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A REASSESSMENT OF THE HIGH PRECISION MEGALITHIC LUNAR SIGHTLINES, 1: BACKSIGHTS, INDICATORS AND THE ARCHAEOLOGICAL STATUS OF THE SIGHTLINES

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1. *Introduction*

The evidence presented over the years in favour of megalithic lunar sightlines, first by Alexander Thom[1] and more recently by A. Thom and A. S. Thom,[2] is cumulative in nature. At each stage in this work the essential evidence consists of one or more analyses of many putative sightlines from a number of megalithic sites taken together; and at each stage the claimed precision of the sightlines that emerges from the analysis is greater than was claimed at previous stages. Thus the hypothesis of high precision lunar sightlines essentially rests upon a succession of broad-based analyses testing for ever-greater levels of precision in the sightlines. Four such levels have been identified by the author,[3] and a reassessment of the evidence at Levels 2 and 3 has been given in a previous publication.[4]

The data set at Level 4 presented by the Thoms in two recent publications, one of which[5] is an expanded version of the other,[6] consists of all those sightlines which they consider to have been reliably measured—a total of forty-two. Detailed reasons have been given by A. S. Thom[7] why sightlines included in earlier analyses were not now considered suitable. Of these forty-two lines, twenty-three were amongst a sample of twenty-five examined separately in an earlier paper,[8] as being most convincing according to strict terms of reference. In the analyses of both the forty-two and the twenty-five lines, the calculated residuals (differences between measured and expected declinations), and hence the inferred precision of the sightlines, were of the order of only 1 or 2 minutes of arc.[9]

In these two papers we attempt a reassessment of all aspects of the high precision lunar sightlines, taking as our data base the Thoms' forty-two lines together with the two (at Escart and Haggstone Moor) which they included amongst their earlier twenty-five lines but did not carry forward—a total of forty-four putative sightlines.

Our first task is to identify clearly what is the hypothesis being tested, and what is the full nature of the data presented in order to test it. This clarification is of vital methodological importance if effects really present in the data are to be provenly separated from investigator-imposed ones. We must ask whether the data set, taken as a whole, forces us to accept the hypothesis of deliberate lunar sightlines, or whether the putative sightlines that have been presented can quite adequately be explained away as chance occurrences. The key questions are these:

(1) Is each putative sightline archaeologically and intrinsically (*i.e.* in the broad terms of the hypothesis) suitable for inclusion in the analysis?

(2) Is the information supplied about each sightline correct?

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(3) Is the overall selection of putative sightlines for inclusion in the analysis free of subjective bias?

Having re-examined, and perhaps revised, the data set, we can finally ask:

(4) Does the data presented force us, statistically speaking, to accept the hypothesis of deliberate sightlines as opposed to mere chance occurrences?

What follows is directed towards clarifying the data and answering these questions. Part One, presented here, tackles questions (1) and (2), concentrating on backsights and indicators. The reassessments are based upon first-hand examinations by the author during 1979 and 1981 of all the sites involved. Section 2 briefly identifies the hypothesis, and Section 3 presents, reassesses and clarifies in detail the site evidence. Conclusions are drawn in Section 4. Part Two, to follow, tackles questions (1) and (2) as regards the horizon foresights, on the basis of accurate theodolite resurveys. This leads on to a discussion of the selection of putative sightlines, and to suggestions for improving site methodology.

2. *The Hypothesis*

The hypothesis of precise lunar (or other astronomical) sightlines may be split into three parts as follows:

(I) certain distant horizon features, such as notches, hill slopes and peaks, were used as astronomical foresights;

(II) for each foresight there was a well-defined observing position (perhaps more than one); and

(III) permanent structures were erected so as to identify from the observing position the particular horizon feature(s) to be used.

An item of data to test this hypothesis must consist of

(i) a distant horizon feature (putative foresight);

(ii) a proposed observing position; and

(iii) a putative means of identifying the foresight from the observing position.

The reasons for stating the hypothesis in this way, and for choosing this hypothesis as opposed to others (such as the existence of non-indicated foresights) have been given at length in a previous publication.[10]

3. *The Site Data*

The main purpose of this section is to identify clearly for each item of data (putative sightline) what is the nature of the archaeological site involved, what is the proposed observing position and what is the proposed indication of the horizon foresight. Where some or all of these have not been clearly identified by the Thoms, an attempt is made to do so. As a basis for further discussion in Section 4, an attempt has been made to classify three attributes of each item of data as follows:

(1) *Archaeological status of the site.* A = reasonable; B = somewhat dubious; C = very dubious; Z = demonstrably ruled out on archaeological grounds (*e.g.* demonstrably not genuinely prehistoric).

(2) *Intrinsic status of the observing position (OP) and indication.* A = OP at back end of or behind the indication, and the indicated horizon range

includes the foresight; W = OP as above, but the indicated horizon range narrowly misses the foresight, say by up to 5°; X = OP marked on the ground, but the foresight is only indicated from another position, from which observations of the same foresight are also hypothesized to have been made; Y = OP marked on the ground, but the indication is non-existent; Z = the indication is ineffectual (since the horizon foresight is not visible from any position behind it), so the OP must be elsewhere.

(3) *Archaeological status of the observing position marker and/or indicating structure (as appropriate) when considered as such.* Classes as under (1).

Other dubieties, such as the putative use of certain indicating structures at a site when there also exist others which seem inherently more likely (such as the flat side of a slab when it is one element of an alignment pointing in an entirely different direction), are merely noted in the text where they arise.

Line 1: Wormadale Hill, Shetland. This is a single unworked granite menhir, 2·3 m tall but leaning by about 20° to the SW, situated on the northern end of the flattish top of Wormadale Hill. Its lower half measures up to 0·75 m wide and 0·5 m thick (above this it tapers irregularly), and its longer sides are oriented roughly upon true azimuths of 160° and 340° (to the nearest 10°). Thus, even allowing for possible twisting about the base as the stone has leaned over, there is no evidence of any indication of the proposed lunar foresight at an azimuth of 192°. The menhir is, presumably, itself to be taken as marking the observing position. *Class:* site = A; intrinsic status = Y; arch. status = A.

