 |
| 130 | | 4 9 |
| 140 | | 3 10 |
| 150 | | 2 8 |

all stones are laid exactly flush with the faces of the stones in the course below, but in practice, if all the stones were properly locked so as to obviate any danger of movement, they might perhaps be laid with their corners slightly in advance of the stones in the underlying course, and this would naturally result in an accelerated rate of contraction. And it is a fact that some years ago a scale model was constructed by Mr A. Strachan, formerly

employed as a foreman mason on the preservation of brochs by H.M. Office of Works, in which the theoretical height of the dome was very materially reduced. Unfortunately the particulars of this model perished in a fire, but both Mr G. P. H. Watson and the late Professor R. G. Collingwood, who examined the model, were left with the impression that this method of roofing a broch might well have been fully practicable. On the other hand, the contraction noted at Mousa is certainly not of the same order as that exemplified by Mr Strachan's model; and as a dome on the lines of this model, with a possible height of some 25 feet or less, if superimposed on the original structure at Mousa, would have brought the total height of the building to something like 75 feet,[1] even this modified form of the theory of the masonry vault is still difficult to accept.

Again it may be said that if the dome were constructed of corbels set radially, not chord-wise, to the circumference of the tower, a considerably quicker rate of contraction could be obtained, though at the price of decreased stability and increased weight of material. But the surviving examples of false vaults—*e.g.* those of the mural cells—provide no evidence that the radial method of encorbellation was ever used in the brochs, and Mr Strachan is known to have adopted the "chord-wise" system in constructing his scale model. It is probably now too late to look for a solution of this problem, except in the unlikely event of roofing material being identified among the debris of a broch excavated on some future occasion; and in the meanwhile we can only rest on the obvious conclusion that a timber roof would have been very much lighter and easier to construct than any form of vault. A timber roof, pitched at an angle of 45 degrees, would have risen, at Mousa, only 15 feet above the wall-head, or 10 feet less than a vault of Mr Strachan's type.

However the tower was roofed, and whether it was roofed or not, it seems necessary to assume that it did not prevent access to the wall-head, as failing any provision for wall-head defence the most solidly constructed broch must ultimately have become a death-trap. In the absence of positive evidence we are naturally reduced to guess-work, but in the case of a tower which carried accessible galleries as high as the wall-head no actual difficulty of construction need be supposed to have existed. Thus if the tower were open at the top, or if a wooden roof rested on the inner part of the wall-head, the stair could have been carried out into a parapet-walk without any special measures having been necessary; while if the tower ended in a dome the walk could have been set on its haunch and the stair carried through the masonry mass in an ascending mural passage. This arrangement could hardly have been used in such cases as Dun Telve or Dun Carloway, where the upper galleries became too narrow for passage, but an alternative one has been suggested on p. 64.

[1] On the height of the original structure see p. 80.

(viii) *Wells and Tanks.*—Arrangements for the supply or storage of water have been reported in twenty-six places and, except as noted below, there is no reason to suspect that they do not belong to the primary period of habitation. Of the structures in question, thirteen are in the Northern Mainland, eleven are in Orkney, and two are in Shetland. Too much should not be made, however, of this apparent concentration in two regions, as a well or tank is unlikely to come to light unless a broch is cleared out to ground-level, and it is just in Caithness and Orkney that most so-called "excavation" has been done. Again, much of the underlying rock in these regions is at once easier to quarry and more suitable for slab-construction than the West Coast or Shetland formations.

The provisions made include covered well-chambers and cistern-like cavities, cut in the rock or partly cut and partly constructed of masonry, and on the surface slab-built tanks. Some brochs contain more than one of these types of construction. Eighteen of the wells or cisterns [1] have steps leading down to the water, while the remaining nine [2] have none. Mid Howe and Stackrue possess cavities which may not actually have been wells at all, but dry storehouses or cellars. The finest of the well-chambers of which a description has been published is the one at Gurness, where the bottom of the chamber, itself 8 feet high, is 14 feet below the surface, and the stair has nineteen steps. The largest cavity seems to be the one at Skirza Head, which measures 10 feet by 7 feet by 10 feet.[3] Two wells (Burray (E.) and Netlater) were approached by short underground passages roofed with slabs. At Elsay and at Keiss a water-hole was placed within the thickness of the wall, at the foot of the stair, the one at Keiss being additional to a well close by in the court. The wells at Hillhead, Skirza Head, and Burray (E.) are all just outside the entrances, the steps leading down to the one at Hillhead opening within the outer door-checks of a prolongation of the entrance-passage in a way which may suggest a connection with external and perhaps secondary buildings. The method of access to the communicating underground passage at Burray (E.) is unknown, and consequently nothing can be said as to its primary or secondary character. Mention may also be made here of two shafts, some 5 feet apart and sunk respectively 11 feet 3 inches and 9 feet 2 inches into the ground, at the farm of Oust, Caithness,[4] the former containing a steep stair and the latter seven

[1] In the following sixteen structures: Burray (E.), Burrian (N. Ronaldsay), Gurness, Hillhead, Hill of Works, Jarlshof, Keiss, Keiss Road, Kettleburn, Kintradwell, Loch of Ayre, Mamie Howe (an "uncertain example" not yet described), Ness, Netlater, Oxtro, Redland.

[2] In the following eight brochs: Burroughston, Carn Liath, Dunbeath, Elsay, Mousa, Nybster, Ousedale Burn, Skirza Head.

[3] The so-called "Roman Bath" at Burghead is comparable with a broch cistern, measuring about 11 feet by 10 feet 8 inches by 4 feet 4 inches in depth (*P.S.A.S.*, vol. iv. pp. 351 f.); but the chamber in which it is set is larger and deeper than anything found at a broch, and the surrounding ledge is also without a parallel.

[4] R.C.A.M., *Inventory of Caithness*, No. 455.

shelf-like steps projecting from one side. These may be on the site of a broch, but no other structure survives.

The slab-built tanks, as described in the published accounts, bear sufficient resemblance to other box-like constructions, found on sites belonging to various prehistoric periods, to suggest that they may in some cases be connected with secondary occupations of the brochs in question; eight,[1] however, may be noted as perhaps primary, of which one at least (Mid Howe) was found to be fed by a spring. In every broch in which these slab-built tanks occur there is also a well or cistern—or at Mid Howe the supposed dry cellar.

(ix) *Hearths.*—One or more large open hearths was probably a feature of the court of every broch, but so few brochs have been excavated with a proper regard for stratigraphy that primary and secondary hearths cannot usually be distinguished in the records. No useful discussion of this subject can therefore be undertaken at present.

## 4. Shape and Dimensions.

(i) *Ground-plan.*—Although broch towers are commonly said to be circular, a study of large-scale plans and of carefully prepared descriptions will show that the courts frequently measure rather more on one diameter than another, and that the even curve of the wall is sometimes broken by minor irregularities. The external outline, again, is liable to diverge from the circle to a greater degree than the inner, as the thickness of the walls is sometimes far from regular throughout the whole of the circumference.[2] A question may consequently be raised as to whether the normal ground-plan should be regarded as a circle or not.

This question may be answered in the affirmative, and for the following reasons. Internal diameters are on record for a total of one hundred and thirty-two brochs,[3] and it is only in six of these cases that the major and minor axes diverge from the mean by as much as 6 per cent.[4] The interiors of the great majority are thus so nearly round that a divergence from the true circle would hardly appear to the unaided eye. Again, it must be remembered that rough drystone walls, even when not purposely battered, will hardly ever present a truly vertical face—especially after suffering the vicissitudes of two thousand years—and that measurements taken at irregular heights above ground-level, as is often necessary on a site encumbered by debris, may well diverge materially from the true dimensions as

[1] In the following five brochs: Keiss Road, Mid Howe, Nybster, Ousedale Burn, Skirza Head.

[2] *E.g.* at Borwick, Burroughston, Camas an Duin, Clickhimin, Kintradwell, Lamb Head, and Dun Torcuill.

[3] Region I, 14; II, 16; III, 69; IV, 21; V, 6; VI, 6.

