

## THE LINEAR SETTINGS OF ARGYLL AND MULL

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### I. INTRODUCTION

Between 1973 and 1981 some three hundred western Scottish megalithic sites were visited and surveyed in an attempt to assess the statistical evidence that astronomical considerations might have affected their orientations.<sup>1</sup> A major motivation for this work was provided by the earlier conclusions of Thom;<sup>2</sup> however these had been open to doubt on various grounds<sup>3</sup> and efforts were made to counter criticisms of Thom's approach in the new project. For example, in selecting sites and structures for consideration, rigorous criteria were identified and adhered to. This overcame the difficulty of unwitting selective bias, but uncovered a number of other problems to do with the diversity of sites being considered, their often poor state of repair, and in some cases their doubtful authenticity.<sup>4</sup> Despite these problems it was hoped that such a project might reveal overall trends, and groups of sites of particular interest, which might then be studied further.

The major conclusions of the project were as follows.<sup>5</sup>

- (1) Indicated declinations manifested overall trends at three levels of precision. At the lowest level, declinations between about  $-15^\circ$  and  $+15^\circ$  were strongly avoided. At the second level, there was a marked preference for southern declinations between  $-31^\circ$  and  $-19^\circ$ , and for northern declinations above  $+27^\circ$ . At the most precise level, there was marginal evidence of a preference for six particular declination values to within a precision of one or two degrees:  $-30^\circ$ ,  $-25^\circ$ ,  $-22^\circ.5$ ,  $+18^\circ$ ,  $+27^\circ$  and  $+33^\circ$ .
- (2) Certain coherent groups of sites were found to feature predominantly amongst the indications which fall in particular 'preferred' declination intervals. These were sites in Mull and mainland Argyll in general, and the three-, four- and five-stone rows in these areas in particular.
- (3) When consideration was limited to the stone rows, pairs and single flat slabs in Mull and mainland Argyll, the overall declination trends noted above became more marked. The clearest of these, at the second level of precision, is summarised in Table 1.<sup>6</sup> Of those sites where measurements were obtained,

TABLE 1. Summary of southerly indicated declinations at fifty-one sites in Mull and mainland Argyll with respect to the declination range  $-31^\circ$  to  $-19^\circ$ , based on fieldwork up to 1981.

*Column headings*

R Three-, four- and five-stone rows  
 AP Pairs of aligned slabs  
 NP Non-aligned pairs of menhirs  
 SS Single flat slabs  
 T Total

	R	AP	NP	SS	T
Southerly indicated dec. in range	13	3	3	8	27
Southerly indicated dec. NOT in range	0	0	4	6	10
Unmeasured (horizon nearer than 1 km)	4	1	2	7	14

the great majority, including every row of three or more stones and every pair of aligned slabs, were oriented in the south upon a declination between  $-31^\circ$  and  $-19^\circ$ , i.e. upon a declination which the Moon reaches at the southern limit of its monthly motions at some point in the 18.6-year cycle. Only ten measured sites, non-aligned pairs of menhirs or single slabs, failed to fit the pattern.

The declination range  $-31^\circ$  to  $-19^\circ$  is of particular interest because it represents, to within a degree or so, the range of possible values of the southerly limit of the Moon's motions in a particular month.\* The construction of deliberate orientations within this range need not have involved nightly observations of the Moon in a given month, but could have been achieved simply by observing the rising or setting of the full Moon nearest to the summer solstice. If such alignments were set up at arbitrary points in the 18.6-year cycle, then one would expect a scatter of declination values within the interval between about  $-30^\circ$  and  $-19^\circ.5$ , with more values occurring towards the edges of the range owing to the sinusoidal motion within this range of the actual monthly limit.

A preference for declinations near to  $-30^\circ$ , over and above that accountable for by the sinusoidal effect, would indicate a specific interest in the southern major standstill Moon, and would imply that organized observations were undertaken over periods of at least twenty years. Similarly, a preference for declinations near to  $-19^\circ.5$  would indicate the same for the minor standstill Moon. However a preference for declinations near to  $-24^\circ$  would indicate that there was also some interest in the winter solstitial Sun. Such conflicting (or possibly co-existing) interests might be extremely difficult to resolve at individual sites.

The data available from the original project were insufficient to resolve these issues on purely statistical grounds. However, because the larger project singled out the settings of linear form in Mull and mainland Argyll, we have some objective justification for examining these sites further in the light of the hypothesis of observations of the southern Moon. In doing so we can begin to relax our strict adherence to rigid, pre-conceived selection criteria that was so necessary in the initial investigation, and adopt a somewhat more interpretative approach. We do however still feel it essential that selection decisions must be documented and justified in detail.

The original data set lacked a good deal of data relevant to the hypothesis it suggested. This came about because the original aim was to reassess the higher-precision alignments noted by Thom, and so 'local' horizons, i.e. those closer than 1 km, were excluded from consideration. In May 1985 fieldwork was undertaken in an attempt to obtain as much as possible of the missing information.

We begin in Section 2 by defining a linear setting and producing a source list of these features in Argyll and Mull. In Section 3 we present details of the southern indicated horizon profiles. We then proceed in Section 4 to discuss the results

\* In this paper, as in the original study of 300 sites,<sup>7</sup> declinations quoted are corrected for celestial refraction but uncorrected for parallax. When investigating possible high-precision lunar alignments one must of course make the appropriate correction and obtain a geocentric lunar declination;<sup>8</sup> however, for our present purposes the parallax correction is effectively constant, and so, following Thom,<sup>9</sup> we can simply compare the observed declinations with 'expected' lunar values by adjusting the latter by minus the parallax correction.

obtained, considering separately the different types of linear feature. A more general discussion follows in Section 5.

## 2. THE SITES UNDER CONSIDERATION

We restrict our attention to the areas of Mull, Lorn, mid-Argyll, Knapdale and Kintyre, that is, to the sites numbered ML1-ML41, LN11-LN23, AR1-AR39 and KT1- KT44 in our original analysis.<sup>10</sup> Of these 137 documented sites, 45 were excluded from further consideration after an archaeological reappraisal.<sup>11</sup> The remaining 92 are documented as sites involving free standing megaliths and form the subject matter of this paper.

The great majority of megalithic sites in these areas are linear in form, varying from several standing stones and cairns in line, which appears to have been the original arrangement at Ballochroy (KT10),<sup>12</sup> down to the many single flat slabs which are especially prevalent in Kintyre. We shall refer to these sites as linear settings, extending the concept to include single menhirs with an obvious longer

TABLE 2. Free-standing megalithic sites, emphasizing linear settings, in Mull, Lorn, mid-Argyll and Kintyre. Further details about the sites are available elsewhere.<sup>15</sup>

### *Column headings*

- 1 Site reference
- 2 Site name
- 3 Linear setting in question (given only to distinguish different linear settings at the same site)
- 4 Features forming the linear setting, listed in order, starting with the most northerly
- 5 Other features at the site
- 6 Length of linear setting
- 7 Height of tallest stone forming part of the linear setting<sup>16</sup>
- 8 Latest year of visit by the author
- 9 Comments

### *Key to columns 4 and 5 (features)*

- M Menhir (unspecified)
- SM Slab (by the 'twice as wide as thick' criterion)<sup>17</sup>
- LM Menhir with an obvious longer axis, but not a slab as defined above
- OM Standing menhir with no obvious longer axis
- FM Fallen (or recumbent) menhir
- ZM Re-erected menhir
- B Boulder
- SC Stone circle or ring
- G Rectangular setting<sup>18</sup> of small stones
- C Cairn (unspecified)
- KC Kerb-cairn
- LC Long cairn
- RC Ring cairn
- P.. Possible..
- ../.. ..surrounding..
- ..i ..oriented in the line of the setting
- ..o ..oriented out of the line of the setting

### *Key to column 9 (comments)*

- a The two stones other than the slab were re-erected between 1880 and 1942,<sup>19</sup> to form a triangular setting. The site has also been enhanced by the addition of a surrounding ring of small boulders. Since there are several known linear settings on northern Mull, but none similar to the present form

of this site, it is quite likely that the Glengorm site was originally a linear setting. We have tentatively assumed that the slab is in its original position and that its longer axis is in the direction of the original setting. Excavation might reveal the true original design of the site.