Lines 2–10: Brogar, Orkney. This is a Class II (two-entrance) henge with interior stone circle (the Ring of Brogar), together with a nearby outlier (the Comet Stone) and two adjacent broken companions, and several large and small mounds. While recent excavations of the ring ditch[11] yielded no useful

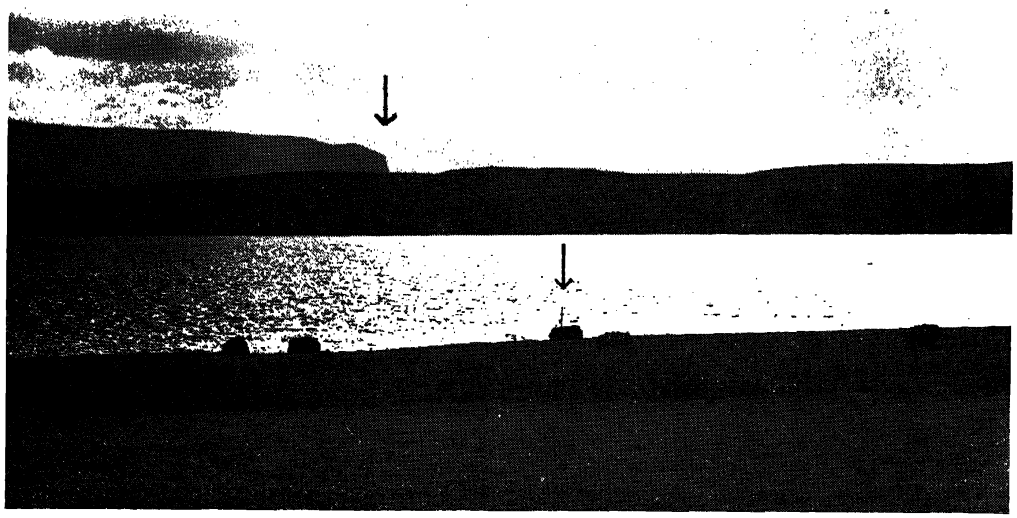

FIG. 1. Sightline no. 2, Hellia from mound *J* at Brogar. The camera is at the assumed observing position, the centre of *J*. The proposed indication is provided by mound *K*, whose centre is marked by a surveying pole and an arrow. The foresight is also marked by an arrow. (All photographs are by the author.)

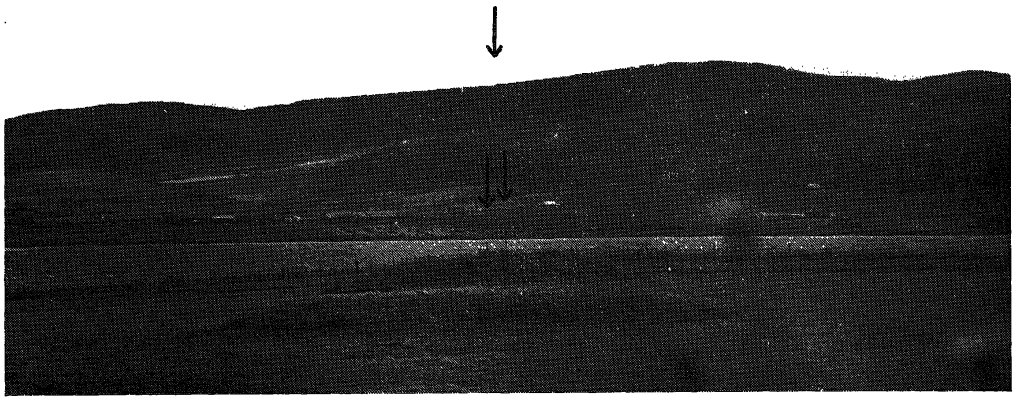

FIG. 2. Sightline no. 6, Mid Hill from mound *M* at Brogar. The camera is on the NE side of *M*. The proposed indication is provided by mounds *L* and *J*, whose centres are marked by surveying poles and arrows. The foresight is also marked by an arrow.

radiocarbon dates, such information from other Class II henges would suggest a date of construction from about 2100 bc (2500 B.C.),[12] but certainly before about 1700 B.C., the earliest possible date of use as a lunar observatory as deduced by Thom and Thom.[13] Of the larger mounds, only mound *B* is directly relevant to any of the proposed nine sightlines.[14] Also known as Fresh Knowe, it is an elongated mound some 35 m to 40 m long (NW to SE) by about 25 m wide, and between $3\frac{1}{2}$ m and $5\frac{1}{2}$ m high. While the only documented incursion (in 1853) uncovered no evidence of burials,[15] the mound is very likely a much despoiled chambered cairn, possibly horned.[16] As such, it is unlikely to have been constructed after about 2500 bc (3000 B.C.);[17] that is, it probably predates the Ring of Brogar itself by about 500 years. Most of the smaller mounds noted by the Thoms are roughly circular, between about 6 m and 10 m across, up to 2 m high and flat-topped.[18] They are of uncertain original dimensions and could be additions of considerably later date, certainly as late as 1100 bc (1400 B.C.), as at the nearby Knowes of Quoyscottie.[19] The Comet Stone and its broken companions are themselves set in such a mound, which perhaps makes it likely that they are broadly contemporary with the other smaller mounds. As with all single menhirs and especially the smaller ones (the Comet Stone is 1·8 m tall), their date is uncertain within wide margins unless such an assumption can be made.

Two out of the nine proposed sightlines (Lines 8 and 9) involve mound *B*, which seems very dubious on archaeological grounds, since the construction of the mound probably predated the proposed use of the sightline by some 1500 years. In addition, Lines 8 and 10 involve barely discernible mounds of uncertain artificial status (L_2 and T respectively), which makes them somewhat dubious. The use of the other six proposed sightlines seems not unreasonable on archaeological grounds. However, if we are to entertain this hypothesis we must accept in consequence that the convenient placing of the Ring of Brogar itself some 1000 years earlier was either fortuitous or was achieved by

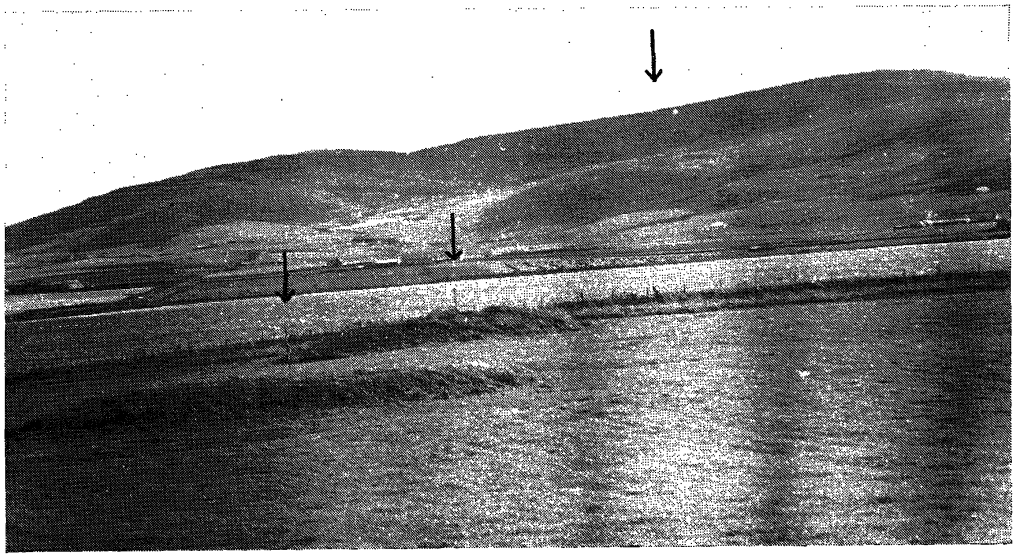

FIG. 3. As in Fig. 2, but with the camera on the SW side of *M*.

earlier observations of at least two of the same lunar foresights. This is not out of the question: in 1000 years the obliquity of the ecliptic, ϵ, changes by approximately 6′,[20] so that in order to observe the same lunar event on, say, the Hellia foresight[21] (distance 13·3 km, azimuth 228°), one would need to alter the azimuth by approximately 15′ at constant altitude; *i.e.* the observing position would have to move perpendicular to the sightline by something like 60 m. Whether the placing of the Ring was fortuitous or not, the fact that a total of four foresights in distinct directions could be used from the same general area could have been nothing but sheer good fortune, a point recognized by the Thoms.[22] *Class:* site = A; the intrinsic status of the individual sightlines at Brogar to be considered further on their own merits; arch. status (Lines 2–7) = A, (Lines 8 and 9) = C, (Line 10) = B.