[4] Camas an Duin, 13 per cent.; Dunrobin Wood, 10 per cent.; Dun Colbost and Edinshall, 8 per cent.; Dun na Maigh, 7 per cent., possibly as a result of reconstruction; Dun Cromore, 6 per cent.

laid out on the ground by the builder. It will consequently be quite safe to regard the normal broch-plan as a circle, and to make use of mean diameters in all cases except the six just mentioned. These may be treated as abnormal, and left out of the present discussion.

(ii) *Diameter.*—Although not always accurate for the reason that has just been given, the internal diameter is far more reliable than the outer as an index of the size of a broch, as the inner wall-face is not battered. Material divergence from the vertical is only shown where the wall-face recedes above a scarcement, to produce a slightly "cupped" effect when viewed in section, as in the cases of Mousa and Dun Telve.[1] The external diameter, however, is considerably affected by the batter of the outer face, and decreases as the rising wall decreases in thickness. Consequently, in the numerous cases in which the base of a tower is obscured by fallen stones and only the broken stumps can be seen above the debris, the outer diameter and wall-thickness can safely be assumed to be less by some unknown amount than they are at ground-level; whereas the internal diameter, notwithstanding its shortcomings, can be taken as sufficiently accurate for practical purposes.

The main facts concerning internal diameter, as observed in the approximately circular examples only, are shown in Table VIII. It must be noted that the exclusion from this table of the six examples (*supra*) which diverge markedly from the circular plan causes us to ignore the largest broch of all, namely Edinshall, which measures 60 feet by 51 feet, or 55 feet on the average.

It will be seen at once from this table that the diameters recorded vary somewhat from one region to another, and a question consequently arises as to whether these variations reflect real local differences in broch-construction or are merely accidental. In order to get some light on the mathematical aspect of this question I referred the detailed measurements to Professor Godfrey Thomson, who was kind enough to submit them to statistical analysis, and from his calculations the following facts emerge: (*a*) In respect of the standard deviation of the measurements within each Region, the Regions do not differ significantly even at the 1·0 per cent. point —that is to say, the difference that is actually found in the scatter of the measurements on either side of the mean might be expected to occur by chance sampling more often than once in a hundred times if no real difference existed. (*b*) In respect of their means, the six Regions do differ significantly, even at the 0·1 per cent. point—that is to say, on the hypothesis that there was really no difference between the Regions, the observed differences would occur by chance sampling less often than once in a thousand times. They should therefore not be regarded as samples of one "population." (*c*) Again

[1] Mousa is 19 feet in diameter at ground-level but expands to 24 feet above the cupping. The corresponding figures for Dun Telve are 32 feet and 35 feet.

in respect of their means, Regions I, II, and III, if grouped together, are found to be homogeneous in themselves, while Regions IV, V, and VI, similarly grouped, are likewise homogeneous in themselves, *i.e.* the apparent differences between the subdivisions of these groups are not significant even at the 5 per cent. point. (*d*) The difference in mean between these two groups of regions is significant at the 0·1 per cent. point, *i.e.* the northern district as a whole differs very significantly from the rest of Scotland. (*e*) Region II does not differ significantly from Region IV if compared with

TABLE VIII.—INTERNAL DIAMETERS.

| Region. | No. of examples. | Internal diameters (feet). | | | Notes. |
|---|---|---|---|---|---|
| | | Max. | Min. | Average. | |
| I. | 14 | 35 | 19 | 29 | * This measurement, which is fully authenticated, exceeds the next greatest in Region II by 8 feet.<br>† This measurement is recorded by Pennant and may be unreliable. The next greatest in Region IV is 42 feet.<br>‡ Or 34 feet if Pennant's figure is ignored. |
| II. | 16 | 45* | 27 | 32 | |
| III. | 67 | 44 | 20 | 30 | |
| IV. | 20 | 52† | 28 | 35‡ | |
| V. | 6 | 36 | 25 | 30 | |
| VI. | 4 | 40 | 30 | 34 | |
| All Regions | 127 | 52† | 19 | 32 | |

it alone, and if it is combined with Regions IV, V, and VI, the group so formed still differs significantly from Regions I and III grouped together. This suggests that, notwithstanding the undoubted homogeneity of Region II with Regions I and III, it may occupy something of an intermediate position between the groups having respectively large and small mean diameters.

Statistical analysis thus appears to suggest that we may have to deal with two different races or strains in the species broch; and although no corroborative evidence or plausible explanatory theory can be brought forward, the possibility should perhaps be remembered in future study.

Before passing on from the question of the mean diameter, it will be well to deal with a point which may appear open to criticism. It may be

said that the mean diameter of Region III is lowered through the influence of the nine brochs found within it that measure less than 25 feet, and that certain of these—actually seven in number—may not be fair samples seeing that they stand on artificially restricted sites such as narrow cliff-bound promontories, small islands, or the tops of hillocks.[1]

But before any such argument could be admitted it would be necessary to test the whole of the material, and not only a single diameter-class in one district, for signs of artificial limitation; and this would be quite impossible on the strength of the published descriptions alone. Moreover, in the light of some further calculations it is seen to be quite unnecessary, as if the seven small brochs in question are ignored the following results appear: (i) the six regions still differ significantly, though now at the 1 per cent. point and no longer at the 0·1 per cent. point; (ii) no change is made in the comparison of Regions III and IV, as these still differ significantly at the 1 per cent. point as they did before; (iii) Region III, it is true, now no longer differs from the whole of the rest of the country even at the 5 per cent. point, whereas it did so previously at the 5 per cent. point and nearly at the 1 per cent. point; but in view of the comparatively low degree of significance this fact need not be accorded any great importance. Artificial limitation need therefore detain us no further.

(iii) *Height.*—The only four brochs that still stand to any considerable height—in part at least of their circumference—are Mousa, Dun Troddan, Dun Telve, and Dun Carloway, and it is consequently to these structures that we must look in the first instance for evidence regarding the original height of the towers. And it will be convenient to consider the question in terms of the wall-head only, ignoring the additional height to be allowed for a roof—supposing that any roof existed (pp. 71 ff.).

The Broch of Mousa is now 43 feet 6 inches high, and must have carried at least one more gallery or a parapet-walk. Quite possibly there was more than one additional storey of superstructure, but at least one must be assumed. The tower can therefore hardly have been less than 50 feet high to the wall-head in its pristine state, and may well have been higher. It is worth noting here that the figure of 50 feet would make the height of the tower the same as its external diameter at the base.

The surviving fragment of Dun Troddan shows two galleries intact and a third partially preserved. In its present state it is about 25 feet in height.[2] In 1720, however, when Gordon saw it,[3] four galleries were intact; and as the additional gallery and a half may probably have added some 8 feet or 9 feet to to-day's figure, we arrive at 33 feet to 34 feet as the true height at that date. Gordon does, in fact, give the height as 33 feet, but it is clear

[1] See R.C.A.M., *Inventory of Caithness*, Nos. 33, 35, 203, 518; *Inventory of Sutherland*, Nos. 4, 25, 190.
[2] *P.S.A.S.*, vol. lv. p. 85.
[3] *Itinerarium Septentrionale*, p. 166.

from his allusion to four internal doors leading into a gallery, as well as from his figure for the thickness of the wall at what seemed to him to be ground level, that in his time the ground inside the tower stood 6 feet above the true level of the court; and when the necessary correction is made the resulting total height of 38 feet is seen to be impossibly great, as the fourth gallery and the missing part of the third could never, between them, have accounted for a height of 14 feet. Nor is there, in fact, anything at all impossible in the idea that Gordon should have exaggerated this measurement by as much as 6 feet, seeing that he was most unlikely to have been properly equipped for measuring a building, and that the base of a ruined fifth gallery—unnoticed and consequently unmentioned—might possibly have added a foot or two to the total. The discrepancy consequently need not be regarded as important, and we are left with the inference that in 1720 Dun Troddan, with a height of 34 feet, was already reduced from its original height by an unknown but possibly quite considerable amount. That Gordon saw the inner and outer walls actually merging into one at an original wall-head seems quite improbable.[1]

On the question of the vanished portion the six feet of debris collected in the court can perhaps throw some light. Theoretically this represents a volume of some 3700 cubic feet of piled stones, and on the purely arbitrary assumptions (*a*) that laid masonry would occupy half the space of random debris, (*b*) that the debris inside the tower represented the ruins of the inner wall alone, the outer wall being supposed to have fallen outwards, this volume would provide for an additional height of something under 7 feet. An unknown amount of stone-robbing must also no doubt be assumed. It would thus appear allowable to carry the tower up to an original height of over 40 feet, though it is impossible on the available evidence to say that it went no higher than this; and if the proportion of height to basal diameter was the same here as at Mousa, a height of some 60 feet might well have to be allowed for.