- b A group of five stones, three standing and two recumbent, was recorded in the last century, although apparently with no mention that they formed a linear setting.<sup>20</sup> In 1976 there remained one standing and three recumbent stones, which appear to have formed a linear setting.<sup>21</sup> There was no sign of the fifth stone.
- c Orr's stones<sup>22</sup> are not included in the site description as they are actually the remains of a relatively recent boundary wall.<sup>23</sup> The recumbent stone appears to have fallen from its eastern end, which would put it roughly in line with the longer faces of the other. Orr's stones are in fact roughly in this line too.
- d The two prostrate stones may well represent fallen menhirs, but they lie close together and, without excavation, there is no way of telling whether they once formed an aligned pair.
- e Thom's plan,<sup>24</sup> which includes details supplied by Orr, shows two further stones forming part of the alignment and situated some 170m and 290m respectively to the SSE of the other five. The latter stone could not be located. The former is 1.0m tall and irregular in shape. This, and other large boulders nearby, are in fact natural boulders built into a relatively recent field wall.<sup>25</sup> A Forestry Commission plantation currently prevents direct verification that this sixth stone is indeed in the line. A survey undertaken in 1985 gave its distance from the more south-easterly of the two standing stones as 162m and its direction from that stone as 10° off the alignment to the SW.
- f The tallest stone appears to be broken off.
- g The fourth stone noted by the R.C.A.H.M.S.<sup>26</sup> forms one side of a gateway through a field wall and is probably not in its original position.
- h The standing stone is possibly one of a series of pilgrim route marker stones.<sup>27</sup>
- i The standing stone was recently re-erected, but by a qualified archaeologist in its excavated stone hole.<sup>28</sup> An earlier discussion by the present author<sup>29</sup> implied erroneously that the orientation of the long axis of the menhir is significantly different from the that of line joining the centres of the two cairns; however, its essential conclusion about the imprecision of the claimed indication is unaffected.
- j A second stone 1.9m long, lying some 650m away from the standing stone, is thought originally to have come from near it.<sup>30</sup>
- k The 2m-high stump of the slab now stands *in situ*; the top part, some 4m long, lies next to it.<sup>31</sup>
- l The status of this stone may be uncertain, since it is incorporated into what appears to be the wall of an old rectangular building.
- m Stones are identified using Thom's nomenclature.<sup>32</sup>
- n This site consists of several tiny erect stones sunken in peat. Its status as a prehistoric site is doubtful and its original form difficult to determine from the visible remains. It has not been considered further.<sup>33</sup>
- o The prostrate stone is a slab 4.2m long, which was erect in the last century and faced ENE (i.e. across the line).<sup>34</sup>
- p Two large prostrate slabs, respectively some 4m and 3m long, lying close together. Without excavation, there is no way of telling whether they once formed an aligned pair.
- q The prostrate stone is 4.5m long.
- r There is some evidence to suggest that the group may formerly have comprised more stones.<sup>35</sup>
- s This site, first mentioned by Thom and Thom,<sup>36</sup> is unrecorded on any ancient monuments lists. The two stones could merely be the remaining grounders of a former field wall.<sup>37</sup>
- t According to the Ordnance Survey<sup>38</sup> it is possible that this stone was only a drove road marker.
- u A sketch of the site made in 1700 and uncovered recently by Burl<sup>39</sup> shows not only the three stones and cairn (still erect; today only a kist remains) but also a further two cairns and a standing stone in the alignment to the south of the other features.
- v The Beacharra long cairn<sup>40</sup> is situated some 30m to the north of the standing stone, roughly in line with its orientation.
- w The first slab is generally known;<sup>41</sup> what may be the stump of a second is set into a field wall. Its existence was pointed out in 1979 by R.J.C. Atkinson in a private communication to the present author. Further details have been given elsewhere.<sup>42</sup>
- x The standing stone in fact stands at the foot of the remains of the outer of two banks surrounding a cairn. The R.C.A.H.M.S. consider that the site may represent the ploughed-out remains of an embanked stone circle.<sup>43</sup>
- y This small slab, leaning at about 45° to the vertical, may have been robbed from a cairn 400m away to serve as a culvert cover, and subsequently discarded.<sup>44</sup>

TABLE 2 (for caption and explanations, see pages S107 and S108).

1	2	3	4	5	6	7	8	9
ML1	Glengorm		SM	2ZM	10	2.1	85	a
ML2	Quinish		FM, FM, FM, OM	YM		2.8	79	b
ML4	Balliscate		OM, FM, OM		5	2.5	76	c
ML6	Lag		LMi, FM		2	1.6	85	
ML7	Cillichriosd		SM			2.6	79	d
ML8	Calgary			2PFM			85	
ML9	Maol Mor		FM, OM, LMi, LMi		10	2.2	85	
ML10	Dervaig N		FM, LMi, FM, LMi, FM		18	2.5	85	e
ML11	Dervaig S		SMi, LMi, OM	PZM	15	>1.3	79	fg
ML12	Ardnacross	NW group	FM, FM, FM		10	--	76	
ML12	Ardnacross	SE group	FM, SMi, FM	3KC	10	2.4	76	
ML13	Tenga		3LM, OM		10		76	
ML14	Tostarie		LM			1.7	76	
ML15	Killichronan		LM			2.4	85	
ML16	Gruline	ab	SMo, LMo		270	2.4	85	
ML16	Gruline	a	SM	LMi		2.3	85	
ML16	Gruline	b	LM	SMi		2.4	85	
ML17	Ormaig		FM		4		79	
ML18	Cragaig		OM, LMi			1.6	79	
ML19	Dishig		OM		5	1.2	76	
ML21	Scallastle		LMi, FM, FM				85	
ML23	Duart		OM				85	
ML24	Port Donain			PFM, KC, LC	10	0.5	--	
ML25	Uluvalt		FM, FM, B, FM	OM		2.0	79	h
ML27	Rossal		LM	3C		2.0	76	h
ML28	Lochbuie			SC, 4M, KC		2.1	85	h
ML30	Taoslin		LM		11	2.2	76	
ML31	Uisken		SM			1.9	85	
ML33	Ardalanish		SMi, FM				76	
ML34	Suie			2M, C		2.4	85	h
ML35	Tiraghoil		LM	OM		2.5	76	h
ML37	Poit na h-I		LM				76	
ML39	Achaban House			OM			81	
LN14	Taynuilt			OM			81	
LN15	Black Lochs			OM			81	
LN17	Strontoiller			OM, RC, SC			81	

TABLE 2 - continued

1	2	3	4	5	6	7	8	9
LN18	Glenamacrie		OM,B		3	1.5	81	
LN22	Duachy		OM,OM,OM	OM	5	2.8	81	
AR2	Sluggan		PFM,SMi		50	2.5	85	
AR3	Barbreck		SMi,SMi	G/SMi	3	2.5	81	i
AR5	Kintraw		C,Z,SMi,KC		20	4.3	85	
AR6	Salachary		OM,OM,FM		4	2.5	85	
AR7	Torrán		LM			3.0	79	j
AR8	Ford		LM			3.0	79	k
AR9	Glennan N		SM			5	85	l
AR10	Glennan S		SM	C,C		2.0	85	
AR12	Carnasserie		SMi,SMi	C	3	2.4	85	
AR13	Kilmartin		SMo,G/SMo,G,SMo		75	2.9	81	m
AR13	Kilmartin	$S_2-S_3$	SMo,G/SMo,G,SMo		75	2.9	81	m
AR13	Kilmartin	$S_3-S_4$	SMo,G/SMo,G,SMo		110	2.4	81	m
AR13	Kilmartin	$S_6-S_7-S_3$	SMo,SMi,SMi			2.9	81	m
AR13	Kilmartin	$S_1$	SM		5	2.7	81	m
AR13	Kilmartin	$S_4-S_5$	SMi,SMi			2.7	81	m
AR15	Duncracaig	<i>dcba</i>	SMi,SMi,SMi,SMi		15	4.0	79	
AR15	Duncracaig	<i>fe</i>	SMi,SMi,SMi	C,C,YM	4	3.0	79	
AR16	Rowanfield		SM			2.5	81	
AR17	Duntroon		LM			1.3	85	
AR18	Crinan Moss		SM	XPM		2.8	79	n
AR19	Inveraray		SM			3.0	85	
AR23	Lechuary		SM	PFM		3.0	85	
AR24	Loch na Torr.		SM			2.0	85	
AR25	Torbhlaran		LMi,FSMo			4	81	o
AR27	Dunadd		SMi,FM,SMi		250	2.5	85	
AR28	Dunamuck I		SMi,SMi		6	3.5	85	
AR29	Dunamuck II		SMi,SMi		7		81	
AR30	Dunamuck III		FM,FM	FM,FM	275	4	85	p
AR31	Achnabreck		SM			1.7	79	q
AR32	Oakfield		SM			2.5	79	
AR33	Kilmory		SM	OM		2.5	85	
AR37	Barnashaig		LM			2.5	85	
AR38	Upper Fernoch		SM			2.0	85	
AR39	Lochhead		PLM			1.6	85	
KT1	Cretshengan		SMi,LMi	OM	4	3.0	79	
KT2	Carse							

1	2	3	4	5	6	7	8	9
KT3	Ardpatrick		SM			2.2	79	
KT4	Avinagillan		SM			1.9	85	r
KT5	Escart		SMo,SMi,LMi,OM,SMi		15	3.3	79	s
KT8	Dunskeig		B,POM		7	1.0	79	t
KT9	Loch Ciaran		LM			1.8	85	u
KT10	Ballochroy	cba	SMo,SMo,OM,C	{	45	3.4	81	
KT10	Ballochroy	c	SM	OM,C		>2.0	81	
KT12	Tarbert, Gigha	b	SM	}		3.0	81	
KT14	Rhunaorine		SM			2.3	85	
KT15	Beacharr		LM	OM			81	v
KT19	South Muasdale	ab	SMo,PSMi	LC		5.0	85	w
KT19	South Muasdale	a	SM	PSMo	12	3.0	81	w
KT21	Barlea		SM			1.8	85	
KT23	Beinn an Tuirc		SM			1.8	81	
KT24	Tighnamoile		LM			0.8	81	
KT25	Drumalea						79	
KT27	Clochkeil	cba	FM,LMi,SMo	FM	7	1.9	79	
KT27	Clochkeil	a	SM	LM,FM		1.9	79	
KT28	Skeroblingarry		SM			1.5	85	
KT29	High Park		SM			3.0	79	
KT31	Craigs		SM			2.6	85	
KT32	Glencraigs S		SM			2.1	85	
KT35	Glenussa Lodge		SM			2.3	81	
KT36	Campbeltown		SM			4.0	79	
KT37	Stewarton			FM			79	
KT39	Mingary		SM	C		1.4	79	x
KT40	Lochorodale		PSM			1.5	85	y
KT41	Knockstapple		SM			3.2	79	
KT42	Cuilnlongart		LM			2.1	79	
KT44	Southend		SM			2.7	79	



axis. There are a number of linear settings consisting of three or more standing stones, particularly on northern Mull and in the Kilmartin valley of Argyll. Many of the sites are associated with cairns, although these do not always form part of the linear setting (i.e they do not always fall in line with a stone row or the orientation of a single slab). Stone circles only occur at three, or possibly four, sites in the entire area.<sup>13</sup>

Details of the 92 sites under consideration are given in Table 2. An attempt has been made to identify those features which might have constituted linear settings, and to separate them from other features. A slab is identified, following the earlier analysis, as a menhir which has opposite faces both of which are of maximum width at least twice that of the other faces.<sup>14</sup> However, in addition we have introduced the concept of a 'long menhir': one which is not a slab by the 'twice as wide as thick' criterion, but which nonetheless has an obvious longer axis, and hence whose orientation might have been of significance. This new category is the first example of the rather more interpretative approach we have allowed ourselves in the current analysis: the identification of an 'obvious' longer axis, and hence the division between a long menhir and a non-directional one, is admittedly subjective. However, decisions as to the classification in particular cases were made in advance of the analysis of any indications involved, so as to avoid introducing subjective bias.