Line 2: Hellia[21] *from mound* J.[14] The proposed backsight here is the centre of *J*, a mound about 1 m high and 8 m across. The assumed observing position is the present level of the top of *J*. For this foresight (distance 13·3 km) a difference of 2 m in observer height would alter the altitude of the foresight by about 0′·5. The proposed indication is provided by the centre of *K*, a mound somewhat more difficult to make out, but which appears to be about $\frac{1}{2}$ m high and 6 m across. The present centre of *K*, marked by a pole in Figure 1, indicates the horizon some 2° to the right of the proposed foresight, marked by an arrow. *Class:* intrinsic status = W.

Line 3: Hellia from mound L. *L* is about $\frac{1}{2}$ m high and 8 m across. The observing position is upon it. The effects of changes in observer height are as per Line 2 above. There is no indication of the foresight from here. *Class:* intrinsic status = X.

Line 4: Hellia from mound M. *M* stands to about 2 m in height, and is about 10 m across from north to south. The observing position is given[23] as at ground level by *M*, rather than upon it. The effects of changes in observer height are

as per Line 2 above. There is no indication of the foresight from here. *Class: intrinsic status* = X.

Line 5: Mid Hill from Comet Stone. The Comet Stone is a flat slab 1·8 m high by 0·8 m wide by 0·2 m thick. Its flat faces are oriented about 0°·5 and 1°·5 respectively to the left of the foresight, as noted by the Thoms.[24] It stands on a mound about $\frac{1}{2}$ m high and 6 m across, but is accompanied by the stumps of two further menhirs which were set with their longer faces in line and roughly at right angles to those of the Comet Stone. *Class:* intrinsic status = W.

Line 6: Mid Hill from mound M. *M* is as described above (Line 4). The observing position is given[23] as at ground level by *M*; for this foresight (distance 6·0 km) a difference of 2 m in observer height would alter the altitude of the foresight by 1′·1. The indication is given[23] as the line *LJ* (see Lines 3 and 2 respectively for details), presumably along their line of centres. From the NE side of *M*, the centres of *L* and *J*, marked by poles in Figure 2, are almost in line, and point within acceptable margins of error to the foresight, marked by an arrow. However, from the SW side of *M* they are a good way off line and point at least 4° to the left of the foresight (Figure 3). Thus the NE side of *M* seems to be the appropriate observing position. *Class:* intrinsic status = A.

Line 7: Kame (*Upper*) *from* J_2. J_2 is an unmarked point on the ground in line with mounds *M*, *L* and *J* on a slight ridge. Its position is found "by standing so that the small cairns *D*, *E*, *F* and *G* appear below Kame".[25] *D*, *E*, *F*, *G* and *H* are a group of five mounds so close together as to be almost contiguous. However, if there is any remaining evidence of an indication, the mounds within the group must themselves provide it, since J_2 can only be deduced from this. In their site plan[14] the Thoms mark the mounds *G*, *F*, *E* and *D* showing their centres in a line pointing to the proposed foresight. In their overgrown state when visited in 1979, only *G* and *E* (together with *H*) could be defined with any degree of certainty. *G* and *E* are both about $\frac{1}{2}$ m high, and about 7 m and 10 m wide respectively. Their line of centres, as admittedly determined with large uncertainties, is oriented about 5° to the right of the foresight. A point directly behind this line of centres, and still on the line *MLJ*, would be about 7 m NW of J_2, and would result in an increased azimuth for the foresight (distance 8·2 km) of about 3′. *Class:* intrinsic status = W.

Line 8: Kame (*Lower*) *from mound* L_2. There is a discernible bump at L_2, perhaps about 6 m across, but its status as a ploughed out artificial mound is uncertain. The proposed observing position is at present ground level here. For this foresight (distance 8·2 km) a difference of 2 m in observer height would alter the altitude of the foresight by 0′·8. The proposed indication is provided by the large mound *B* (see general site remarks above). As viewed from L_2, its centre is about 4° to the right of the foresight. *Class:* intrinsic status = W.

Line 9: Ravie Hill from Comet Stone. For details about the Comet Stone see Line 5. The proposed indication is provided by the large mound *B* (see general site remarks above). This wide mound is only some 90 m away from the Comet Stone, and subtends over 5° in azimuth; its estimated centre, marked by a pole in Figure 4, is only about 1° to the right of the proposed foresight, marked by an arrow. It should be noted, on the other hand, that if the original height of *B* was only 1 m or so greater than at present, this would be sufficient

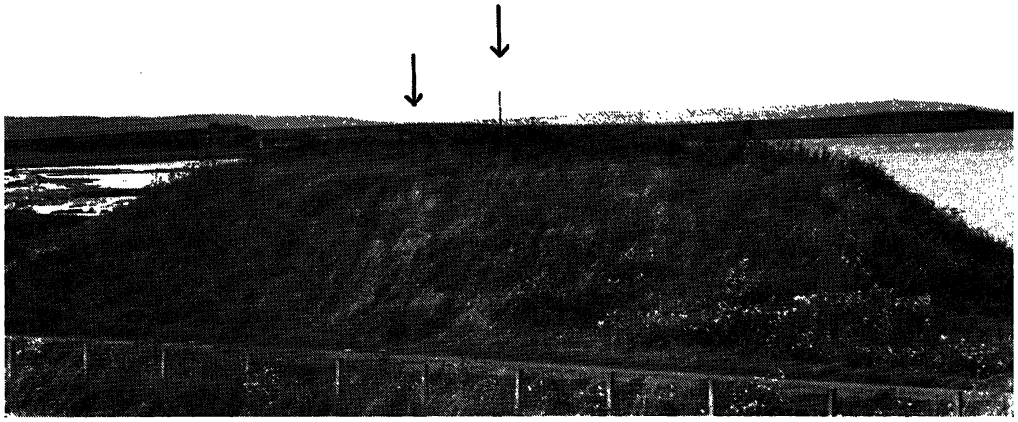

FIG. 4. Sightline no. 9, Ravie Hill from the Comet Stone at Brogar. The camera is at the assumed observing position, by the Comet Stone, at eye height. The proposed indication is provided by mound *B* (Fresh Knowe), whose centre is marked by a surveying pole and an arrow. The foresight is also marked by an arrow.

to obscure the foresight. As it has been trenched and quite possibly plundered for road-building material, this is not unlikely. *Class:* intrinsic status = W.