To Gordon's record Pennant adds little of value—the fourth gallery had disappeared by 1772, and he does not give any figure for the height of the third. His total height to the top of the third gallery is 24 feet 5 inches; and if this figure is corrected for the depth of the debris in the court, it accords fairly well with the conclusions reached above. His engraving[2] cannot be relied on, as he shows a high-level scarcement crossing a part of the wall-face which is still preserved and where no scarcement exists.

As regards Dun Telve, not only is Gordon's description regrettably short but his language raises the suspicion that he may have borrowed some of his points from Dun Troddan, then much better preserved than its neighbour, in the belief that the two structures were identical. In any

[1] *Cf.* p. 63.

[2] *Tour in Scotland*, vol. ii. p. 340 (4).

case even partial sense can be made of it only by assuming—what is not in itself unlikely—that in 1720 the lower parts of the tower were deeply buried in debris, and that Gordon entered by a hole [1] which led into the second gallery. The second gallery, at any rate, is the lowest level at which he could have made—as he alleges that he did—a complete circuit of the building within the wall-space, as the first gallery is barred at more than one point and there is no gallery on the ground floor. But while he gives no measurements, his drawing [2] evidently represents the same sector of the wall as still survives, and it can be usefully compared with the section prepared by H.M. Office of Works and published by Dr Curle.[3] This comparison shows that whereas in 1720 three voids of the flight rising from over the entrance existed above the high-level scarcement, in 1916 the lowest of these voids was intact but the second had lost its lintel; the total height of the wall at this point must thus have decreased since 1720 by the height of one void plus some half-dozen courses of masonry—probably some 5 feet at most. On this showing the true height of this part of the broch in 1720 would have been about 38 feet. Pennant's illustration,[4] though evidently taken from a sketch made on the spot, does not seem fully accurate in respect of these voids, but suggests none the less that very little height had been lost since 1720 in a vertical line above the door, though perhaps two or three feet from above the other long flight of voids (see fig. 3). This implies that the broch was about 35 feet high at its highest point in 1772; and although the figures stated in the text of Pennant's description [5] give a height of 37 feet 6 inches, the lower estimate is probably to be preferred. In view of the fairly close correspondence of all these lines of reasoning, it is impossible to accept Pennant's estimate that the height had been reduced by as much as 10 feet 6 inches since the date of Gordon's visit, at least in this part of the circuit; though a robbery on the scale that he records may well have taken place elsewhere.

The evidence obtainable at Dun Telve thus shows that a tower from which a great deal of debris had already fallen was probably just under 40 feet high in 1720; and that at that height the intra-mural space had become so narrow that an inexpert observer considered the walls to have "joined together." This is not to say, however, that the wall-head had been reached or that it was even particularly near; Gordon's illustration, while showing the faces of the walls as being very close together, does not

[1] A trace of what may have been this hole, now built up, can be clearly seen in one of Dr Curle's published photographs (*P.S.A.S.*, vol. l. p. 251, fig. 8) about 9 feet above the top of the entrance. *Cf.* also pp. 63, 65 on Clickhimin.

[2] *Op. cit.*, pl. 65.

[3] *P.S.A.S.*, vol. l. p. 245, fig. 4.

[4] *Tour in Scotland*, pl. xli. (3).

[5] *Ibid.*, pp. 337 f. He gives the height as 30 feet 6 inches, but his further figure for a wall-thickness of 7 feet 4 inches "taken at the distance of ten feet from the bottom" shows that the level of the ground inside the tower had been raised some 7 feet by accumulated debris.

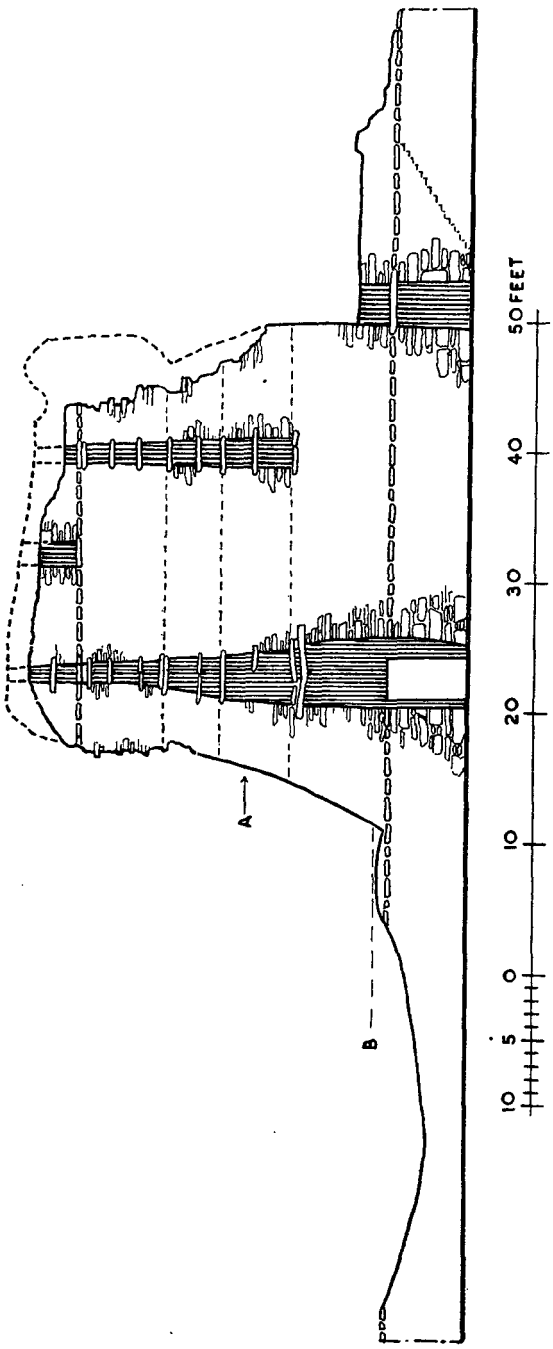


Fig. 3. Interior elevation of Dun Telve as in 1916, developed on the flat after H.M. Office of Works' elevation (*P.S.A.S., loc. cit.*). Dotted outline indicates probable condition in 1772, after Pennant (*Tour in Scotland, loc. cit.*).

by any means indicate that they had actually been bonded into one. Moreover, if the proportion of height to diameter was the same as that observed at Mousa, the tower would have been at least 60 feet in height.

The facts relating to Dun Carloway can be better obtained from the account written by Thomas in 1861 [1] than from that prepared by the Ancient Monuments Commission exactly sixty years later, as during this interval something like 11 feet seems to have fallen from the upper part of the wall and a piece of modern walling has been erected in its place at the level of the vanished fourth gallery.[2] As seen by Thomas, Dun Carloway in its highest part still showed four galleries and the outer wall of a fifth, as compared with the three now surviving; for this he gives a height of 34 feet, which compares well enough with the existing height of about 22 feet for the top of the third gallery. He does not believe that the original height was more than two or three feet in excess of the former figure; he gives no reasons for this opinion, but may have been led to it by the close convergence of the walls—these are now only 12 inches apart at the floor of the third gallery and 8 inches apart at its top, and he regards all the upper galleries as having been too narrow for access. This inference seems reasonable enough and, if it is accepted, we are left with a picture of a tower under rather than over 40 feet in height, and this on an external basal diameter of 47 feet. It would thus have been considerably lower than Mousa, and rather more squat in profile.