We have also attempted to identify whether long menhirs and slabs which form part of a longer linear setting are oriented in or out of the longer alignment. In many cases this seems clear-cut: thus for example the pairs of slabs at Barbreck (AR3), Carnasserie (AR12), Kilmartin (AR13;  $S_2S_3$  and  $S_4S_5$ ), Duncraaig (AR15; *ef*) and Dunamuck II (AR29) are all aligned to within about  $10^\circ$  and it seems reasonable to assign any error either to a lack of precision in their construction or else to the shifting of the stones in the intervening millennia. On the other hand, two of the three stones at Ballochroy (KT10) are slabs oriented perpendicularly across the alignment. However, in a number of borderline cases the decision is much more subjective and interpretative. Thus for example the northernmost of the five remaining stones at Escart (KT5) is oriented at about  $45^\circ$  to a rather sinuous alignment.<sup>45</sup> At Lag (ML6), whether one proposes that the standing stone of the pair was in the alignment depends upon whether one surmises that the recumbent stone fell from its eastern or western end.<sup>46</sup> As with the identification of long menhirs, decisions in particular cases were made in advance of the analysis of any indications involved.

No linear feature has been identified at 19 of the 92 sites. These mostly comprise stone rings and close outliers, single menhirs with no obvious longer axis, single prostrate menhirs, or pairs of prostrate menhirs lying too close for any estimate to be made of an original alignment. The trapezoidal setting at Tenga (ML13) has also been included in this list, as has the large ruined cairn and two outlying menhirs at Suie (ML34). The northern outlier at Lochbuie (ML28), a slab, has been omitted from consideration because of the complex nature of the entire site, although it might have been included on the grounds that it is situated some 300m from the stone circle and remaining outliers and is quite possibly unrelated directly to them. The status and design of the Crinan Moss site (AR18) is difficult to determine from the visible remains, and it has not been considered further. At Glengorm (ML1), on the other hand, we have tentatively assumed – given the



preponderance on northern Mull of 3-, 4- or 5-stone rows – that the one menhir not known to have been re-erected, a slab, was originally oriented in the line of the setting. Accordingly we have taken its orientation as an approximation to the original orientation of the setting. Further details of many of these decisions are given in the comments to Table 2.

Of the remaining 73 sites, two – Ardnacross (ML12) and Duncraraig (AR15) – comprise two separate linear features each of which is listed in Table 2. At a further four sites the orientation of individual slabs across the setting of which they form part suggests the presence of a second direction of significance at the sites. This is clearest at Ballochroy (KT10), where the northernmost two stones are oriented across the alignment and roughly parallel to each other. At Clochkeil (KT27) the southernmost stone is a slab oriented across the three-stone alignment. At Gruline (ML16) we find two roughly parallel menhirs some 270m apart. The site at South Muasdale (KT19) consists of a possible menhir stump built into a field wall and a large intact menhir. The former is oriented in the line joining the two; the latter across it. (We have not included in this list the northernmost menhir at Escart (KT5), since the alignment is so sinuous.) The ‘subsidiary’ linear features at the four sites are listed additionally in Table 2. Finally, at the complex site of Kilmartin (KT13) the principal extant design, consisting of five slabs all oriented roughly parallel to one another, form not only short alignments in the direction of their orientation (NW-SE) but also longer ones in a second direction (NNE-SSW). A total of five linear features at this site have been identified and listed in Table 2.

Thus a total of 85 linear features are listed in Table 2. These comprise 20 rows of three or more stones, including Glengorm (ML1) (see above); eight pairs of aligned slabs or long menhirs, including Ardalanish (ML33) and Achnabreck (AR31), where the fallen stone appears to have been a slab standing in the alignment, but excluding Lag (ML6) and Dunadd (AR27) where it does not; seven non-aligned pairs of menhirs, including Lag and Dunadd but excluding Sluggan (AR2) where the supposed prostrate menhir, if genuine, may have been moved to its present position amidst field clearance;<sup>47</sup> 34 single flat slabs (including Sluggan) and 16 single ‘long menhirs’.

### 3. INDICATED AZIMUTHS AND DECLINATIONS

In the case of 29 of the 85 linear features identified above, survey data for the southern indicated profiles were available from fieldwork undertaken between 1973 and 1981. A number of these have not previously been published, being deemed inadmissible according to the selection criteria adopted in the original project. Twenty-seven additional profiles were surveyed during May 1985, concentrating upon ‘local’ horizons (i.e. those nearer than 1 km) which had been excluded from consideration before; two others, Dunamuck I (AR28) and Dunamuck II (AR29), were re-surveyed owing to earlier uncertainties. The remaining ten ‘non-local’ profiles have been calculated from 1:50000 (or old 1”) Ordnance Survey maps; in addition the profile at Cragaig (ML18, 0.5 km) has been calculated from the 1:25000 map and three at Kilmartin (AR13, between 0.5 and 0.7 km) from the 1:10000 map.

This leaves fifteen profiles unaccounted for. No survey was attempted in the

case of seven menhirs considered to have an obvious longer axis, but whose shape was considered sufficiently irregular (e.g. of rounded, lozenge-shaped or triangular, rather than rectangular, cross-section) that any proposed indication would have been very wide indeed, say in excess of  $10^\circ$ , and the data would have added very little to the present investigation. These are menhir *b* at Gruline (ML16), Rossal (ML27), Torran (AR7), Ford (AR8), Tighnamoile (KT24), Campbeltown (KT36) and Culinlongart (KT42).

Insufficient time during the 1985 fieldwork period prevented surveys of the remaining eight profiles, namely Ardalanish (ML33), Glenamacrie (LN18), Duntroon (AR17), Dunadd (AR27), Cretshengan (KT1), menhirs *c* and *b* at Ballochroy (KT10) and menhir *a* at Clochkeil (KT27), although a survey was attempted at Duntroon (AR17) and abandoned because of poor weather conditions. In these cases profiles could not be calculated because either (i) the exact orientation of the linear setting was unrecorded or (ii) the profile was too close to be reliably calculated from the 1:50000 map (larger-scale maps being unavailable), or both.

A survey priority list was drawn up prior to the 1985 fieldwork on the basis of the type of site involved (preference was given to rows and alignments over single slabs and, finally, 'long menhirs'), and decisions about which sites were to be surveyed were made purely on the basis of this list, travel strategy and weather conditions. In fact, in a few cases we can dismiss the possibility that a linear setting yields a southern declination of possible interest under the current hypothesis, despite the lack of more precise information. The Campbeltown menhir (KT36), for example, despite its rounded cross-section, is clearly oriented approximately east-west. At Ardalanish (ML33) the indicated azimuth of around  $103^\circ$  (surveyed in the other direction in 1976) gives, even for an assumed horizon altitude of zero, a declination of at least  $-7^\circ.5$ . The pair of stones at Glenamacrie (LN18) are aligned approximately east-west. Finally, the slab at Cretshengan (KT1) has an azimuth of about  $100^\circ$  giving a declination of at least  $-6^\circ$ ; but then the idea of anyone standing on the seaward side of this improbable megalith, wedged into a small rock cleft, seems ruled out by its precipitous situation. We might also mention again here the northern outlier at Lochbuie (ML28): no reliable survey data are currently available on this stone, but on the basis of some site notes of 1976 its orientation is thought to be about  $252^\circ$ . This gives an indicated profile on the southern slopes of Beinn nan Gobhar (3.1 km) with an altitude in excess of  $6^\circ$ , hence a declination somewhat above  $-5^\circ$ . There do however remain a small

TABLE 3. Southern indications by linear features in Argyll and Mull.

*Column headings*

- 1 Site reference
- 2 Site name
- 3 Linear setting in question (given only to distinguish different linear settings at the same site)
- 4 Distance of southern horizon in km.
- 5 Minimum southerly azimuth
- 6 Maximum southerly azimuth
- 7 Mean altitude of southerly horizon
- 8 Minimum indicated southerly declination
- 9 Maximum indicated southerly declination
- 10 Classification of survey
- 11 Reason(s) that profile survey is less reliable

- 12 Date of latest survey  
 13 Line number given elsewhere<sup>48</sup>  
 14 Comments

*Key to column 10 (classification of survey)*

- A Reliably surveyed  
 B Less reliably surveyed  
 C Calculated

*Key to column 11 (reason that profile survey is less reliable)*

- p A large parallax correction was necessary from the theodolite to the observing position.  
 c The profile is very close, about 200m or nearer.  
 t There are trees at some distance which obscure the exact profile.  
 v Visibility during the survey was poor.