Line 10: Ravie Hill from mound H. *H* is the southernmost of five mounds very close together (see Line 7). It is roughly 1 m high and 8 m across. For this foresight (distance 12·8 km) a difference of 2 m in observer height would alter the altitude of the foresight by 0′·5. The proposed indication is provided by the line *HFT*. *F* is another mound in the group containing *H*; its extent could not be determined with any certainty by the author during 1979, owing to undergrowth, but its centre can be no more than 10 m from that of *H*. *T* is a barely discernible area of slightly raised ground which appears to correspond to a "very small tumulus" marked on a plan made in 1849 by Lt. F. W. L. Thomas.[26] This seems to be the only reference to the mound in the literature and its status must be regarded as uncertain. From *H*, this area sits under and to the right of the proposed foresight. *Class:* intrinsic status = A.

Line 11: Stenness, Orkney. This is a Class I (single entrance) henge with interior stone circle. Although it shares with the nearby Ring of Brogar the feature of a rock-cut ditch, it is considerably smaller in diameter, and two radiocarbon dates of around 2300 bc (3000 B.C.) from the ditch[27] put its date of construction well before the earliest probable date for the Ring of Brogar, which is a Class II henge.[12] The Thoms hypothesize that the Stones of Stenness were used as an observing point to supplement the observations possible from Brogar;[28] however, if this was the case the convenient placing of the site, which had been constructed some 500 years earlier than Brogar, must have been entirely fortuitous. Thus the use of this site as a backsight is very dubious on archaeological grounds. The proposed indication for this sightline also forms the distant foresight: it is the Ring of Bookan, on the skyline 2·9 km away. The Ring of Bookan is an approximately circular ditch enclosing a destroyed structure of unknown type.[29] On the basis of the similarity of the ditch to that of Maes Howe it has been suggested, but never proved by excavation, that it was similar to the

latter.[30] Thus there is no good evidence for the date of the proposed foresight; however, even if the site line was used as suggested, the placing of the backsight and indicator, some 1000 to 1500 years earlier, must have been entirely fortuitous. *Class:* site = A; intrinsic status = A; arch. status = Z.

Lines 12–13: Mid Clyth, Caithness. This fan-shaped array of small upright stones consists of a main sector of rows and a smaller sector annexed to the west.[31] If there originally existed an eastern annexe, symmetrical to the surviving one according to Thom's geometrical interpretation, then its outer radius would have provided the indication of both foresights. Although three or four stones survive to the east of the main sector, and the Ordnance Survey note the presence of small hollows edged with packing stones as evidence of the former existence of further rows,[32] it seems unlikely that an entire annexe would have been almost entirely destroyed, whilst much still remains of the adjacent eastern part of the main sector.[33] The stone rows are placed on a south-facing slope, and points on the ridge immediately to their north provide likely observing positions. For these foresights (distances 79 km and 88 km) a lateral shift of 10 m in the observing position would alter the azimuth of the foresight by only 0′·4, so that the site itself could be considered as marking the observing position. *Class:* site = A; intrinsic status = Y; arch. status = A.

Line 14: Callanish, Lewis. This well-known site consists of a circle of tall menhirs surrounding a central 4½ m-high monolith and chambered cairn, together with five radial rows of menhirs, the two northern ones running parallel and known as "the avenue". The proposed indication is provided by either side of the avenue running south; that is, through the taller stones of the central setting. A rocky outcrop some 50 m to the south obscures the proposed foresight as seen from the north end of the avenue,[34] although it can be seen from 7 m further west.[35] *Class:* site = A; intrinsic status = Z; arch. status = A.

Line 15: Airigh nam Bidearan ("*Callanish V*"), *Lewis.* This site consists of five small upright slabs about ½ m high, three of which are close (within 10 m) and in line, situated on an east-facing slope;[36] recently more stones have been identified under the peat.[37] While these stones may represent no more than the remaining part of a field or enclosure wall,[38] some or all of them may well be sunken prehistoric menhirs. In the absence of excavation, though, one can do no more than record the site as of uncertain status. The line of three stones indicates the horizon some 1°·5 to 2° to the right of the proposed foresight, not 7° as misquoted in a previous publication.[39] *Class:* site = B; intrinsic status = W; arch. status = B.

Line 16: Corogle Burn (*Glen Prosen*), *Forfar.* This is an alignment of four stones, consisting at one end of two prostrate slabs close together, both about 2½ m long, which may well be fallen menhirs, and at the other end, some 20 m distant, two small irregular earthfast blocks about 1 m high. They occur between the edge of rig and furrow cultivation and an old track, which suggests that they could possibly be the remains of a former field wall.[40] In this case, even if the prostrate slabs had been standing in Antiquity, the proposed indication, along the alignment, could be fortuitous. The observing position would be behind the small blocks. *Class:* site = B; intrinsic status = A; arch. status = B.

Line 17: Fowlis Wester, Perth. This site consists of two rings of small stones, a fallen menhir some 2½ m long lying between them, and a menhir 2 m high.[41] Thom proposed as observing position the centre of the eastern ring, and as indication the right-hand side of the menhir, some 13 m to the NE. In fact the eastern ring is undoubtedly the kerb of a small cairn, originally surrounded by a free-standing ring of ten small stones; it would have been built up, but its original height cannot have been more than about 1·5 m.[42] This being the case, we must postulate an observing position behind the cairn, with the indication provided by lining up its centre with the right-hand side of the menhir. *Class:* site = A; intrinsic status = A; arch. status = A.

Line 18: Lundin Links, Fife. There are three large menhirs here, between 4 m and 5½ m tall. A fourth is known to have existed two centuries ago.[43] Two of the stones are situated within 7 m and roughly aligned, forming the only plausible indication at the site. This points some 2° to the right of the position where the Moon would have set when it rose behind the proposed foresight (Bass Rock);[44] there is no indication of the foresight itself. We can only take the site itself as marking the observing position. For this foresight (distance 24·8 km) a lateral shift of 10 m in the observing position would alter the azimuth of the foresight by 1′·4. *Class:* site = A; intrinsic status = Y; arch. status = A.