While the evidence so far reviewed suggests that brochs may have varied in height, and that in particular some may have been a good deal lower than Mousa, there is nothing to show that any one of them was low enough to be excluded from the class of "tower" in respect of its general proportions. It is theoretically possible to argue [3] that the brochs now seen broken down to comparatively low heights never, in fact, attained to the proportions of towers, and that tower-like brochs were rare and exceptional structures. But against this suggestion both direct and indirect evidence can be brought. A passage in George Buchanan's *Rerum Scoticarum Historia* [4] compares Arthur's O'on with "numerous" (*compluria*) structures then standing "in a certain island," stating that they are "rather bigger and more roomy" (*majuscula et laxiora*) than the O'on.[5] These structures can only have been brochs, and to give grounds for the comparison

[1] *Arch. Scot.*, vol. v. pp. 383 ff.

[2] This modern walling is shown hatched in the section published by the Ancient Monuments Commission (*Inventory of the Outer Hebrides, etc.*, fig. 57), though without explanation in the text. But that this was the Commissioners' interpretation of the remains I am informed by Mr C. S. T. Calder, who prepared the published drawings.

[3] As by Sir W. Lindsay Scott, D.S.C., F.S.A., in *P.P.S.*, New Series, vol. xiii. (1947), pp. .

[4] Ed. 1582, fol. 6.

[5] Aikman, in his English version of 1827, p. 24, gives "in the islands," which is an obvious mistranslation; and "more loosely constructed" for *laxiora*, for which again there seems to be little justification.

they must have shown a somewhat tower-like profile. We have thus direct evidence that a number of high-standing brochs, additional to those now known,[1] still existed in the sixteenth century. The indirect evidence is furnished by the lower storeys of all the broch ruins alike, and is even more compelling. The immensely wide and solid basal storey, combined with so ingenious an arrangement as the hollow, galleried wall for decreasing the volume of the stonework, points clearly to the fact that the wall was intended to be high,[2] and that the builders consequently saw need to reduce unnecessary weight and to provide for stability under the lateral pressure of wind, as well as to save material. And in connection with this latter factor it is well to point out that the broch method of construction will not effect any saving unless the wall is of more than moderate height, as several galleries are required to compensate for the massive size of the solid basal portion. Thus an ordinary solid wall 20 feet high by 7 feet and 5 feet in thickness at the base and the top respectively would be perfectly stable and also, probably, sufficient as an obstacle to escalade;[3] but the section of this wall contains about 120 square feet, whereas the lowermost 20 feet of the Dun Carloway wall, if sectioned elsewhere than through the cell, gives a corresponding figure of about 140 square feet. It would therefore have been allowable, in the case of Dun Carloway, to infer that the height had been more than some 20 feet even if we had not known this to be the fact; and the argument is even more compelling in cases where the solid basal portion is higher and thicker.

Nor is it possible to explain away the thickness of the bases of broch walls by comparing them with other thick drystone walls, *e.g.* those of some of the great Irish forts. These latter may well have been intended to give space on their wall-heads for the deployment of a large force of defenders, with which tactic their easy, open stairs would have accorded very well indeed. But a defensive plan of this kind would have been quite unsuitable to a broch, with its narrow, awkward stairs and tortuous galleries. The analogy would be rather with the outer defensive works found at a number of brochs (pp. 87 ff.); the one at Mid Howe, for example, being up to 19 feet in thickness at its highest surviving level, is already unnecessarily massive if regarded as a barrier or as cover, while the extraordinary construction at Kilmster, originally 22 feet broad and subsequently thickened to a maximum of 40 feet,[4] strongly suggests a vantage-ground for hand-to-hand fighting at the lip of the ditch.

The foregoing conclusions as to height, however, undoubtedly raise a

[1] To which may be added the vanished Dun Alascaig.

[2] That the principal purpose of the thick basal portion was not to accommodate cells is shown by the high proportion of brochs which contained one cell only (*supra*, p. 58).

[3] Part of the prehistoric parapet remains, intact and unrestored, at the fort of Loch Doon, near Ardara, Co. Donegal. The wall is about 17 feet high.

[4] I am indebted for this piece of information to Mr C. S. T. Calder, who excavated the remains of this broch in 1940, before they were swept away in the construction of an air-field.

difficulty in connection with the very large examples. Thus Edinshall, which is not round on plan, measures from 79 feet to 93 feet over all and from 51 feet to 60 feet internally across the court; and it is quite impossible to suggest that it ever showed the same proportions in profile as Mousa, with a height of 95 feet or more. The same might be said of Achaneas, with an external diameter of about 80 feet; or of Dun Bhorairaic, to which Pennant's measurements would give one of 76 feet; [1] or even of Torwoodlee, which closely approaches this figure. In such cases one is virtually bound to suppose that the brochs were high enough for the owners' purposes, whatever these were, but that their profiles were squat and not tower-like—thus Edinshall, if 40 feet high, would have had the same profile as a broch 26 feet high on a base 56 feet in external diameter. Apart, however, from these and other exceptional cases—and no doubt exceptions occurred from a variety of causes—there seems to be no good reason to suppose that the broch was not, in essence, a tower-like structure, and that it normally stood 40 feet or more in height to the wall-head.

It remains to consider for what purpose structures of tower-like proportions may have been built.

One important object in the builders' minds was no doubt defence against escalade—a danger perhaps increased by the roughness of the outer face of a drystone wall.[2] It is not at all clear, however, why the builders of the brochs should have taken, as it would thus appear, so much more serious a view of this particular hazard than the builders of ordinary forts, who were content with walls, again of drystone construction, of very much lower height—the more so as it can hardly be supposed that their enemies were equipped with regular scaling-ladders. While no general comparisons can properly be made on these lines owing to the influence of varying site-conditions on the practicability of scaling any individual structure, the difficulty remains, and prevents this explanation from appearing completely adequate. However, if the broch was the residence of a single family and not the stronghold of a community, its garrison would presumably have been smaller than that of a fort, and correspondingly stronger material defences might have been desired on this account.

It is likewise common to find brochs regarded as watch-towers, but this explanation of their height is again far from satisfactory. The terrain in Glen Beag (Glenelg) is such that the only view obtainable is one up and down the glen, and this would not have been materially improved by a rise of some 40 feet; while at Mousa a watchman on the hill behind the broch could have observed any movement on the sea with perfect safety to himself and would have had ample time to give the alarm. It is possible,

[1] On a recent visit Professor Childe found the diameter unmeasurable on account of fallen debris.

[2] *Cf.* the tradition of how Dun Carloway was scaled, with the help of two dirks used alternately as foot-holds (*Arch. Scot.*, vol. v. pp. 387 f.). The lower, battered portion of a broch wall is not, in fact, difficult to climb.

however, that on a site among rocks, gullies, and scrub-wood a tower might have given greatly improved observation into pockets of dead ground, besides the opportunity of searching such areas with a fire of arrows from the wall-head—supposing always that the bow and arrow was in use.[1] Indeed, were it not for the largely treeless condition of most of the broch country, one would certainly be led to suggest that the towers were designed to give a view over tree-tops. A high firing-platform, again, would no doubt help to increase the range of missiles, though simple wall-head defence against an assaulting rush would not in itself seem to call for an exceptionally high wall-head. None of the ordinary theories thus appear to carry conviction, and it is therefore perhaps not wholly fantastic to ask whether the height of the brochs may have been determined, or at any rate influenced, by other than material considerations. Magnificence in building is a common foible of wealthy and aristocratic societies, and the leading men of this northern Iron-Age community may conceivably have built their strongholds to an unnecessarily imposing height as a means of asserting their prestige.

### 5. External Defences.

While something must be said about this subject, it can only be approached in a tentative manner for lack of reliable data. Conclusions regarding the quality and strength of external defences can hardly be based on such summary mention as these works are frequently accorded in the published accounts, which tend to be chiefly concerned with the structural remains of the brochs; while the fact that the observations have been made by numerous observers with no uniform set of criteria introduces further uncertainties. Again, artificial defences can hardly be considered apart from the natural defensive features of the sites on which they are constructed—no true comparison, for example, can be held to obtain between two brochs which are alike unprovided with artificial defences if one of them stands on open, accessible ground and the other on a sea-girt stack. The subject, in fact, requires a fresh approach, with appropriate comparative field-work, and failing this the existing data must be treated with a great deal of caution. In particular, mere lack of any mention of external defences in a given case should not be regarded as dependable negative evidence, seeing that so remarkable a system as the one at Gurness was only brought to light by the spade.

Subject to all these provisos, external defences are recorded as shown in Table IX.