*Key to column 14 (comments)*

- a Trees at 400m obscure the true profile which, at the right-hand end of the range, may be 800m distant.  
 b The distance of this profile was given earlier as 0.1 km, and hence the line was listed as local.<sup>49</sup> Our present estimate of the azimuth range, which is based on the assumption that the prostrate stone fell from its eastern end, gives a horizon further to the north than that assumed earlier.  
 c The site is surrounded, and the nearby profile covered, by mature Forestry Commission trees. Measurements of available points have been reduced to the standard observing position (SOP) from a point some 30m to the W and 6m above it (on Maol Mor itself).  
 d Measurements were reduced to the SOP from a point 62m to the SE, towards the profile.  
 e Estimates of the azimuth range are subject to more error than usual because the menhir is leaning at about 70° to the vertical.  
 f Further details of the reasons why this survey was not of quality 'A' are given elsewhere.<sup>50</sup>  
 g Two profile points have been estimated from the 1:25000 Ordnance Survey map. Because the horizon is close, these estimates are subject to considerable uncertainty.  
 h A diagram of this profile can be found elsewhere.<sup>51</sup>  
 i The standard observing position 2m behind this pair of stones gives as the indicated horizon a rocky hillock little more than 100m away. However rather more distant hills (2.7 km) appear a little to the left. From vantage points 50m or 100m behind the stones one can view the more distant profile in line with the stones over the top of the local hillock.  
 j This profile has been calculated using the 1:10000 Ordnance Survey map.  
 k Measurements were reduced to the SOP from a point 19m to the SE, towards the profile.  
 l This is an update of a low-reliability survey undertaken in 1981,<sup>52</sup> when access within some 100m of the site was prevented by crops.  
 m This is an update of a low-reliability survey undertaken in 1981,<sup>53</sup> when access within some 200m of the site was prevented by crops.  
 n Direct measurement of menhir *b* from menhir *a* is currently prevented by intervening gorse bushes, so the measurements quoted are deduced from a survey of the whole site. Some errors are possible as result.  
 o As viewed from the SOP 2m behind the fallen menhir *a*, at an assumed eye-level 1.5m above current ground level, the tip of the menhir *b* has an azimuth of 159°.6 and an altitude of 2°.4, giving a declination within 0°.1 of -29°.5. The base of the menhir has an altitude of 1°.8, giving a declination of -30°.1.  
 p Nearby trees intervene between the site and the horizon, rendering a profile photograph impossible. A number of points on the profile were, however, surveyable. The shape of the profile between surveyed points can best be estimated by extrapolation, but some error is possible as a result.  
 q This profile replaces the calculated one given elsewhere.<sup>54</sup> For the new survey the azimuth limits were estimated by placing survey poles across the faces at various heights and measuring their orientation.  
 r The indicated profile (Beinn Ghuilean, 6.6km) was photographed but not surveyed, owing to rapidly worsening weather conditions. The photographed profile was fitted to nearby surveyed points. Some errors are possible as a result.  
 s Estimates of the azimuth range are subject to more error than usual because the menhir is leaning at about 60° to the vertical.

TABLE 3 (for caption and explanation, see pages S114 and S115).

1	2	3	4	5	6	7	8	9	10	11	12	13	14
ML1	Glengorm		0.4	128	134	6.0	-17.0	-14.5	B	t	850516	122	a
ML2	Quinish		8.2	166	170	2.0	-31.5	-31.0	A		760819	125	b
ML4	Balliscate		1.3	184	186	5.0	-28.5	-17.0	A		760821	126	c
ML6	Lag		1.6	128	132	3.5	-19.0	-20.5	A		850516		d
ML7	Cillichriod		5.3	132	134	2.0	-20.5	-28.5	B	pct	790710		e
ML9	Maol Mor		0.1	161	163	3.0	-29.0	-25.0	B	p	850515		f
ML10	Dervaig N		0.5	149	151	3.5	-26.0	-29.0	A		850516		g
ML11	Dervaig S		8.2	156	158	2.0	-29.0	-24.5	A		760823	131	
ML12	Ardnacross	NW group	1.9	195	200	6.5	-26.0	-22.0	A		760824	133	
ML14	Ardnacross	SE group	1.9	206	209	7.0	-23.0	-26.0	A		760822		
ML15	Tostarie		5.2	213	217	1.0	-27.0	-9.5	B	c	850517	136	
ML16	Killichronan	ab	0.2	239	246	3.5	-13.5	-17.5	B	p	760820		
ML18	Gruline	a	2.3	177	186	12.5	-21.0	-11.0	A		850518		
ML18	Gruline		0.5	247	248	2.0	-11.0	-10.0	C				
ML21	Cragaig		0.9	119	125	2.0	-16.5	-14.0	A		850518	140	
ML25	Scallastle		4.0	136	138	6.5	-18.5	-18.0	A		790712		
ML30	Uluvalt		0.1	148	150	3.0	-26.0	-25.5	B	c	850517		
ML31	Taoslin		3.9	229	230	0.5	-21.5	-21.0	A		760827	145	
ML35	Uisken		0.3	234	243	6.5	-13.0	-9.5	A		850517		
ML39	Tiraghoil		2.7	181	184	0.5	-33.5	-33.5	A		760826		
LN22	Achaban House		1.1	147	149	7.0	-21.5	-21.0	B	t	810601	150	f
AR2	Duachy		0.6	176	178	13.0	-21.5	-20.5	A		850518		
AR3	Sluggan		3.8	186	188	3.0	-30.5	-30.5	A		810527	154	h
AR5	Barbreck		28	231	234	0.5	-19.5	-18.0	A		810601		
AR6	Kintraw		0.9	176	178	2.0	-32.0	-31.5	A		850512		
AR9	Salachary		0.7	249	251	10.0	-3.0	-1.5	A		850512		
AR10	Glennan N		0.8	206	219	9.5	-20.0	-18.0	A		850512		
AR12	Glennan S		0.1	163	171	2.0	-32.0	-30.0	B	c	850512		
AR13	Carnasserie		18.5	200	201	1.0	-31.0	-30.5	C		810525	164	i
AR13	Kilmartin	S <sub>2</sub> -S <sub>1</sub> -S <sub>5</sub>	6.4	206	207	1.0	-29.5	-29.5	B	pt		166	f
AR13	Kilmartin	S <sub>3</sub> -S <sub>1</sub> -S <sub>4</sub>	0.7	149	150	2.0	-27.5	-27.0	C				j
AR13	Kilmartin	S <sub>6</sub> -S <sub>2</sub> -S <sub>3</sub>	0.5	142	144	3.5	-24.0	-23.0	C				i
AR13	Kilmartin	S <sub>1</sub>	0.5	141	143	3.0	-24.0	-23.0	C				f
AR15	Duncraigaig	S <sub>4</sub> -S <sub>5</sub>	3.0	141	144	2.0	-26.0	-23.5	B	p	790630	169	
AR15	Duncraigaig	dcba	5.5	153	155	0.5	-30.0	-29.5	C			171	
AR16	Rowanfield	fe	10.5	137	140	1.0	-24.5	-23.5	B	t	810526	174	f

1985

## Linear Settings of Argyll and Mull

S117

1	2	3	4 °	5 °	6 °	7 °	8 °	9	10	11	12	13	14
AR19	Inveraray		4.0	213	218	2.0	-26.0	-24.0	C				
AR23	Lechuary		1.0	149	151	6.5	-23.0	-22.0	A		850513		
AR25	Torbhlaran N		0.4	133	136	8.5	-16.0	-14.0	B	P	850513		k
AR28	Dunamuck I		1.7	165	168	2.0	-31.5	-30.5	B	t	850513		l
AR29	Dunamuck II		1.1	137	141	3.5	-22.5	-21.0	B	t	850513		m
AR31	Achnabreck		0.3	159	160	2.0	-30.0	-29.5	B	p	850513		no
AR32	Oakfield		3.1	107	109	3.0	-8.0	-7.0	C			190	
AR33	Kilmory		1.0	119	122	2.0	-16.0	-14.0	C		850514	192	
AR38	Upper Fernoch		2.5	205	211	1.0	-30.5	-28.0	A				
AR39	Lochhead		5.6	117	119	5.0	-11.5	-10.5	C				
KT2	Carse		1.5	177	178	1.5	-33.0	-33.0	C			234	
KT3	Ardrpatrick		3.2	136	137	2.0	-22.5	-22.5	A		790608	240	
KT4	Avinagillan		4.3	166	170	3.5	-30.5	-29.5	B	t	850521	244	pq
KT5	Escart		9.5	207	209	1.0	-29.5	-29.5	C			245	
KT8	Dunskeig		19	128	129	1.5	-20.0	-19.5	A		790609		
KT9	Loch Ciaran		6.8	220	224	0.5	-25.0	-24.0	A		850521		
KT10	Ballochroy		12	222	224	0.0	-25.5	-24.5	B	t	730903	247	f
KT12	Tarbert, Gigha	<i>cba</i>	0.9	185	186	1.5	-33.0	-33.0	A		850520		
KT15	Beacharr		4.3	181	194	1.0	-33.5	-33.5	A		850520		
KT19	South Muasdale	<i>ab</i>	Sea	250	251	0.0	-12.0	-11.5	C		790628	249	
KT19	South Muasdale	<i>a</i>	23.1	195	197	0.5	-33.0	-33.0	A		850520		
KT21	Barlea		0.2	187	191	3.0	-32.0	-31.5	B	c	810519		
KT23	Beinn an Tuirc		4.8	222	225	0.5	-25.5	-23.5	A		790627	250	
KT27	Clochkeil	<i>cba</i>	>45	227	229	0.0	-23.0	-22.0	B	v	850520	252	f
KT28	Skeroblingarry		0.8	247	252	2.0	-11.5	-9.0	A				
KT29	High Park		0.5	237	240	2.0	-16.5	-15.0	A		790626		
KT31	Craigs		0.8	116	118	2.0	-14.0	-13.0	A		850520		
KT32	Glencraigs S		6.6	144	152	2.5	-28.5	-25.5	B	v			r
KT35	Glenlussa Lodge		63.2	108	110	0.0	-12.0	-10.5	C		850519	262	
KT39	Mingary		2.4	133	136	1.5	-23.0	-22.0	A		790624	268	s
KT40	Lochorodale		0.5	183	189	7.0	-27.0	-27.0	A		850519	274	
KT41	Knockstapple		1.6	140	144	1.0	-27.0	-25.0	A		790624	276	
KT44	Southend		>70	188	190	0.0	-35.0	-34.5	A		790625		