Line 19: Kintraw, Argyll. This site, consisting of a 4 m-high menhir and two cairns, has been much discussed in the context of solar solstitial observations from an alleged observing platform.[45] The proposed indication of the lunar foresight is the line from the menhir through the centre of the small cairn to its SW.[46] The latter is a kerb-cairn of diameter approximately 6 m, with its centre less than 10 m from the menhir. When built up it is unlikely to have been so tall as to have obscured the foresight for an observer at ground level. The observing position must be assumed to have been either behind or beside the menhir. If behind, the observer could have no hope of seeing over it, so would presumably need to line up along one side. This seems extremely unlikely, as the longer sides of the menhir are not aligned in this direction. (It was re-erected in 1979 after excavation of the socket-hole.[47]) On the other hand, if the observer stood beside the menhir, the proximity of observer and indicating structure, together with our uncertainty of the exact position of either, means that the indication could have been towards any part of an azimuth range several degrees wide. While this includes the proposed foresight, it equally well includes points within 2–3° in azimuth on either side of it. *Class:* site = A; intrinsic status = A; arch. status = A.

Lines 20–23: Kilmartin, Argyll. This site consists firstly of the Temple Wood stone circle, excavated over recent years by Scott,[48] who has also uncovered the remains of a second, previously unsuspected circle some 20 m to the NE of the first, and presumably of earlier date.[49] Some 300 m to the SE is a group of five large standing stones and some small stones, with a sixth menhir of intermediate size outlying to the NW.[50] The proposed indications at the site involve alignments between various of these features. In the absence of dating evidence, it is not unreasonable to hypothesize that the standing stone group and the Temple Wood circle are broadly contemporary, although this is by no means certain. Patrick[51] has pointed out that the site bears a structural resemblance to

the nearby site at Barbreck, yet the latter appears to have no candidates for indications of possible lunar significance. *Class:* site = A; the intrinsic status of individual sightlines at Kilmartin to be considered further on their own merits; arch. status = A.

Line 20: Notch A_1 *from menhir* S_1.[52] According to Thom,[53] the foresight is seen by looking from the group of menhirs over the circle; in the site plan the longer faces of S_1 can be seen also to be oriented in this direction. S_1 is a $2\frac{1}{2}$ m-high slab whose NE face is rather too convex to provide a convincing indication, but its SW face indicates the horizon some 7° to the right of the proposed foresight. From S_1, the main circle sits below the horizon between approximately 0°·5 and 2° to the left of the foresight.[54] The new circle sits somewhat to the right. *Class:* intrinsic status = W.

Line 21: Notch A_1 *from group* Q. Group *Q* consists of three tiny slabs no more than $\frac{1}{2}$ m tall, which lie roughly on three sides of a rectangle. From behind this group the centre of the main Temple Wood circle sits centrally below the proposed foresight. Assuming that an observer would stand behind or within the stone group, and that there originally existed a fourth stone to complete the setting (as seems likely in view of similar settings surrounding stone S_1 and also a menhir at Barbreck), the observing position is defined to within about 1 m. For this foresight (distance 2·2 km) a lateral shift of 1 m in the observing position would alter the azimuth of the foresight by 1′·5. *Class:* intrinsic status = A.

Line 22: Notch A_1 *from menhirs* S_5S_4. S_5 and S_4 are two aligned slabs about $2\frac{1}{2}$ m tall. The alignment indicates the horizon some $4\frac{1}{2}$° to the right of the foresight. The main circle as seen from behind S_5 sits below the horizon between approximately 3° and $4\frac{1}{2}$° to the right of the foresight.[54] The new circle sits even farther to the right. *Class:* intrinsic status = W.

Line 23: Notch A_2 *from menhir* S_2. A comparison of the declination quoted by Thom and Thom in the analysis of the forty-two lines[55] and those quoted in an earlier discussion of this site by Thom[56] shows the assumed backsight to be menhir S_2, one of a pair about $2\frac{1}{2}$ m tall and aligned, as are the other menhirs discussed above, to the NW. The indication is provided by looking from the pair S_2 and S_3 past the central menhir S_1 towards and over the pair S_4 and S_5. Because there is a pair of stones at each end, the range of possibly indicated azimuths is fairly wide, despite the length of the alignment; between 202° and $206\frac{1}{2}$°.[57] The azimuth of the proposed foresight is 208°. *Class:* intrinsic status = W.

Lines 24–25: Duncracaig (*Ballymeanach*), *Argyll.* At this site there is an alignment of four slabs, another roughly parallel to it consisting of only two, and the site of a holed stone, recently excavated.[58] The proposed indication is provided by the alignment of four. These are not exactly in line; thus, aligning the two end slabs gives an azimuth around 321° to $322\frac{1}{2}$° whereas aligning the SE-most three slabs gives an azimuth some 3° or so greater. The former azimuth range includes both proposed foresights. *Class:* site = A; intrinsic status = A; arch. status = A.

Line 26: Dunadd, Argyll. This is a large prostrate slab 4·2 m long, which was erect in 1872 and faced ENE.[59] Some 250 m away on a bearing of 328°[60] is a

small menhir, 1·4 m high, of uncertain origin, though the Ordnance Survey feel there is no reason to suppose it is not an antiquity.[61] Thom mentions the latter stone, but apparently dismisses it as an indication, as it is some 3° to the right of the proposed foresight to be viewed from the fallen slab. In fact, the error is no greater than at a number of other sightlines, although the method of indication—viewing from a large menhir and siting over a small one—seems somewhat unlikely. *Class:* site = A; intrinsic status = W; arch. status = A.

Line 27: Knockrome, Jura. The backsight here is a menhir 1·4 m high by 0·7 m wide by 0·2 m thick, leaning slightly to the ESE. According to Thom[62] the orientation of the stone "draws attention" to the foresight. Its faces are flattish and indicate azimuths respectively about 3° to the left and $1\frac{1}{2}$° to the right of the proposed foresight.[63] It is the central stone of a long and almost straight alignment of three, the others being respectively some 200 m to the WSW and 900 m to the ENE (at Ardfernal). *Class:* site = A; intrinsic status = W; arch. status = A.

Lines 28–29: Ballinaby, Islay. The backsight here is a very impressive menhir 5m high. According to Thom[64] its long sides are accurately oriented upon one of the proposed foresights (*B*), at an azimuth of about 329°. The other foresight (*C*) is at an azimuth of about 327°·5. At head height, the SW face is flat and indicates an azimuth of about 330°, whereas the NE face is rather convex and does not provide an accurate indication. Higher up the stone both faces are reasonably flat, but the SW face, being twisted, now indicates an azimuth more like 324°, and the NE face indicates about 327°. Thus the range of possibilities certainly includes the proposed foresights, but is in total about 6° wide. A second standing stone, broken off and now only 2 m tall, is situated some 200 m to the NNE of the first, and Pennant in 1772 recorded "three upright stones, of a stupendous size".[65] It is quite possible that these three stones formed an alignment. *Class:* site = A; intrinsic status = A; arch. status = A.

Line 30: Stillaig, Cowal. The backsight here is a 1·8 m-high menhir which might be prehistoric but might be more modern, for example a trackway marker.[66] The indication is provided by the right-hand one of a pair of menhirs some 700 m away, the other of which has been broken to a low stump. The far menhir is within $\frac{1}{2}$° in azimuth of the proposed foresight. Thom[67] states that the orientation of the backsight "invites one to look" at the far stone. Its SW face is reasonably flat and indicates roughly 10° to the left of the foresight. Its NE face is concave and could be taken to indicate anywhere within a 15° azimuth range. *Class:* site = B, intrinsic status = A; arch. status = B.