On the figures in the table the following remarks may be made: (i) The totals (col. *d*) seem unexpectedly small, not only when stated as percentages of the total number of "certain" brochs, broch sites, and "uncertain

[1] On which *cf.* p. 71, note 1.

TABLE IX.—EXTERNAL DEFENCES.

| Region. (a) | Particularly strong defences. (b) | Less strong defences. (c) | Totals (b) + (c) (d) | Totals (d) as percentage of Table I, cols. (b) + (d) totalled. (e) | Totals (d) as percentage of Table I, col. (e). (f) |
|---|---|---|---|---|---|
| I. Shetland . . | 15 | 6 | 21 | 32 per cent. | 22 per cent. |
| II. Orkney . . | 7 | 10 | 17 | 20 ,, | 16 ,, |
| III. Northern Mainland | 7 | 31 | 38 | 18 ,, | 17 ,, |
| IV. West Coast and Inner Islands . | .. | 19 | 19 | 39 ,, | 39 ,, |
| V. Outer Islands . | .. | 4 | 4 | Not calculated: see below. | |
| VI. Central and Eastern Mainland . | 3 | .. | 3 | | |
| Totals . | 32 | 70 | 102 | | |

examples" (col. *f*), but also when stated as percentages of "certain" brochs and "uncertain examples," without consideration of sites (col. *e*). While negative evidence—admittedly of doubtful validity—is exerting an influence here, as it were by implication, and while the low figure for Orkney (col. *d*) must be suspect on the ground that it may be due in part at least to defective observations by early excavators as well, perhaps, as to extensive stone-robbery by farmers, it still seems clear that external defences are in fact less common, particularly in Shetland and Orkney, than the Ancient Monuments Commission suggests in its summing-up of the subject.[1] No valid conclusion can be based on the very few examples recorded in the Outer Islands except that external defences must be very rare in that region; while the figure for Region VI should be ignored until more is known of the relationship of the brochs in question to the works among which they stand.[2] (ii) Comparison of columns (*b*) and (*c*) shows a notable contrast

[1] R.C.A.M., *Inventory of Orkney and Shetland*, vol. i. p. 33.
[2] *Infra*, p. 90.

in the proportions of "particularly strong" and "less strong" defences in Regions I, II, III, and IV—the other two regions being again left out of consideration. While the figures have no doubt been influenced to some extent by the disturbing factors of which mention has been made above, there undoubtedly exists in Shetland a series of brochs heavily and elaborately defended by ramparts of earth or walls, and wide, deep ditches (*infra*). That "less strong" defences predominate in the Northern Mainland, and on the West Coast and Inner Islands, may also be taken as certain; their absence, or apparent absence, from the latter region being comparable with a similar blank in the Outer Islands. (iii) The figures for Region IV in cols. (*e*) and (*f*) are exaggerated in comparison with those for Regions I, II, and III by reason of the fact that no broch sites are recorded in Region IV. (iv) If Table IX is compared with the statistical conclusions given above under Section 4 (ii), no marked correspondence is found. It can only be said that "particularly strong" defences seem to be present in the northern group of Regions (I, II, and III) and absent from the southern group (IV, V, and VI), these groups also differing significantly in respect of their internal diameters (p. 79). However, in view of the comparatively small numbers of instances from Regions IV to VI that are shown in Table IX, this observation should not be regarded as establishing a fact but rather as pointing to a possible subject for study.

The main types of defensive outworks may be classified as follows:

(i) *Multiple Ramparts and Ditches.*—This type is magnificently exemplified by the complex laid bare at Gurness, where the defensive belt of three ramparts and three ditches must originally have measured at least 70 feet in width. With this system should no doubt be compared the Shetland examples just mentioned, though their details are still unexplored; in some of them the defences are drawn across a neck and do not encircle the broch, as they probably did at Gurness before the site became eroded. The most striking of the Shetland examples are at Hoga Ness, Burland, Sna Broch (Fetlar), and Underhoull.

(ii) *Walls and Ditches on Promontories.*—With the foregoing works link up the single walls, usually accompanied by ditches, that are frequently drawn across promontories or narrow necks. The massive wall at Mid Howe, 13 feet 6 inches to 19 feet in thickness, and with an outer ditch 9 feet wide and a narrower inner one, is the finest example of this type that has yet been excavated; but analogous though slighter walls may be seen at Nybster and Ness, and a ditch at Skirza Head.

(iii) *Encircling Walls.*—Clickhimin shows the best example of a simple encircling wall; this runs round the former shore-line of the islet on which the broch is built and averages 10 feet in thickness. At Jarlshof part of a thinner wall survives, and unexcavated traces of similar encircling walls occur at many sites in various localities. The great wall of enceinte at

Edinshall cannot at present be placed in this class with certainty, as its connection with the broch, though quite probable, is unproved; and even less can be said of the superficially similar cases of The Laws and Torwoodlee.

(iv) *Foreworks.*—A final word must be said about the forework at Clickhimin, an internal gatehouse set within the wall of enceinte and spanning the passage that leads to the door of the broch through a complex of external buildings. No other such forework is known to be connected with a broch, but it invites comparison with the gateway in the wall that surrounds an island in the Loch of Huxter (Whalsay),[1] and with the totally detached building that stands within an outer defence of ditch and bank near the point of the Ness of Burgi.[2]

## 6. Recapitulation.

The chief points made in this paper may be summarised as follows:

The facts of *distribution and typology* cannot safely be used as evidence for the broch's place of origin. The large total *number* indicates the former importance of the broch as a social factor, but there is no reason to suppose that all brochs were in use at once. Among the architectural features, *entrances* follow the "normal" plan except in a very few cases. The supposed "normal" arrangement of *guard-cells* (one on each side of the entrance) occurs in only 21 per cent. of the cases noted; a single cell occurs in 52 per cent., "right-hand" outnumbering "left-hand" cells by more than three to one; no cell at all is present in 26 per cent. The arrangement of three *mural cells* ("right," "left," and "opposite") made familiar by Mousa is likewise not normal, as three cell-entrances are found in only 13 per cent. of the cases, while one cell-entrance occurs in 47 per cent., two in 30 per cent., and more than three in 10 per cent. "Left-hand" cell-entrances preponderate. Complete *basal galleries* are much less common than cells, and occur mainly in the Inner and Outer Islands. In respect of *upper galleries and stairs* Mousa, which is commonly regarded as the norm, differs from the three other least ruinous brochs in various ways which cannot be resumed summarily. A second stair exists in four cases. Of the stair-entrances 69 per cent. are on the "left-hand" side of the court. Veranda-roofs resting on low-level *scarcements* probably served also as balconies; high-level scarcements (only one preserved) may have supported some roof-structure. *Voids*, besides relieving lintels, may in some cases have given access to galleries from balconies. Theoretical considerations are against *roofs* of towers, if present, having been masonry vaults, though some experimental evidence for this exists. Elaborate arrangements for *water-supply* are made in many cases. Statistical study of *mean internal diameters* shows

[1] R.C.A.M., *Inventory of Shetland*, No. 1316.
[2] *Ibid.*, No. 1154.

that the northern district (Shetland, Orkney, Caithness, Sutherland) differs significantly from the rest of the country in this respect. In *height* brochs probably varied, some being lower than Mousa and more squat in profile; but there is no reason to believe that any were too low to be characterised as towers. Several explanations can be suggested for their height but none is completely convincing. Very strong *external defences* seem to be commonest in Shetland (15 out of total 32).

## APPENDIX.

### List of Brochs, Broch Sites, and certain Comparable Structures.

The following list contains five hundred and fifty items, as follows: (i) Three hundred and four structures which have been positively identified as brochs and are still in existence. For those printed in italics no dimensions or structural features are on record. (ii) Sixty-seven sites of vanished structures which are recorded as brochs. These are listed as "broch sites." In a few cases descriptions exist. (iii) One hundred and forty-one structures which probably are or possibly may be brochs, but which have not been positively identified as such. These are listed as "uncertain examples." (iv) Thirty-eight "comparable structures." These are not brochs, but they embody features which appear in broch architecture.