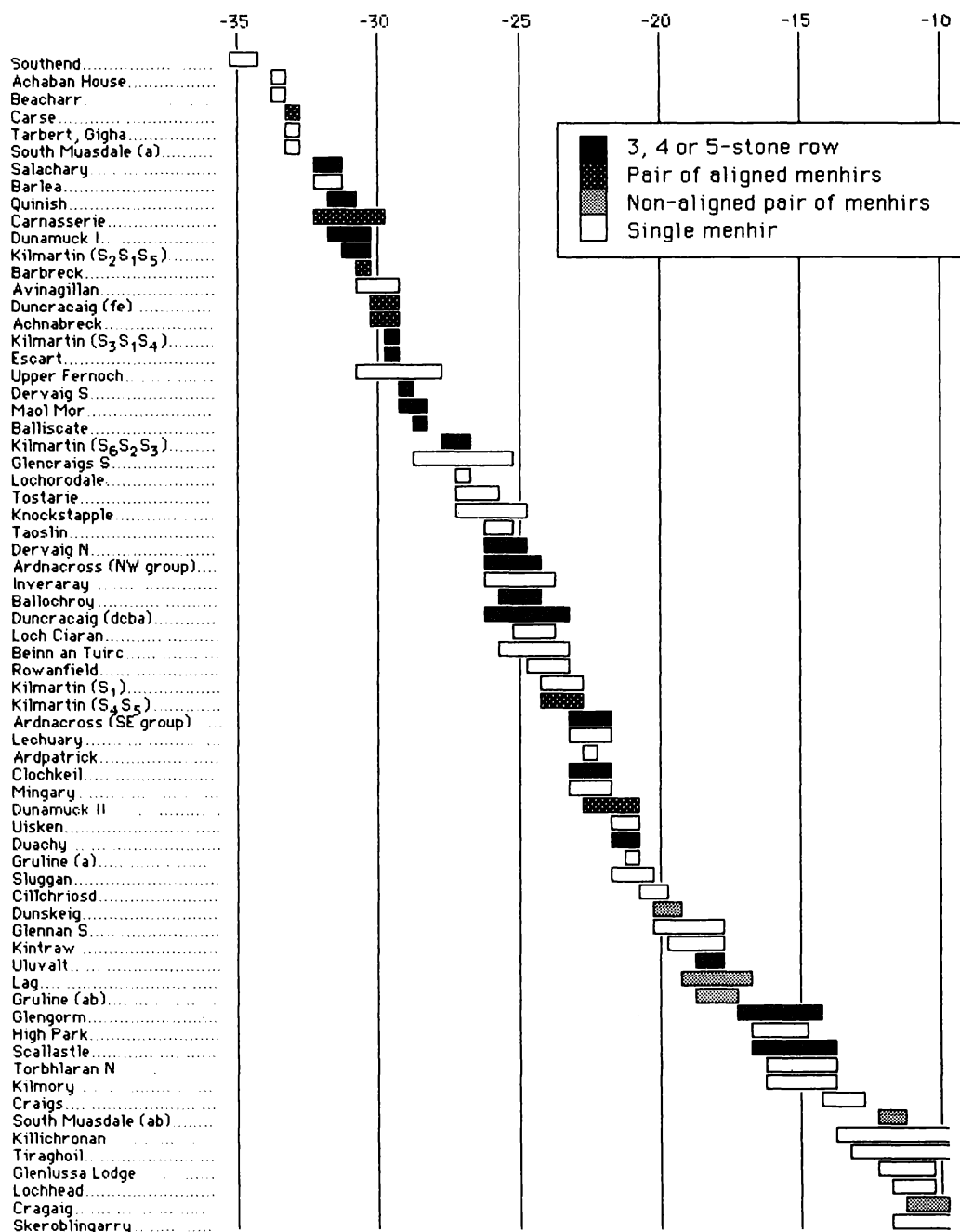


FIG. 1. Southern declinations indicated by linear features in Argyll in Mull. The type of feature is indicated by the shading.

number of sites, as yet unsurveyed, which indicate more southerly declinations and hence would provide data undoubtedly relevant to the current hypothesis.

Details of indicated azimuths and declinations for the remaining 70 linear features are given in Table 3. Azimuths are quoted to the nearest degree; altitudes



and declinations to the nearest half-degree. Data from existing surveys, which were previously quoted to greater accuracy,<sup>55</sup> have generally been rounded to the nearest acceptable values, although at Cillchrìosd (ML7) and Ardpatrik (KT3), where such a procedure would have resulted in an indication of zero width, azimuths have been rounded away from the mean.

The instrument used for surveys during 1985 was a Nikon NT-2A theodolite reading to 20". Our survey technique and our procedure for the reduction of the survey data largely followed previous practice, as described in detail elsewhere.<sup>56</sup> Plate bearing zero was normally determined from timed observations of the Sun or from sightings of three or more reference points such as Ordnance Survey triangulation stations, although at Taoslin (ML30) and Tiraghoil (ML35) it was necessary to 'tie in' to a previous survey at the same site. This did, however, give sufficient accuracy for the present purposes.

The distances of local horizons quoted in the course of the original project<sup>57</sup> were merely estimated on site and from available Ordnance Survey maps, since they were not to form any further part of that analysis. The more careful measurement of a number of these distances has resulted in minor adjustments to several of the earlier quoted values. In one instance, at Lechuary (AR23), this has resulted in a line previously excluded as local now being found to have a horizon at 1.0km. At Lag (ML6) we now consider that the prostrate menhir fell from its eastern end, rather than the western end as assumed earlier: the new indicated horizon is non-local.

In the case of non-local profiles we have continued, as in the original project, to digitize 200mm photographs and perform a least-squares fit of relocatable points to their surveyed azimuths and altitudes. However, in the majority of cases, where the surveyed profiles are local, we have simply deduced the azimuths and altitudes of points between the surveyed ones by making measurements directly from the photographs. The potential inaccuracies involved are negligible in view of the low-precision hypothesis currently being tested, and to use these data to test higher-precision ones would be unjustified given the uncertainties due to possible changes in ground level and vegetation.

The exact azimuth and altitude, and hence declination, of a horizon point will depend upon the postulated 'observing position'. The closer the horizon, the more critical the observing position. In the interests of objectivity, it is important to define profile measurements relative to a standard observing position (SOP).<sup>58</sup> Following our earlier practice we take the SOP at a distance of 2m directly behind the linear feature and at a height of 1.5m above present ground level.

One of the problems that arises in attempting to identify the orientation of a slab or 'long menhir' is that its two wide faces may indicate rather different directions. In such cases, again following earlier practice,<sup>59</sup> we select the flattest side (narrowest indication).

#### 4. THE RESULTS

In order to help identify overall trends, we have simplified the information on the indicated profiles and sorted it into declination order. This tabular material is presented in Table 4. In addition we have presented the data visually in Figure 1. When examining this material we should bear in mind the missing data about



TABLE 4. A summary of the southern indications by linear features in Argyll in Mull, listed in order of the mean indicated declination.

*Column headings*

- 1 Site reference
- 2 Site name
- 3 Linear setting in question (given only to distinguish different linear settings at the same site)
- 4 Nature of the linear setting
- 5 Distance category of the horizon
- 6 Rising or setting
- 7 Minimum indicated declination
- 8 Maximum indicated declination

*Key to column 4 (nature of the linear setting)*

- R Three-, four- or five-stone row  
 AP Pair of aligned menhirs  
 NP Non-aligned pair of menhirs  
 S Slab  
 L 'Long menhir' (see text)

*Key to column 5 (distance category of the horizon)*

- L Less than 1 km  
 A At least 1 km and less than 3 km  
 B At least 3 km and less than 5 km  
 C At least 5 km

1	2	3	4	5	6	7	8
KT44	Southend		S	C	Set	-35.0	-34.5
ML39	Achaban House		L	A	Set	-33.5	-33.5
KT15	Beacharr		L	B	Set	-33.5	-33.5
KT2	Carse		AP	A	Rise	-33.0	-33.0
KT12	Tarbert, Gigha		S	L	Set	-33.0	-33.0
KT19	South Muasdale	<i>a</i>	S	C	Set	-33.0	-33.0
AR6	Salachary		R	L	Rise	-32.0	-31.5
KT21	Barlea		S	L	Set	-32.0	-31.5
ML2	Quinish		R	C	Rise	-31.5	-31.0
AR12	Carnasserie		AP	L	Rise	-32.0	-30.0
AR28	Dunamuck I		R	A	Rise	-31.5	-30.5
AR13	Kilmartin	$S_2-S_1-S_5$	R	C	Set	-31.0	-30.5
AR3	Barbreck		AP	B	Set	-30.5	-30.5
KT4	Avinagillan		S	B	Rise	-30.5	-29.5
AR15	Duncraigaig	<i>fe</i>	AP	C	Rise	-30.0	-29.5
AR31	Achnabreck		AP	L	Rise	-30.0	-29.5
AR13	Kilmartin	$S_3-S_1-S_4$	R	C	Set	-29.5	-29.5
KT5	Escart		R	C	Set	-29.5	-29.5
AR38	Upper Fernoch		L	A	Set	-30.5	-28.0
ML11	Dervaig S		R	C	Rise	-29.0	-29.0
ML9	Maol Mor		R	L	Rise	-29.0	-28.5
ML4	Balliscate		R	A	Set	-28.5	-28.5
AR13	Kilmartin	$S_6-S_2-S_3$	R	L	Rise	-27.5	-27.0
KT32	Glencraigs S		S	C	Rise	-28.5	-25.5
KT40	Lochorodale		S	L	Set	-27.0	-27.0
ML14	Tostarie		L	C	Set	-27.0	-26.0
KT41	Knockstapple		S	A	Rise	-27.0	-25.0
ML30	Taoslin		L	L	Rise	-26.0	-25.5
ML10	Dervaig N		R	L	Rise	-26.0	-25.0
ML12	Ardnacross	NW group	R	A	Set	-26.0	-24.5
AR19	Inveraray		S	B	Set	-26.0	-24.0
KT10	Ballochroy	<i>cba</i>	R	C	Set	-25.5	-24.5
AR15	Duncraigaig	<i>dcba</i>	R	B	Rise	-26.0	-23.5
KT9	Loch Ciaran		L	C	Set	-25.0	-24.0
KT23	Beinn an Tuirc		S	B	Set	-25.5	-23.5