Line 31: Escart, Kintyre. This is an alignment of five menhirs, and there is some evidence to suggest that there may originally have been more menhirs at the site.[68] The proposed indication is along the alignment. However, unlike, for example, the rows forming the avenue at Callanish or the row of four menhirs at Duncracaig, the menhirs are not all slabs oriented (at least roughly) in the alignment, and furthermore the line is rather sinuous. Thus while a mean line indicates an azimuth of about 208°,[69] an intended indication might have been anywhere within about 4° on either side of this. This range includes the proposed foresight at an azimuth of 207°. *Class:* site = A; intrinsic status = A; arch. status = A.

Line 32: Skipness, Kintyre. In discussing the possible lunar significance of this site[70] the Thoms mention it as an unimpressive stone, and assume that it has fallen or been knocked over since the Ordnance Survey reported it as a "standing stone". However many of the designations on early Ordnance Survey maps were inaccurate, and there is no doubt that the stone is a natural erratic boulder.[71] It is rounded, of maximum dimensions about 1·0 m, and approximately 0·3 m thick. The Thoms refer to a socket on the west side of the stone; although there is a marked depression here there are also depressions in the ground on two other sides of the stone. There is no indication of the proposed foresight. *Class:* site = Z; intrinsic status = Y; arch. status = Z.

Line 33: Dunskeig, Kintyre. This site is unrecorded on any ancient monuments list. It consists of two stones some 6 m apart, the SE of which is 1·0 m high and leans by 30° or so from the vertical, while the NW stone is rounded, 0·4 m high, and earthfast. Atkinson has noted[72] that they could be the surviving grounders of a former field-wall, and the fact that the line between them is parallel to an existing wall some 10 m away to the NE seems to make this very likely. The proposed indication is along the line of two stones, from the smaller to the larger. Lining up the two stones squarely from behind gives a possible indication only about 1° wide, even though the far stone is leaning, and this includes the proposed foresight. Thus the Thoms' claim[73] that the stones "indicate accurately" the proposed foresight seems quite justified, despite their proximity to each other. *Class:* site = C; intrinsic status = A; arch. status = C.

Line 34: Tarbert, Gigha. This is a single menhir,[74] 2·3 m tall but leaning by about 20° to the east. It is a slab measuring 0·9 m by 0·4 m, its west face being oriented upon azimuths of around 7° and 187°, and its east face around 18° and 198°. Thus, even allowing for possible twisting about the base as the stone has leaned over, there is no evidence of any indication of the proposed foresight included amongst the forty-two lines, at an azimuth of 34°, or of another proposed foresight[75] at an azimuth of 324°. The menhir is, presumably, itself to be taken as marking the observing position. *Class:* site = A; intrinsic status = Y; arch. status = A.

Line 35: Beacharr, Kintyre. This is another single menhir,[76] 5·0 m high, measuring 1·4 m by 0·8 m at the base. Its longer axis is oriented roughly north–south, but neither of its longer faces is at all flat. There is no indication of the proposed foresight at an azimuth of 326½°. Again, the menhir is, presumably, itself to be taken as marking the observing position. *Class:* site = A; intrinsic status = Y; arch. status = A.

Line 36: Beinn an Tuirc, Kintyre. This inaccessible site in the middle of Kintyre consists firstly of a menhir, "MacKay's Cross".[77] It is a slab 1·8 m tall but leaning by about 20° to the SE, and 1·4 m by 0·3 m at the base. Both faces are reasonably flat, and their present orientation is between 221° and 225°. When Thom visited the site it was covered with peat and moss, and he planned several more stones in the vicinity, noting that other parts of the moor were largely devoid of stray boulders.[78] Since his visit the site has been prepared for planting by the Forestry Commission. Their drainage ruts show this to be an area of unusually thin peat cover: many of Thom's stones can now be identified as natural boulders or bedrock, and others appear to have been boulders which

were moved in the furrowing. The large stone marked by Thom as *S* is a flattish lump of rock, some 2·7 m long by 0·9 m wide and at least 0·5 m thick, which is buried at one corner although three are exposed. Prodding failed to reveal any end to the stone in the buried corner and it is very likely (though not certainly) an outcrop. The foresight (Cnoc Moy) is to be viewed from stone *S* or farther back, as it can not be seen from the menhir, and the proposed indication is provided by the line from *S* to the menhir. As seen from *S*, the menhir, if vertical, would have stood below and about 1° to the right of the foresight. It is within the bounds of possibility that the original orientation of the menhir, when upright, was towards the foresight (azimuth 211½°) but as the foresight was not visible from the menhir this is not a plausible indication. *Class:* site = A; intrinsic status = W; arch. status = C.

Lines 37–38: High Park, Kintyre. This is a single menhir,[79] 3·0 m tall by 1·3 m wide by 0·6 m thick at the base. Its SE face has two flat areas pointing in directions some 20° apart, and the NW face is generally convex, but the longer faces could be said to indicate directions within 10° either side of azimuths of 50° and 230°. The proposed foresights are at azimuths of 152½° and 156°, and are thus unindicated. The menhir is, presumably, itself to be taken as marking the observing position. *Class:* site = A; intrinsic status = Y; arch. status = A.

Lines 39–40: Campbeltown, Kintyre. This is another single menhir,[80] 4·0 m tall but leaning by about 20° to the north, and 1·4 m by 0·5 m at the base. Both its longer faces are rounded, and could be said to indicate points within a wide range, but the limits are about 20° in azimuth either side of east and west. Thus the proposed foresights, at azimuths between 177° and 178°, are unindicated. Again, the menhir is, presumably, itself to be taken as marking the observing position. *Class:* site = A; intrinsic status = Y; arch. status = A.

Line 41: Knockstapple, Kintyre. This is again a single menhir,[81] 3·2 m high by 1·8 m by 0·6 m at the base. Although the slab is wide the longer faces are highly irregular. The NE face is rough and contains a central projection; lining up the SE (near) end with this indicates an azimuth 4° to 6° to the right of the proposed foresight, whereas lining up the projection and the NW (far) end indicates approximately 11° to its left. The SW face is even rougher; however flat parts at the top and bottom both indicate azimuths around 6° to the left of the foresight. Thus the author cannot agree with Thom[82] that "the indicated azimuth of 326° is reliable". *Class:* site = A; intrinsic status = W; arch. status = A.

Line 42: Haggstone Moor, Wigtown. The backsight here is a menhir[83] called "Long Tom", 1·7 m tall but leaning slightly, not oriented upon the foresight at azimuth 304½°. The proposed indication is provided by a cairn about 1 km away, which is about 1½° to the left of the foresight.[84] *Class:* site = A; intrinsic status = W; arch. status = A.