The material is arranged under the six regional headings adopted in the body of the paper, namely Shetland, Orkney, Northern Mainland,[1] West Coast [2] and Inner Islands, Outer Islands, and Central and Eastern Mainland (*cf.* fig. 1). The county, island, or district in which each broch stands is noted, and a reference is given to the principal source from which information regarding it has been obtained. In the case of brochs surveyed by the Royal Commission on the Ancient and Historical Monuments of Scotland, this reference takes the form of the structure's serial number in the appropriate County Inventory.

### I. SHETLAND.

All numbers refer to the Royal Commission's Inventory of Orkney and Shetland.

Brochs.

*Aithsetter, 1141.*
Balta, 1596.
Brough Holm, 1548.
*Burga Water, 1606.*
Burgar Stack, 1544.
Burland, 1247.
Burra Ness, 1716.
Burraland, 1143.
Burraland, 1607.
Burravoe, 1114.
Clevigarth, 1147.

[1] North of a line joining Tain and Gruinard.

[2] From Gruinard to Kirkcudbright.

## I. SHETLAND (*contd.*).

### Brochs (*contd.*).

Clickhimin, 1246.
Clumlie, 1145.
Culswick, 1397.
Dalsetter, 1146.
*East Burra Firth, 1395.*
Eastshore, 1148.
Feal, 1211.
*Footabrough, 1608.*
Fugla Ness, 1115.
Gossabrough, 1718.
Greenbank, 1715.
Hamnavoe, 1353.
*Hawk's Ness, 1500.*
*Head of Brough, 1721.*
Hoga Ness, 1545.
Holm of Copister, 1720.
Houbie, 1212.
*Houlland, 1396.*
*Housabister, 1282.*
Infield, 1116.
*Islesburgh, 1354.*
Jarlshof, 1149.
Levenwick, 1144.
Loch of Houlland, 1352.
Loch of Huxter, 1605.
*Loch of Kettlester, 1719.*
Loch of Watsness, 1609.
Mousa, 1206.
Noss Sound, 1085.
*Nounsburgh, 1394.*
Sna Broch, Fetlar, 1210.
Sna Broch, Unst, 1546.
Southvoe, 1142.
Stoal, 1717.
Underhoull, 1547.
*Wadbister Ness, 1499.*
West Burra Firth, 1393.
*West Houlland, 1398.*
*West Sandwick, 1722.*
Windhouse, 1723.

### Broch Sites.

Aith, 1106.
Baliasta, 1579.
Barra Holm, 1529.
Brei Wick, 1744.
Brough, 1107.
Brough, 1277.
Brough, 1343.
Brough Lodge, 1238.
Brough Taing, 1580.
Burgan, 1386.
Burland, 1535.
Burra Voe, 1384.
Burrastow, 1673.
Burravoe, 1745.
Burrian, 1308.
Burwick, 1528.
Heogan, 1105.
Houllands, 1468.
Knowe of Houlland, 1188.
Loch of Burraland, 1387.
Loch of Stavaness, 1307.
Mail, 1187.
Musselburgh, 1582.
Orbister, 1385.
Sand Wick, 1581.
Scousburgh, 1190.
Stoura Brough, 1674.
Sumburgh Head, 1189.
Symbister, 1342.
Vidlin, 1306.

### Uncertain Examples.

Bousta, 1610.
Brindister, 1399.
Burga Water, 1284.
Cullingsburgh, 1086.
Fethaland, 1355.
Gord, 1150.
Heglibister, 1501.
Loch of Benston, 1283.
Loch of Brindister, 1248.
Loch of Brow, 1153.
Lunabister, 1152.
Pinhoulland, 1611.
Skelberry, 1151.
Wester Skeld, 1400.

### Comparable Structures.

Loch of Huxter, 1316.
Ness of Burgi, 1154.

## II. ORKNEY.

All numbers refer to the Royal Commission's Inventory of Orkney and Shetland.

### Brochs.

*Berstane, 405.*
Borwick, 679.
*Braebuster, 624.*
Breckness, 920.
Burgar, 261.
Burness, 321.
Burray (East), 862.
Burray (West), 861.
Burrian, Corrigal, 12.
Burrian, N. Ronaldsay, 193.
Burrian, Russland, 14.
Burroughston, 778.
Burwick, 817.
Castle of Bothican, 522.
Dingieshowe, 625.
*Green Hill, 379.*
Gurness, 263.
Helliar Holm, 806.
*Hillock of Breckna, 486.*
Howe of Hoxa, 815.
*Hunda, 863.*
Ingshowe, 322.
*Knowe of Burrian, 551.*
Knowe of Burristae, 1034.
Knowe of Dishero, 265.
Knowe of Stenso, 262.
Lamb Head, 947.
Lingro, 406.
Loch of Ayre, 360.
*Loch of Clumly, 678.*
Mid Howe, 553.
*Ness of Ork, 777.*
Ness of Woodwick, 264.
Netlater, 13.
Oxtro, 11.
Point of Buryan, 437.
Skogar, 16.
Steiro, 779.
Taft, 15.
Verron, 260.
Westside, 552.
Wasso, 438.

### Broch Sites.

Arion, 939.
Brough, 851.
Burrowstone, 1023.
Colli Ness, 473.
Dennis Ness, 205.
Harra, 852.
Harray Church, 138.
Hoor Ness, 1071.
Hunton, 980.
Knoll of Skulzie, 1072.
Loch of Westhill, 801.
Overbrough, 139.
Redland, 320. A description of the structure of this broch is on record.
Scar, 182.
Scockness, 606.
Smiddybanks, 850.
Stackrue, 677. A description of the structure of this broch is on record.
Stromness, 940.
Tofts, 430.
Westbrough, 183.

### Uncertain Examples.

Backaskaill, 159.
Braebister, 380.
Burrian, Garth, 21.
Burrian, Loch of Harray, 680.
Cantick, 1006.
Cummi Howe, 872.
Deerness Church, 629.
Finstown, 323.
Green Hill of Hesti Geo, 1008.
Green Hill, Stronsay, 948.
Green Hill, Walls, 1007.
Hall of Rendall, 270.
Hillock of Baywest, 949.
Hodgalee, 1035.
How Farm, 158.
Howan, 20.
Howe of Langskaill, 627.
Kirk of Cleaton, 23.
Knowe of Gullow, 22.
Knowe of Hunclett, 555.
Knowe of Ryo, 267.
Loch of Hundland, 18.
Loch of Isbister, 17.
Mamie Howe; information from Mr J. S. Richardson.
Mithouse, 19.
Nebister, 160.

## II. ORKNEY (*contd.*).

UNCERTAIN EXAMPLES (*contd.*).

Ness of Boray, 313.
Newark, 439.
North Howe, 557.
Riggan of Kami, 628.
St Mary's Kirk, 24.
St Tredwell's Chapel, 523.
Scarrataing, 681.
Scockness, 554.
Tankerness, 626.
The Howe, 921.
The Skeo, 1009.
Tingwall, 268.
Verron, 682.
Viera Lodge, 556.
Vinquin, 266.
Wass Wick, 269.
Weems Castle, 816.

## III. NORTHERN MAINLAND.

Numbers refer to the Royal Commission's Inventories of Caithness (abbr. C.) and of Sutherland (abbr. S.).

BROCHS.