TABLE 4 – concluded

1	2	3	4	5	6	7	8
AR16	Rowanfield		S	C	Rise	-24.5	-23.5
AR13	Kilmartin	$S_1$	S	L	Rise	-24.0	-23.0
AR13	Kilmartin	$S_4-S_5$	AP	L	Rise	-24.0	-23.0
ML12	Ardnacross	SE group	R	A	Set	-23.0	-22.0
AR23	Lechuary		S	A	Rise	-23.0	-22.0
KT3	Ardpatrick		S	B	Rise	-22.5	-22.5
KT27	Clochkeil	<i>cba</i>	R	C	Set	-23.0	-22.0
KT39	Mingary		S	A	Rise	-23.0	-22.0
AR29	Dunamuck II		AP	A	Rise	-22.5	-21.0
ML31	Uisken		S	B	Set	-21.5	-21.0
LN22	Duachy		R	A	Rise	-21.5	-21.0
ML16	Gruline	<i>a</i>	S	A	---	-21.0	-21.0
AR2	Sluggan		S	L	Rise	-21.5	-20.5
ML7	Cillichriod		S	C	Rise	-20.5	-20.0
KT8	Dunskeig		NP	C	Rise	-20.0	-19.5
AR10	Glennan S		S	L	Set	-20.0	-18.0
AR5	Kintraw		S	C	Set	-19.5	-18.0
ML25	Uluvalt		R	B	Rise	-18.5	-18.0
ML6	Lag		NP	A	Rise	-19.0	-17.0
ML16	Gruline	<i>ab</i>	NP	C	Rise	-18.5	-17.5
ML1	Glengorm		R	L	Rise	-17.0	-14.5
KT29	High Park		S	L	Set	-16.5	-15.0
ML21	Scallastle		R	L	Rise	-16.5	-14.0
AR25	Torbhlaran N		S	L	Rise	-16.0	-14.0
AR33	Kilmory		S	A	Rise	-16.0	-14.0
KT31	Craigs		S	L	Rise	-14.0	-13.0
KT19	South Muasdale	<i>ab</i>	NP	C	Set	-12.0	-11.5
ML15	Killichronan		L	L	Set	-13.5	-9.5
ML35	Tiraghoil		L	L	Set	-13.0	-9.5
KT35	Glenlussa Lodge		S	C	Rise	-12.0	-10.5
AR39	Lochhead		S	C	Rise	-11.5	-10.5
ML18	Cragaig		NP	L	Set	-11.0	-10.0
KT28	Skeroblingarry		S	L	Set	-11.5	-9.0
AR32	Oakfield		S	B	Rise	-8.0	-7.0
AR9	Glennan N		S	L	Set	-3.0	-1.5

which we have some relevant information. Thus

- (i) two measured indications (Glennan N and Oakfield) listed in Table 4 yield southern declinations above  $-10^\circ$  and do not appear in Figure 1;
- (ii) four unmeasured indications – one aligned pair (Ardalanish), one non-aligned pair (Glenamacrie) and two single menhirs (Cretshengan and Campbeltown) – yield southern declinations well outside the lunar range and do not appear in Table 4 or Figure 1; and
- (iii) a further eleven unmeasured indications – one non-aligned pair (Dunadd) and ten single menhirs – will yield data relevant to the current investigation, but which are currently unavailable.

In the remainder of this section we discuss in turn the results obtained for the different types of linear feature in our list.

#### 4.1 Stone Rows and Aligned Pairs

Perhaps the most striking feature to emerge from Figure 1 is that the extra data from local horizons at the rows and aligned pairs conform generally to the pattern

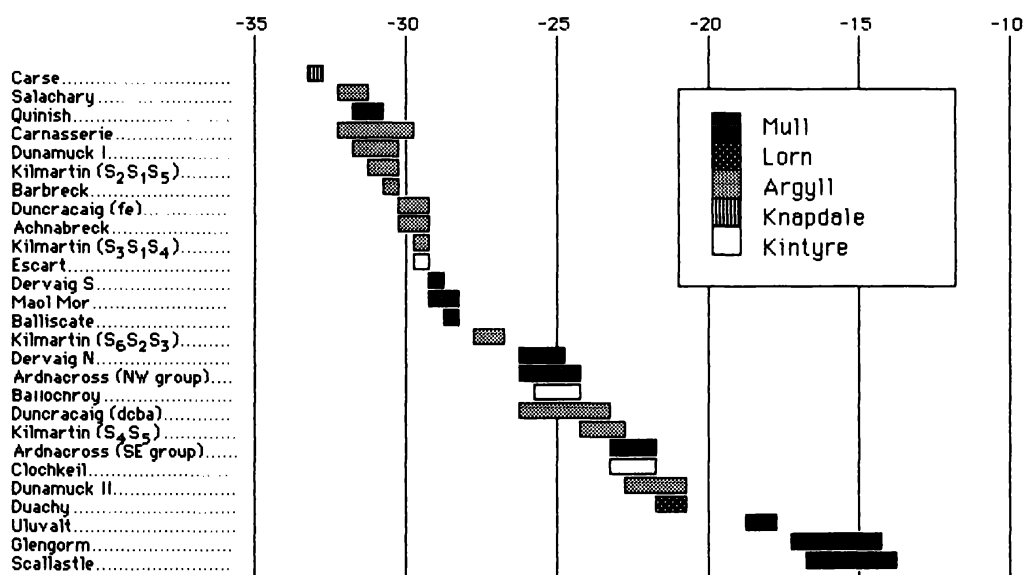


FIG. 2. Southern declinations indicated by stone rows and aligned pairs of standing stones in Argyll in Mull. The geographical location of the feature is indicated by the shading.

observed previously, i.e. they fall within the range  $-31^\circ$  to  $-19^\circ$ . The only exceptions are Glengorm (ML1) and Scallastle (ML21), which fall between about  $-17^\circ$  and  $-14^\circ$ , and Ardanish (ML33), which is above  $-8^\circ$ . (The case of Carse (KT2) was known previously.) This conclusion is reinforced by a comparison between Figure 1, which includes data on local horizons, and an earlier illustration<sup>60</sup> which did not.

In Figure 2 we have displayed only the stone rows and aligned pairs, shading them according to the geographical location of the site. The overall pattern suggests a concentration of indicated declinations between about  $-32^\circ$  and  $-29^\circ$ , with a more even distribution at higher declinations but tailing off above  $-20^\circ$ . This is not the distribution one would expect if sites were oriented upon the southern maximum monthly Moon at arbitrary points in the 18.6-year cycle: instead, the addition of the new data emphasizes the concentration of indications around  $-30^\circ$  and the absence of such a concentration in the vicinity of  $-19^\circ.5$ . This implies a specific interest in the major standstill, and demands that we examine more closely the sites concerned, both to check the status of the data giving rise to this trend and to check whether to any extent it might be explicable by factors unrelated to astronomy.

*Sites in northern Mull.* Of the Mull sites, seven – Glengorm (ML1), Quinish (ML2), Balliscate (ML4), Maol Mor (ML9), Dervaig N (ML10), Dervaig S (ML11) and Ardnacross (ML12) – form a close geographical group. Each of them is an impressive site which, it appears, comprised at least three menhirs between about 2m and 3m tall (although several have fallen and those at Dervaig S have been broken off). The latter six sites appear to have been rows of at least three standing stones, and Ardnacross to have been two separate three-stone rows flanking three kerb-cairns. We have surmised that the three stones at Glengorm, of which two are known to have been recently re-erected, once also formed a three-stone row.

Those sites where at least two stones stand and the deduced indication seems most reliable are Balliscate, Maol Mor, Dervaig N and Dervaig S. Three yield declinations of  $-29^\circ$  or  $-28^\circ.5$ ; Dervaig N yields a declination around  $-25^\circ.5$ . Balliscate is a setting line, the other three rising lines. On the other hand the row at Quinish and the two at Ardnacross consist of at most one standing stone, the remainder being prostrate and in most cases partially turf-covered: the intended orientation in these cases is in greater doubt. The declinations obtained at Ardnacross (about  $-25^\circ$  and  $-22^\circ.5$  respectively for the NW and SE groups) fall well within the lunar range; but that obtained at Quinish, around  $-31^\circ$ , is lower than the remainder and perhaps anomalously low if the orientation was indeed lunar. With this in mind we can re-examine the 1976 plan of the fallen stones at Quinish upon which our estimate of the indicated azimuth range was based.<sup>61</sup> It is easy to see that, on present evidence, the alignment could well have been somewhat more to the NW-SE than the  $168^\circ$ – $348^\circ$  we have assumed, so that its declination is increased. Similarly the anomalously high declination (around  $-16^\circ$ ) obtained at Glengorm is purely the result of our assumption that, if the site was originally an alignment, then it was in line with the present orientation of the slab. The figure may easily be considerably in error.

*Sites elsewhere in Mull.* The three other stone rows or aligned pairs in Mull are Scallastle (ML21), Uluvalt (ML25) and Ardalanish (ML33). Ardalanish is the only stone row or aligned pair not to appear in Figure 2 since it yields a declination somewhat above  $-8^\circ$ , yet there seems no reason to doubt its prehistoric status. The alignment at Uluvalt, however, consists of three prostrate slabs and an intervening earthfast boulder, and its status as a prehistoric site is disputed.<sup>62</sup> Thus the indicated declination of about  $-18^\circ$  may be fortuitous. Finally Scallastle appears to be the remains of a stone row similar to those in northern Mull, but only one of three menhirs still stands; the other prostrate stones lie within 4m of it amidst field clearance.<sup>63</sup> It seems, therefore, not out of the question that the other stones have been dragged a short distance to their present positions, and that the quoted declination of around  $-15^\circ$  may be misleading.

*Sites in the Kilmartin valley area.* The other main geographical grouping of rows and aligned pairs in our list is in the Kilmartin valley. The sites at Kilmartin (AR13), Duncraigaig (AR15), Dunamuck I (AR28), Dunamuck II (AR29) and Dunamuck III (AR30) form a well-known group of standing stone sites consisting of menhirs between 2.5m and 4m tall (with the exception of stone  $S_6$  at Kilmartin) and varying in form from the simple three-stone row and aligned pair at the Dunamuck sites to the complex arrangement at Kilmartin. They exist alongside a variety of prehistoric sites of many periods. Three sites to the north may also be related: the aligned pair 3 km north of Kilmartin at Carnasserie (AR12), the three-stone row some 3 km north again at Salachary (AR6) and the site some 2 km north again at Barbreck (AR3), which has certain architectural features in common with the Kilmartin site.<sup>64</sup> The Ach nabreck site (AR31) is noticeably different from the others in form: it comprises not a closely-spaced setting or complex of such settings, as do all the others, but two widely spaced menhirs almost 300m apart. The northernmost is a large prostrate stone some 4.5 long, and from its vicinity the other, smaller upright appears on the horizon. They may very well never have been directly related, although they do seem to have been aligned.