Line 43: Blakeley Moss, Cumbria. This is a circle of 13 stones, reconstructed in 1925. However there is considerable doubt as to the accuracy of the reconstruction, and we cannot be absolutely certain that the original ring stood exactly on the spot where it has been reconstructed.[85] Some of the stones are visibly set in concrete. The observing position would presumably be in the

TABLE I. Summarized details of the forty-four proposed sightlines, excluding horizon foresights, and of the results of reassessments.

Column headings

1 Sightline number

2 Site reference in site lists to be published by the author

3 Site reference used by Thom

4 Site name

5 Location

6 All-figure National Grid reference

7 Description of the site

8 Foresight (given only to distinguish different sightlines at the same site)

9 Observing position (given only to distinguish different sightlines using the same foresight)

10 Nature of indication

11 Nature of observing position marker, given where there is no indication

12 Archaeological status of the site (see Section 3)

13 Intrinsic status of the observing position and indication (see Section 3)

14 Archaeological status of the observing position marker and/or indicating structure (as appropriate) when considered as such (see Section 3)

15 Overall status (see Section 4)

16 Latest year of visit by the author

Key to column 7 (site description)

C	Stone circle or ring
G	Setting of small stones
M	Menhir
BM	Broken menhir (*i.e.* earthfast stump)
FM	Fallen menhir
R	Stone rows
T	Chamber tomb, cairn or mound
P . . .	Possible . . .
X . . .	Several . . .
Y . . .	Site of . . .
Z . . .	Reconstructed . . .
. . ./. . .	. . . surrounding . . .
A (. . .)	Alignment consisting of . . .

Key to column 10 (nature of indication)

Am	Alignment of menhirs and/or possible menhirs
At	Alignment of cairns or mounds
CT	Circle centre to cairn or mound
F	Flat side of menhir
GC	Setting of small stones to circle centre
MC	Menhir to circle centre
MM	Menhir to menhir
MT	Menhir to cairn or mound
TM	Cairn or mound to menhir
TT	Line joining two cairns or mounds

Key to column 11 (nature of observing position)

C	Circle centre
M	By menhir
S	Somewhere on site (exact position uncertain)
T	Atop or beside cairn or mound

1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
1	SH31	Z3/4	Wormadale Hill	Shetland	4405	11465	M			—	M	A	Y	A	Y	81
2	OR30	O1/1	Brogar	Orkney	3294	10132	C, M, 2BM, XT, XPT	Hellia	*J*	TT		A	W	A	WA	79
3									*L*	—	T	A	X	A	XA	
4									*M*	—	T	A	X	A	XA	
5								Mid Hill	Comet	F		A	W	A	WA	
6									*M*	At		A	A	A	A	
7								Kame (Upper)		At		A	W	A	WA	
8								Kame (Lower)		TT		A	W	C	WC	
9								Ravie Hill	Comet	MT		A	W	C	WC	
10									*H*	At		A	A	B	B	
11	OR32	O1/2	Stenness	Orkney	3306	10125	C			CT		A	A	Z	Z	79
12	—	N1/1	Mid Clyth	Caithness	3296	9384	R	A_1		—	S	A	Y	A	Y	79
13								A_2		—	S	A	Y	A	Y	
14	LH16	H1/1	Callanish	Lewis	1213	9330	C/T, 5A (XM)			Am		A	Z	A	Z	81
15	LH24	H1/5	Airigh nam Bidearan	Lewis	1234	9299	A (3PM), 2PM			Am		B	W	B	WB	81
16	—	P3/1	Corogle Burn	Forfar	3349	7601	A (2PFM, 2PM)			Am		B	A	B	B	79
17	—	P1/10	Fowlis Wester	Perth	2924	7250	M, T, FM, C			TM		A	A	A	A	79
18	—	P4/1	Lundin Links	Fife	3405	7027	3M, YM			—	S	A	Y	A	Y	79
19	AR5	A2/5	Kintraw	Argyll	1830	7050	ZM, 2T			MT		A	A	A	A	81
20	AR13	A2/8	Kilmartin	Argyll	1827	6979	C, YC, G/M, 5M, G	A_1	S_1	MC		A	W	A	WA	81
21									*Q*	GC		A	A	A	A	
22									S_5	MC		A	W	A	WA	
23								A_2		Am		A	W	A	WA	
24	AR15	A2/12	Duncracaig	Argyll	1833	6964	A (4M), A (2M), YM	A_1		Am		A	A	A	A	79
25								A_2		Am		A	A	A	A	
26	AR27	A2/13	Dunadd	Argyll	1840	6933	FM, M			MM		A	W	A	WA	81
27	JU4	A6/4	Knockrome	Jura	1548	6715	2M			F		A	W	A	WA	79
28	IS15	A7/5	Ballinaby	Islay	1221	6673	PA (M, BM, YM)	*B*		F		A	A	A	A	79
29								*C*		F		A	A	A	A	
30	—	A10/5	Stillaig	Cowal	1935	6678	M			MM		B	A	B	B	81
31	KT5	A4/1	Escart	Kintyre	1846	6667	A (5M)			Am		A	A	A	A	79
32	KT6	—	Skipness	Kintyre	1906	6588	"M"			—	M	Z	Y	Z	Z	81
33	KT8	A4/23	Dunskeig	Kintyre	1762	6571	2PM			MM		C	A	C	C	79
34	KT12	A4/17	Tarbert	Gigha	1655	6523	M			—	M	A	Y	A	Y	81
35	KT15	A4/5	Beacharr	Kintyre	1692	6433	M			—	M	A	Y	A	Y	79
36	KT23	A4/9	Beinn an Tuirc	Kintyre	1735	6351	M, PFM			MM		A	W	C	WC	81
37	KT29	A4/2	High Park	Kintyre	1695	6257	M	A_1		—	M	A	Y	A	Y	79
38								A_2		—	M	A	Y	A	Y	
39	KT36	A4/14	Campbeltown	Kintyre	1724	6212	M	A_1		—	M	A	Y	A	Y	79
40								A_2		—	M	A	Y	A	Y	
41	KT41	A4/19	Knockstapple	Kintyre	1703	6214	M			F		A	W	A	WA	79
42	—	G3/2	Haggstone Moor	Wigtown	207	572	2M, FM, PM, T			MT		A	W	A	WA	79
43	—	L1/16	Blakeley Moss	Cumbria	3060	5140	ZC			—	C	A	Y	B	Y	81
44	—	W9/7	Parc-y-Meirw	Dyfed	1999	2359	A (4M, XFM, XYM)			Am		A	A	A	A	79

centre of the circle; for the proposed foresight (distance 49 km) a lateral shift of 10 m in observing position would alter the azimuth of the foresight by 0′·7. According to A. S. Thom,[86] even given this uncertainty in the exact original position of the circle, the declination can be determined sufficiently accurately, which is why this sightline is included amongst the forty-two. There is no indication of the foresight. *Class:* site = A; intrinsic status = Y; arch. status = B.