*Achanarras, C. 99.*
*Achaneas, S. 50.*
Achaneas, S. 51.
Acharole, C. 466.
*Achavar, C. 199.*
*Achbuiligan Tulloch, C. 350.*
Achcoillenaborgie, S. 183.
*Achies, C. 98.*
*Achingale, C. 473.*
Achlochan Moss, C. 102.
*Achorn, C. 214.*
*Achow, C. 208.*
Achunabust, C. 351.
Achvarasdal Lodge, C. 353.
*Achvarn, C. 112.*
*Allt a' Choire Mhoir, S. 312.*
Allt an Duin, S. 182.
*Allt an Duin, S. 313.*
Allt Breac, S. 395.
*A' Mheirle, S. 478.*
Appnag Tulloch, C. 218.
Armadale Burn, S. 190.
Backies, S. 272.
*Balantrath, C. 213.*
*Ballachly, C. 192.*
*Bell Mount, C. 431.*
Berriedale, C. 203.
*Berriedale, C. 205.*
*Borrowston, C. 510.*
*Brabstermire, C. 37.*
Brae, S. 107.
*Brinside Tulloch, C. 434.*
Brounaban, C. 511.
*Bruan, C. 193.*
Burg Langwell, C. 201.
*Burg Ruadh, C. 207.*
*Burn of Latheronwheel, C. 212.*
Camas an Duin, S. 157.
*Camster, C. 189.*
*Camster, C. 522.*
Carn Bran, S. 468.
Carn Liath, S. 187.
Carn Liath, S. 270.
*Carn Mor, S. 53.*
Carn na Mairg, C. 105.
Carrol, S. 27.
Castle Cole, S. 25.
*Castlehill, C. 320.*
Clachtoll, S. 7.
Cnoc Donn, C. 103.
Coghill, C. 469.
Coich Burn, S. 23.
Coill' Ach a' Chuil, S. 176.
Croick, E. Ross; personal observation.
Crosskirk, C. 347.
Dail Langwell, S. 49.
*Dalchork, S. 394.*
*Dale, C. 104.*
*Doir a' Chatha, S. 52.*
Duchary, S. 28.
Dun an Ruigh Ruadh, W. Ross; information from Mr C. S. T. Calder.
Dun Carnachaidh, S. 180.
Dun Chealamy, S. 179.
Dun Creagach, S. 175.

## III. NORTHERN MAINLAND (*contd.*).

BROCHS (*contd.*).

Dun Dornaigil, S. 155.
Dun Lagaidh, W. Ross; information from Mr C. S. T. Calder.
Dun na Maigh, S. 527.
*Dun Riaskidh, S. 529.*
Dun Viden, S. 181.
Dunbeath, C. 215.
Dunrobin Wood, S. 271.
East Kinnauld, S. 477.
Eldrable, S. 309.
Elsay, C. 521.
Everley, C. 36.
Feranach, S. 314.
Forsinain, S. 186.
*Framside, C. 111.*
Freswick Links, C. 34.
*Gansclet, C. 501.*
*Gills, C. 53.*
Gledfield, E. Ross; personal observation.
*Golsary, C. 220.*
Green Tullochs, C. 348.
Greysteil Castle, C. 222.
Grum More, S. 174.
*Gunn's Hillock, C. 2.*
*Gunn's Hillock, C. 194.*
Gylable Burn, S. 311.
*Ha' of Duran, C. 436.*
*Hempriggs, C. 504.*
Hill of Works, C. 3.
Hillhead, C. 520.
*Hoy, C. 435.*
Inshlampie, S. 178.
Keiss, C. 515.
*Killin, S. 26.*
*Killouran, S. 310.*
Kilphedir, S. 307.
Kintradwell, S. 467.
*Knock Urray, C. 349.*
*Knockglass, C. 117.*
*Knockglass, C. 475.*
*Knockinnon, C. 216.*
*Kyle of Tongue, S. 530.*
Kylesku, S. 168.
Langdale Burn, S. 177.
*Latheronwheel, C. 211.*
*Leosag, C. 109.*
Loch Ardbhair, S. 4.
*Loch Mor, S. 189.*
*Loch Shin, S. 391.*
*Lynegar, C. 471.*
*Mid Clyth, C. 195.*
*Minera, C. 197.*
*Murkle, C. 319.*
*Murza, C. 63.*
*Mybster, C. 96.*
Ness, C. 33.
*North Calder, C. 110.*
Norwall, C. 508.
Nybster, C. 518.
*Occumster, C. 198.*
Old Stirkoke, C. 499.
Ousedale Burn, C. 204.
Road Broch, Keiss, C. 517.
*Roster, C. 191.*
*Rumster, C. 219.*
Sallachadh, S. 392.
Sandy Dun, S. 184.
*Scotscalder, C. 113.*
*Scottag, C. 470.*
*Scrabster, C. 429.*
Shiness, S. 393.
*Sibmister, C. 321.*
*Skelbo Wood, S. 106.*
*Skinnet, C. 116.*
Skirza Head, C. 35.
*Smerral, C. 209.*
*Spital, C. 100.*
*Spital, C. 101.*
*Spital, C. 474.*
Suisgill, S. 308.
*Tannach, C. 500.*
Thing's Va, C. 432.
Thrumster, C. 502.
Thrumster Little, C. 503.
*Thurdistoft, C. 318.*
*Tiantulloch, C. 196.*
*Toftgun, C. 525.*
*Trantlemore, S. 188.*
*Tulach Bad a' Choilich, C. 202.*
Tulach Beag, C. 107.
Tulach Mor, C. 108.
Tulloch of Lybster, C. 346.
*Tulloch of Shalmstry, C. 437.*
*Tulloch of Stemster, C. 344.*
*Upper Borgue, C. 206.*
*Upper Latheron, C. 217.*

## III. NORTHERN MAINLAND (*contd.*).

### Brochs (*contd.*).

*Upper Sour, C. 114.*
*Usshilly Tulloch, C. 221.*
Warehouse, C. 190.
Watenan, C. 524.
Watten, C. 468.
Wester Broch, C. 513.
Wester Watten, C. 464.
*Westerdale, C. 106.*
White Gate, Keiss, C. 516.
Yarrows, C. 509.

### Broch Sites.

Achies, C. 180.
Auckingill, C. 52.
Clerkhill, S. 265.
Cnoc Chaisteal, S. 386.
Dun Alascaig, E. Ross; *Arch. Scot.*, vol. v. p. 192.
Dun Buidhe, S. 544.
Dun Phail, S. 387.
Ha' of Bowermadden, C. 22.
Hoy Station, C. 179.
Kettleburn, C. 588.
Kilbrare, S. 24.
Kilmster, C. 507.
Leckmelm, W. Ross; Ordnance Survey.
Midgarty, S. 476.
Rattar Burn, C. 84.
Stemster, C. 54.
Wilkhouse, S. 476.

### Uncertain Examples.

Achies, C. 97.
An Dun, Drienach; information from Mr C. S. T. Calder.
Banks of Watten, C. 465.
Bilbster, C. 514.
Borgie Bridge, S. 185.
Bowertower, C. 19.
Cairn of Dunn, C. 462.
Cairn of Humster, C. 506.
Camster, C. 18.
Carn a' Chladda, C. 467.
Carn Mor, Baileuachdrach, E. Ross; personal observation.
Carn Mor, Birchfield, E. Ross; personal observation.
Creag Leathan, C. 352.
Dun Mor, Doune, E. Ross; personal observation.
East Kinnauld, S. 479.
Gearsay, C. 472.
Geise, C. 430.
Ha' of Greenland, C. 64.
Halcro, C. 1.
Hill of Stemster, C. 505.
Hollandmay, C. 39.
Housel Cairn, C. 115.
Knockglass, C. 171.
Learable, S. 315.
Lechanich, Upper (=Leth Choinnich), E. Ross; information from Professor Childe.
Loch Watenan, C. 526.
Old Hall of Dunn, C. 461.
Old Hall of Dunn, C. 463.
Olrig Glebe, C. 322.
Olrig House, C. 323.
Oust, C. 455.
Rattar, C. 83.
Scarfsferry, C. 62.
Scoolary, C. 38.
Scrabster, C. 433.
Smerral, C. 210.
Stemster, C. 345.
Thuster, C. 519.
Torrisdail, S. 528.
Tulloch Turnal, C. 200.
Ulbster, C. 523.

### Comparable Structures.

Dunan Diarmaid, W. Ross; *P.S.A.S.*, vol. xxix. p. 188.
Sgarbach, C. 45.

## IV. WEST COAST AND INNER ISLANDS.

Numbers refer to the Royal Commission's Inventories.