Each of the linear features identified in our list is reliably preserved apart, perhaps, from Salachary, which consists of one upright menhir of irregular cross-section, one stone leaning at about  $70^\circ$  to the vertical and a third which has fallen. Remarkably, seven out of the twelve declinations quoted in Table 4 fall within  $1^\circ$  of  $-30^\circ$ . Four of the remainder fall between  $-27^\circ.5$  and  $-21^\circ$  and the last falls at around  $-32^\circ$ . Only the sites at Salachary (yielding  $-32^\circ$ ) and Dunamuck II ( $-22^\circ$ ) do not have at least one linear feature in the list which indicates a southern declination very close to  $-30^\circ$ . The declination of the southernmost stone at Achhabreck as viewed from the other is worthy of note. Our 1985 survey, hampered by intervening vegetation, gave a declination of almost exactly  $-30^\circ$  for the base of  $b$  as viewed from  $a$ , and almost exactly  $-29^\circ.5$  for its tip. (Further details are given in Table 3.)

Two of the indications in our list are the three-stone alignments  $S_2S_1S_5$  and  $S_3S_1S_4$  at Kilmartin, which yield declinations of  $-31^\circ$  and  $-29^\circ.5$  respectively. However, rather than viewing them as separate indications, we may be nearer to the true intention of the builders if we envisage the five-stone formation at this site (ignoring for the moment the smaller stone  $S_6$ ) as a development of the simple three-stone alignment in which both the northernmost and southernmost stones, instead of being single slabs oriented across the alignment, have become pairs of slabs. Accordingly we should perhaps consider the NNE-SSW alignment at Kilmartin to be a single linear setting indicating a mean declination of around  $-30^\circ$ , and we shall assume this from here onwards.

Thus in the Kilmartin valley area we find six distinct linear settings all of which indicate a southern declination within  $1^\circ$  of  $-30^\circ$ : Barbreck, Carnasserie, Kilmartin (NNE-SSW), Duncraigaig (*f*), Dunamuck I and Achhabreck. The indication is east of south at Barbreck and Kilmartin, and west of south in the other four cases. Only at Salachary, where the orientation of the linear setting appears to be in some doubt owing to its poor state of preservation, was a rather lower declination obtained, between  $-32^\circ$  and  $-31^\circ.5$ . Thus this group of sites appears to present particularly strong evidence of deliberate orientation upon the southern major standstill Moon.

This must lead us to enquire further about the remaining indicated declinations at the stone rows and aligned pairs in the Kilmartin area. At the Kilmartin site itself the orientation of the aligned pair  $S_4S_5$  yields a southern declination of around  $-23^\circ.5$ . (The orientation of the single slab  $S_1$  is similar.) The pair  $S_2S_3$  appear to be aligned with the small stone  $S_6$  some 100m to the NW, and from the latter a declination of about  $-27^\circ$  is obtained. The longer alignment (*dcb*) at Duncraigaig yields a southern declination of between  $-26^\circ$  and  $-23^\circ.5$ , and the aligned pair at Dunamuck II yield a value between  $-22^\circ.5$  and  $-21^\circ$ . It would be unwise to speculate too rashly on the basis of this evidence, but two points are worthy of note.

- (i) With the single exception of  $S_6S_2S_3$  at Kilmartin, each of the indicated declinations is within a degree or two of  $-23^\circ$ . In fact stone  $S_6$  at Kilmartin is much smaller than, and may not have been directly relevant to the main purpose of, the other five. If it is ignored and the orientation of  $S_2S_3$  is viewed from directly behind  $S_2$ , one obtains a substantially higher horizon altitude, and hence declination, more in line with those yielded by  $S_4S_5$  and by the flat faces of  $S_1$ .



- (ii) Each structure indicating a declination near to  $-23^\circ$  occurs in close proximity to one indicating a declination in the vicinity of  $-30^\circ$ . At Kilmartin the orientation of the individual slabs and shorter aligned pairs across the main, longer alignment (indicating  $-30^\circ$ ) seems to suggest a 'secondary' direction (indicating around  $-23^\circ$ ); at Duncraiga row *dcba* (indicating  $-25^\circ$ ) is situated next to the pair *fe* (indicating  $-30^\circ$ ); and the aligned pair at Dunamuck II (indicating  $-22^\circ$ ) are situated less than 500m from the row at Dunamuck I (indicating  $-31^\circ$ ).

The only fact which seems to run against the interpretation of the indications falling near  $-23^\circ$  as 'secondary' is that at Duncraiga it is the four-stone row which indicates the supposed secondary declination and the aligned pair which indicates  $-30^\circ$ .

These secondary structures, if such they were, may have been oriented upon the southern limiting Moon at another point in the 18.6-year cycle, but it would then be somewhat surprising that no declinations higher than  $-21^\circ$  are obtained. It is also possible that they were oriented upon the midwinter Sun. At this stage the two possibilities seem indistinguishable. We should also perhaps take note of their northern indicated declinations: *abcd* at Duncraiga yields a value around  $+29^\circ$ ,<sup>65</sup> close to the northern extreme Moon, the north-western indication at Dunamuck II yields around  $+26^\circ$ <sup>66</sup> and  $S_3S_4$  at Kilmartin yields a value somewhat above  $+30^\circ$ .<sup>67</sup>

*Sites elsewhere in mid-Argyll.* There remain in our data set five rows or aligned pairs which are geographically more scattered. They are Duachy (LN22) in Lorn, Carse (KT2) in Knapdale, and Escart (KT5), Ballochroy (KT10) and Clochkeil (KT27) in Kintyre. At least two stones stand at each of these sites, so that the declinations are considered reasonably reliable. The values obtained are scattered from  $-33^\circ$  at Carse to  $-21^\circ$  at Duachy. Only the Carse indication falls outside the lunar range.

*Discussion.* With the benefit of hindsight, we display once more in Figure 3 the southern declinations indicated by stone rows and aligned pairs in Argyll and Mull. We have now marked those features considered more or less reliable on the basis of their archaeological status and current state of repair, and have omitted Glengorm completely. In the upper diagram all geographical areas are included, whereas only sites in northern Mull and in the Kilmartin valley area appear in the lower diagram. The latter, showing only the two main geographical concentrations of sites, manifests a clear grouping in the vicinity of  $-30^\circ$ . A second, rather wider, grouping is evident centred upon  $-23^\circ$ . (The only indication which does not fall clearly into one of the two groups is  $S_6S_2S_3$  at Kilmartin; but as we have mentioned, the value of the indicated declination here is increased if we suppose that the smaller  $S_6$  was not in fact part of the original design of the site.) In the Kilmartin area each of the structures yielding a 'secondary' declination of around  $-23^\circ$  seems to be situated near to another yielding a 'primary' declination of around  $-30^\circ$ . This rule appears to extend to the Dervaig N site on northern Mull (indicated declination  $-25^\circ$ ) which is situated only 400m from Dervaig S (indicated declination  $-29^\circ$ ). The Ardnacross site, however, appears to be an exception to the rule. Both its three-stone rows indicate declinations in the second grouping, and it is situated several kilometres from any other known site.

Thus on the basis of present evidence the southern declinations indicated by the stone rows and aligned pairs of stones in two important geographical concentrations – northern Mull and the Kilmartin area of Argyll – seem to fit a clear pattern. Either they are oriented within a degree or two of  $-30^\circ$ , or else they are oriented within two or three degrees of  $-23^\circ$  and situated close to another row or pair which does indicate  $-30^\circ$ . The other rows and aligned pairs scattered more widely about Argyll and Mull seem to fit a more general pattern of orientation between  $-30^\circ$  and  $-19^\circ$ , although there are some anomalous sites such as Ardalanish and Carse.

#### 4.2 *Non-Aligned Pairs*

Returning to Figure 1, we note the total absence of any non-aligned pairs of stones yielding a declination below  $-21^\circ$ . A reinspection of the archaeological status of the five non-aligned pairs included in Table 3 – Lag (ML6), Gruline (ML16), Craigaig (ML18), Dunskeig (KT8) and South Muasdale (KT19) – as well the two for which no measurements are currently available – Glenamacrie (LN18) and Dunadd (AR27) – reveals several doubts about the wisdom of including this group of indications in our list. The prostrate menhir at Lag is very close to the standing one, so that the supposed indication depends upon where the prostrate menhir originally stood, about which there is some uncertainty (see Section 3 above); the menhirs at Gruline are 270m apart and quite possibly not directly related; the standing stones at Craigaig are small and unimpressive; one of those at Glenamacrie is merely a rounded boulder which may well not be prehistoric;<sup>68</sup> the two stones at Dunadd are 250m apart, of vastly different sizes, and seem unlikely to be directly related; the site at Dunskeig is of uncertain status (see Table 2); and one of the stones at South Muasdale is of uncertain status (see Table 2). In view of this it is perhaps not surprising that the declinations obtained from these pairs of stones do not contribute to the overall trends observed in the original study. We shall not discuss them further.

#### 4.3 *Single Menhirs*

It seems risky to attempt to isolate any meaningful orientation trends for single menhirs in view of the possible changes introduced over the millennia by stones shifting, leaning, becoming weathered and damaged and so on. (The fact that the slabs in aligned rows and pairs are usually displaced by anything up to  $15^\circ$  from the orientation of the linear setting may itself bear witness to the movements that have occurred since the sites were constructed – assuming of course that they were originally set up reasonably accurately in the line.) Furthermore our data set on the orientations of single menhirs is far from complete, as discussed above. It is, however, of some interest in the light of our earlier conclusions about the stone rows and aligned pairs to investigate whether the orientations of those isolated slabs and ‘long menhirs’ for which we do have measurements seem to follow the trends exhibited by the more impressive sites.