Line 44: Parc-y-Meirw, Dyfed. At this site are the remains of a long alignment consisting originally of at least eight stones. Four standing stones remain, and other fallen ones have been incorporated in the hedge-bank of a road which runs alongside the site.[87] The proposed indication is the alignment, and this points accurately to the proposed foresight.[88] *Class:* site = A; intrinsic status = A; arch. status = A.

4. *Conclusions and Discussion*

The results of Section 3, together with background information on each of the sightlines, are summarized in Table I. The three classifications assigned to each sightline are given in columns 12–14. In column 15 an overall status is assigned on the basis of these.

Three sightlines are classified "Z" on one or other count and have been assigned an overall status of "Z". They represent cases where the proposed sightline can definitely be ruled out as intentional. In one case (Line 11) the archaeological structures forming the sightline predate its date of supposed use, as deduced from the positions of the structures themselves, by some 1500 years; in the second case (Line 14) the proposed foresight cannot in fact be seen from the structure which is hypothesized to be indicating it, a situation which is clearly absurd; and in the third case (Line 32) the backsight is not a genuine archaeological site. Clearly in each of these cases an apparently significant declination has arisen which is demonstrably fortuitous. For example, in the second case, a significant declination has been calculated (from map work, rather than by measurements on site, which is how the anomaly went unnoticed) for a distant horizon feature from an observing position from which it cannot be seen. These three cases demand that we should examine closely the question of how easy it is in general to find candidates for sightlines of apparent lunar significance.

In the third case above (Line 32) a distant horizon feature has arisen with a significant declination as viewed from a point on the ground which is effectively arbitrary, that is, a point on the side of a hill slope with no archaeological structure marking it. This must lead us to ask how easy it is to find distant horizon features of apparent lunar significance from any arbitrary point in mountainous country. If, under the procedure by which distant horizon features are selected as potential foresights, the possibilities are so great that one or more feature of significance can in general be expected, then we must regard with suspicion any proposed foresights which are unindicated, even if viewed from a genuine archaeological site. Eleven of the forty-four sightlines (classified "Y" in column 13 of Table I) involve unindicated foresights, and have been assigned an overall status of "Y".

Two of the proposed sightlines at Brogar (Lines 3 and 4) involve observing from points marked on the ground by an archaeological structure, but where the proposed foresight is only indicated from another position, from which it is also hypothesized to have been observed. Before these lines are included, along with their indicated counterparts, in the data set for a statistical analysis, it must be realized that they are not statistically independent of their counterparts. Furthermore, steps must be taken to check how many other marked spots exist at the site which might equally well have been chosen *per se* (that is, without regard for the astronomical possibilities) as additional backsights for the indicated foresight. The two lines in this class, classified "X" in column 13, have been assigned an overall status of "X" with their archaeological status also noted.

In fourteen out of the remaining twenty-eight cases, the range of azimuths which could reasonably be hypothesized to have been intended by the proposed indication does not quite include the proposed foresight, missing it by up to 5°. These are the lines classified "W" in column 13 and assigned an overall status of "W" with their archaeological status also noted. In these cases it seems appropriate to ask whether we might not expect horizon foresights observed with scientific precision to be indicated in a skilful and precise manner. If the answer is Yes, then we must regard the more rough and ready "indications" as fortuitous and relegate these fourteen lines to the status of "Y". If the answer is No, then we must allow (from the point of view of a statistical verification) that all proposed indications might be in error by (say) up to 5° in azimuth. We must then check how greatly this increases the chances of being able to select a putative foresight within the wider error margins of any given indication. While it is not out of the question that in some cases the present poor state of putative indicating structures might be misleading—for example at Brogar it is possible that errors in our present determination of the mound centres, owing to their extensive destruction, could account for some of the azimuth discrepancies, or that lost markers (such as wooden posts) could have been used, and not necessarily placed centrally on the mounds—such uncertainties must be acknowledged to increase the likelihood of being able to fit an astronomical theory to chance occurrences at a site.

Of the remaining fourteen lines—those where the proposed indication could conceivably have indicated the proposed foresight, and in some cases seems to have done so very precisely—we must check the widths of the azimuth range which might equally well have been meant to have been indicated, and investigate the selection of potential foresights within this range. One of the lines seems very dubious on archaeological grounds (overall status "C"), and a further three seem somewhat dubious (overall status "B"). These classifications are retained in the belief that archaeological dubieties (unless demonstrable) should not necessarily lead us to dismiss an alleged sightline out of hand, but should nonetheless influence our final judgement of it. Ten lines remain, at eight observing sites. Of these, one is at Brogar, involving siting along a line of three mounds; four involve siting along alignments of menhirs (two at Duncracaig, one at Escart and one at Parc-y-Meirw); one (at Fowlis Wester) involves siting from a cairn to a menhir and one (at Kintraw) from a menhir to a cairn; one (at Kilmartin/Temple Wood) involves siting from a setting of small

stones over a stone circle, and two (both at Ballinaby) involve siting along the flat side of a menhir. The sightlines span the Scottish Highlands from Orkney to Kintyre, with three sites fairly close together in Argyll and a far-flung addition in Dyfed. From this it seems that no independent backing is forthcoming for the lunar sightline hypothesis on the basis of the typological or spatial coherence of the sites involved, or of the coherence of the indicating structures proposed.

Clearly, many crucial questions hang upon the selection of distant horizon features as potential foresights, both where they are indicated on the ground and otherwise. A study of the selection of potential foresights forms the heart of the reassessment to be presented in Part Two of this paper, to appear in the next issue of *Archaeoastronomy*.

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MSB A. Thom, *Megalithic sites in Britain* (Oxford, 1967).

OSAR Ordnance Survey archaeological records, Southampton and Edinburgh.

RBAR C. L. N. Ruggles, "A critical examination of the megalithic lunar observatories", in *BAR* (see above), 153–209.

TBAR A. S. Thom, "Megalithic lunar observatories: An assessment of 42 lunar alignments", in *BAR* (see above), 13–61.

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54. *RBAR*, 187, Fig. 4.3c.
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56. *MLO*, 47, Table 5.1.
57. *MLO*, 46, Fig. 5.1.
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59. M. Campbell and M. Sandeman, "Mid-Argyll: A field survey of the historic and prehistoric monuments", *Proceedings of the Society of Antiquaries of Scotland*, xcv (1962), 1–125, no. 175.
60. *MLO*, 63.
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62. *MLO*, 65.
63. *RBAR*, 187, Fig. 4.3b.
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65. T. Pennant, *A tour in Scotland and voyage to the Hebrides, 1772* (London, 1776), 224.
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77. RCAHMS, *op. cit.* (ref. 68), no. 130.
78. *MLO*, 56–57.
79. RCAHMS, *op. cit.* (ref. 68), no. 148.
80. RCAHMS, *op. cit.* (ref. 68), no. 131.
81. RCAHMS, *op. cit.* (ref. 68), no. 149.
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