### Brochs.

Abhuinn Bhaile Mheadhonaich, Skye, 481.
Caisteal Grugaig, W. Ross; information from Mr G. P. H. Watson.
Dun Ard an t-Sabhail, Skye, 478.
Dun Arkaig, Skye, 480.
Dun Beag, Skye, 479.
Dun Bhoreraic, Islay; information from Professor Childe.
Dun Boreraig, Skye, 505.
Dun Borodale (Voradel), Raasay, 575.
Dun Borrafiach, Skye, 510.
Dun Colbost, Skye, 506.
Dun Edinbain, Skye, 512.
Dun Fhiadhairt, Skye, 508.
Dun Flashader, Skye, 513.
Dun Gearymore, Skye, 511.
Dun Greanan, Skye, 539.
Dun Hallin, Skye, 509.
Dun nan Gall, Mull; *P.S.A.S.*, vol. lxxvii. p. 40.
Dun Osdale, Skye, 507.
Dun Raisaburgh, Skye, 540.
Dun Sleadale, Skye, 477.
Dun Suledale, Skye, 618.
Dun Telve, Glenelg; *P.S.A.S.*, vol. l. pp. 241 ff.
Dun Troddan, Glenelg; *P.S.A.S.*, vol. lv. pp. 83 ff.
Glen Heysdal, Skye, 514.
Kingsburgh, Skye, 619.
Sean Dun, Mull; *P.S.A.S.*, vol. lxxvii. p. 40.
Teroy, Wigtown, 28.
Tirefuar, Lismore; *P.S.A.S.*, vol. xxiii. pp. 375 f. and 427 f.

### Uncertain Examples.

An Dun, Loch Fiart, Lismore; information from Professor Childe.
Ardwell, Wigtown, 433.
Dun Boraige Moire, Tiree; Beveridge, *Coll and Tiree*, pp. 78 ff.
Dun Bornaskitaig, Skye, 564.
Dun Borve, Skye, 515.
Dun Borve, Skye, 620.
Dun Choinnich, Skye, 605.
Dun Feorlig, Skye, 516.
Dun Garsin, Skye, 482.
Dun Heanish, Tiree; Beveridge, *op. cit.*, pp. 87 f.
Dun Hiader, Tiree; Beveridge, *op. cit.*, pp. 80 ff.
Dun Ibrig, Tiree; Beveridge, *op. cit.*, pp. 112 ff.
Dun Liath, Skye, 655.
Dun Mhadaidh, Mull; information from Professor Childe.
Dun Mor a' Chaolais, Tiree; Beveridge, *op. cit.*, p. 75.
Dun Mor Vaul, Tiree; Beveridge, *op. cit.*, pp. 76 ff.
Dun Urgadel, Mull; information from Professor Childe.
Mullach Dubh, Mid Argyll; personal observation.
Sean Chaisteal, Mull; information from Professor Childe.
Sean Dun, Lismore; information from Professor Childe.
Stairhaven, Wigtown, 310.

The information at present available does not warrant the inclusion of the following sites: Barchastallain, Castle Chalamine, Castles, Duchoille, Dunan Diarmaid, Kirkmichael Glebe, Lagandruim, and Tomaclare. (*Arch. Scot.*, vol. v. pp. 193 f.). Gordon's "Castle Chonil" (*Itin. Septent.*, p. 166) is evidently the same as Dun Grugaig, Glenelg; *cf.* Anderson, *Scotland in Pagan Times: The Iron Age*, p. 183.

### Comparable Structures.

Ardifuar, Mid Argyll; *P.S.A.S.*, vol. xxxix. p. 260.
Castle Haven, Kirkcudbright, 64.
Druim an Duin, Mid Argyll; *P.S.A.S.*, vol. xxxix. p. 286.
Dun a' Choin Dhuibh, S. Knapdale; *P.S.A.S.*, vol. lxxvii. p. 41.
Dun Aisgain, Mull; information from Professor Childe.

## IV. WEST COAST AND INNER ISLANDS (*contd.*).

COMPARABLE STRUCTURES (*contd.*).

Dun Ardtreck, Skye, 484.
Dun Bhuirg, Mull; information from Professor Childe.
Dun Choinichean, Mull; information from Professor Childe.
Dun Chroisprig, Islay; *P.S.A.S.*, vol. lxxx. p. 00.
Dun Geilbt, Skye, 602.
Dun Grugaig, Glenelg; *P.S.A.S.*, vol. xxix. pp. 180 ff.
Dun Grugaig, Skye, 651.
Dun Kearstach, Skye, 649.
Dun Liath, Skye, 541.
Dun Mhuilig, Mid Argyll; personal observation.
Dun na Mhuirgheidh, Mull; information from Professor Childe.
Dun Ringill, Skye, 650.
Dun Rudh 'an Dunain, Skye, 483.
Dun Skudiburgh, Skye, 542.
Dun Totaig, Skye, 518.
Dun Traigh Mhachir, Islay; *P.S.A.S.*, vol. lxxx. p. 00.
Dun Vallerain, Skye, 544.
Dun Voradel, Skye, 575.
Dunan an Aisilidh, Skye, 576.
Dunburgidale, Bute; *P.S.A.S.*, vol. xxvii. p. 287.
Kildonan Bay, Kintyre; *P.S.A.S.*, vol. lxxiii. pp. 185 ff.
Luing, S. fort, Lorne; *P.S.A.S.*, vol. xxiii. p. 406; xxv. p. 476; xxvii. p. 375.
Peinduin, Skye, 630.

## V. OUTER ISLANDS.

Numbers refer to the Royal Commission's Inventory of the Outer Hebrides, Skye, and the Small Isles.

BROCHS.

Dun a' Chaolais, Vatersay, 442.
Dun an Sticir, N. Uist, 171.
Dun Borve, Lewis, 11.
Dun Carloway, Lewis, 68.
Dun Cromore, Lewis, 38; *cf.* also *Arch. Scot.*, vol. v. p. 380.
Dun Cuier, Barra, 441.
Dun Torcuill, N. Uist, 172.
Loch an Duna, Lewis, 10.

UNCERTAIN EXAMPLES.

Dun Airnistean,[1] Lewis, 33; *cf.* also *Arch. Scot.*, vol. v. p. 373.
Dun Aligarry, S. Uist, 427.
Dun Ban, Barra, 446.
Dun Baravat, Gt. Bernera, 71.
Dun Borranish, Lewis, 74; *cf.* also *Arch. Scot.*, vol. v. p. 393.
Dun Borve, Berneray;[1] *Arch. Scot.*, vol. v. p. 399.
Dun Borve, Harris, 125; *cf.* also *Arch. Scot.*, vol. v. p. 396.
Dun Buidhe, S. Uist, 373.
Dun Chlif, Barra, 448.
Dun Loch an Duin, Barra, 445.
Dun na Buaile Uachdraich, S. Uist, 374.
Dun Sandray, Sandray, 444.
Dun Sleibhe,[1] Lewis, 30; *cf.* also *Arch. Scot.*, vol. v. p. 392.
Dun Smirvig,[1] Lewis; *Arch. Scot.*, vol. v. p. 372.
Dun Stuigh, Gt. Bernera, 70.
Dun Traigh na Berie, Lewis, 69.
Dun Vulan, S. Uist, 375.
Dunan Ruadh, Fuday, 443.
Dunan Ruadh, Pabbay, 447.
Loch Baravat, Lewis, 36; *cf.* also *Arch. Scot.*, vol. v. p. 373.

COMPARABLE STRUCTURES.

Barra Head, Berneray, 450.
Dun Ban, Grimsay, 299; *cf.* also *Arch. Scot.*, vol. v. p. 399.
Dun Bilascleiter, Lewis, 34.
Dun Loch an Duin, Lewis, 51; *cf.* also *Arch. Scot.*, vol. v. p. 378.
Dun Scurrival, Barra, 449.
Loch Hunder, N. Uist, 173.

[1] No structure remains; description from record only.

## VI. CENTRAL AND EASTERN MAINLAND.

Numbers refer to the Royal Commission's Inventories.

### Brochs.

Bow Castle, Midlothian, 233.
Coldoch, Perthshire; *P.S.A.S.*, vol. ix. p. 38.
Edinshall, Berwickshire, 115.
Struy, Inverness-shire; *Arch. Scot.*, vol. v. p. 194, and information from Professor Childe.
Tor Wood, Stirlingshire; *P.S.A.S.*, vol. ix. p. 29.
Torwoodlee, Selkirkshire; *P.S.A.S.*, vol. xxvi. pp. 71 f. and lxvi. p. 341.

### Uncertain Examples.

Hurley Hawkin, Angus; *P.S.A.S.*, vol. vi. p. 210.
The Laws, Angus; *P.S.A.S.*, vol. iii. p. 440.