It is clear in Figure 1 that the extra data from slabs and long menhirs are much more scattered than those from the stone rows and aligned pairs: in particular there are several declinations falling between about  $-16^\circ$  and  $-8^\circ$ , and a number falling at or below  $-33^\circ$ . We begin by investigating the sites producing these outlying declinations.



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## Linear Settings of Argyll and Mull

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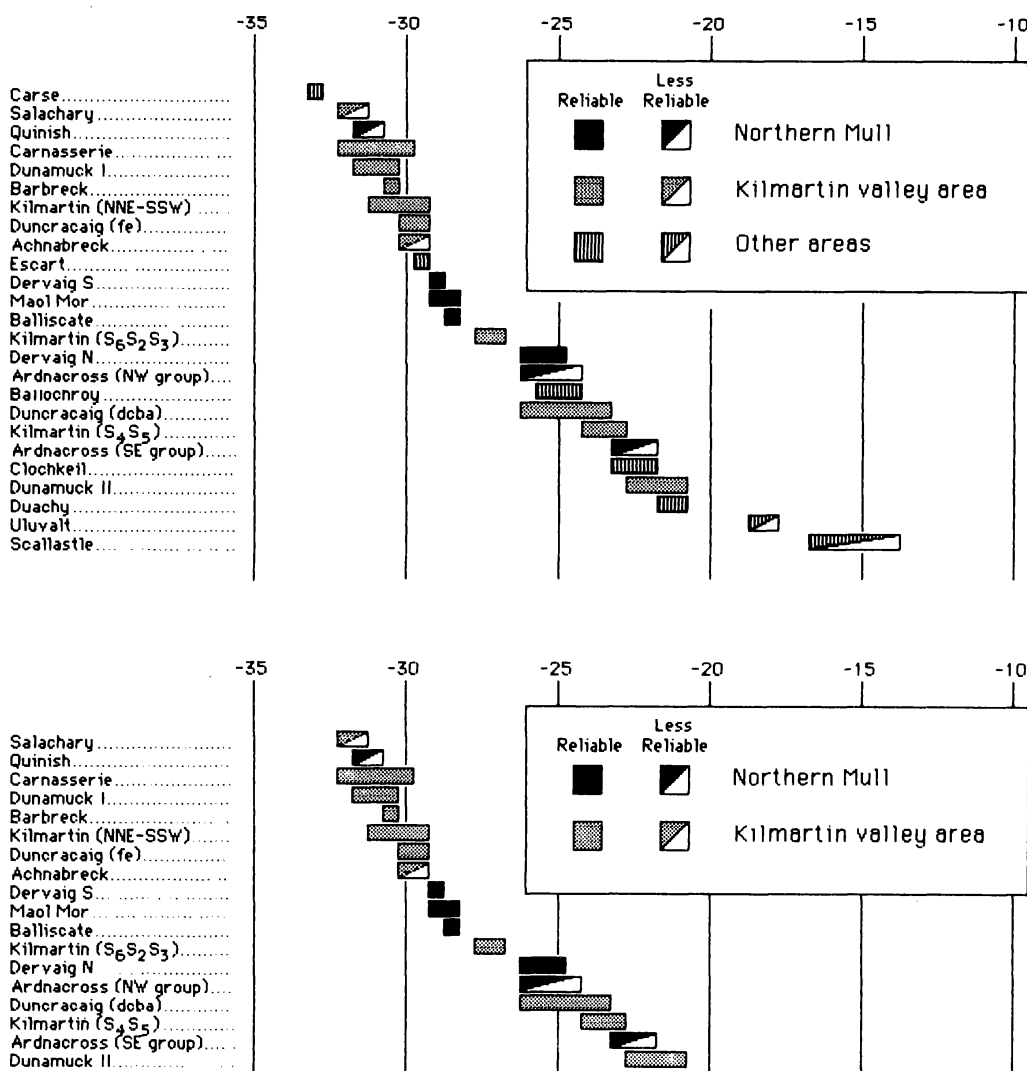


FIG. 3. Southern declinations indicated by stone rows and aligned pairs of standing stones in Argyll and Mull. These have been designated more or less reliable on the basis of the archaeological status and current state of repair of the sites, aided by retrospective consideration of the declinations obtained. The Glengorm data have been omitted completely.

Upper diagram: All geographical areas.

Lower diagram: The two main concentrations (northern Mull and the Kilmartin area of Argyll) only.

The five menhirs yielding very low declinations are Achaban House (ML39), Tarbert (KT12), Beacharr (KT15), *a* (the stone which is standing and whose status is not in dispute) at South Muasdale (KT19), and Southend (KT44). Beacharr and South Muasdale are tall, conspicuous stones situated some 4 km apart on the west coast of Kintyre, and command wide views out to sea. Both are oriented slightly west of south, parallel to the coastline. The stone at Barlea (KT21), 2 km south along the coast from South Muasdale, is smaller but has a similar situation and

orientation and should probably be grouped with them. It seems worthless to seek a purpose for these sites beyond that of marker stones, either of a point on the coastline or, as at Beacharr, of an important burial site.<sup>69</sup> The stone at Tarbert, overlooking a bay on the eastern coast of Gigha, is smaller but also oriented slightly west of south, parallel to the coastline.

The group of sites yielding declinations between about  $-16^\circ$  and  $-8^\circ$  comprises Killichronan (ML15) and Tiraghoil (ML35) in Mull, Torbhlaran (AR25), Oakfield (AR32) and Kilmory (AR33) in Argyll, Lochhead (AR39) in Knapdale, and Skeroblingarry (KT28), High Park (KT29), Craigs (KT31) and Glenlussa Lodge (KT35) in Kintyre. It is noteworthy, though probably without significance, that three of these sites (KT28, KT29 and KT31) are fairly closely grouped in central Kintyre north-west of Campbeltown. The Tiraghoil site, in common with Achaban House mentioned above and with Taoslin (ML30; declination  $-26^\circ$ ), is one of a series of stones on the Ross of Mull traditionally identified as marking the pilgrims' route to Iona.<sup>70</sup> A number of the other sites are of somewhat dubious status or state of repair – Killichronan leans at about  $70^\circ$  to the vertical; Oakfield is situated in the grounds of an estate next to the wall of a dairy; Kilmory is beside the approach road to the offices of the Argyll and Bute District Council; and Glenlussa Lodge is built into the garden wall of a house.

The bulk of the single standing stones yielding declinations between about  $-30^\circ$  and  $-19^\circ$  are situated in Kintyre and mid-Argyll. This may well be a fact without significance in the case of the Kintyre stones, since there are a large number of them and, taken as a whole, their southern declinations are scattered fairly uniformly throughout the entire range up to about  $-8^\circ$ . (There is still a noticeable fall-off above this value, reflecting the general lack of east-west sites noted in the original project.<sup>71</sup>) The Argyll sites, however, may be more interesting. None is of uncertain status apart perhaps from Glennan S (AR10) which is incorporated into what appears to be the wall of an old rectangular building. Apart from the Inverary site (AR19), which is geographically far removed from the others, all six sites for which we have measurements – Sluggan (AR2), Kintraw (AR5), Glennan N (AR9), Glennan S (AR10), Rowanfield (AR16) and Lechuary (AR23) – lie in, or in the general vicinity of, the Kilmartin valley. All but one of the southern indicated declinations lie between about  $-26^\circ$  and  $-18^\circ$  (Glennan N yields an exceptional  $-2^\circ$ ). Whether one should speculate upon the possible significance of this in the light of the 'secondary orientations' observed at the rows and aligned pairs in this area seems at present an open question, and we shall be content in this paper simply to draw attention to this result.

## 5. GENERAL DISCUSSION

From the outset, when the original investigation of 300 western Scottish sites was first conceived, we have adopted the guideline that statistical rigour must precede interpretative reasoning.<sup>72</sup> The first stage is necessary in order to counter unwarranted speculation on the purpose of structure orientations, and to prevent the accumulation of evidence arrived at merely by preferentially selecting oriented structures which appear to support a favoured idea and excluding others which do not. The second stage, however, is also necessary in order to take account of cultural diversity and human perversity. It would be wholly unreasonable to

expect the design and function of a complete group of superficially similar sites to have conformed exactly to any overriding 'master plan'; furthermore the sites and structures investigated in this article cover a wide geographical region, and we have virtually no dating evidence to suggest that they cover a time span less than several centuries – maybe even millennia. Thus, having isolated in the first stage any general trends which show up above the background 'random noise', it is desirable to pursue these trends in more detail and in a rather more interpretative manner. Our eventual aim should of course be to consider the data in the light of their full archaeological and cultural context.

In this paper we have attempted to make explicit the transition from the original analysis with its rigid selection criteria, through the further investigation of apparent trends using pre-determined (though rather more subjective) criteria, to a more interpretative presentation of the data which is based upon a re-appraisal of the archaeological status and current state of repair of the sites, but which also takes into account retrospectively the indicated declinations that were obtained.

Our conclusions may be summarized as follows. Stone rows and aligned pairs with local horizons to the south, surveyed during 1985, fit the general pattern that indicated declinations fall between about  $-31^\circ$  and  $-19^\circ$ . However, the distribution of indicated declinations within this range is far from that to be expected if sites were merely oriented upon the limiting monthly Moon at arbitrary points in the 18.6-year cycle. Instead, we find a grouping of indications within a degree or two of  $-30^\circ$  and a second, rather wider, grouping centred upon  $-23^\circ$ . In the two main concentrations of stone rows and aligned pairs of stones – northern Mull and the Kilmartin area of Argyll – a structure yielding an indication in the second group is invariably situated close to another yielding a declination of around  $-30^\circ$ . Outside the main geographical concentrations, the rows and aligned pairs of Argyll and Mull seem to fit a more general pattern of orientation between  $-30^\circ$  and  $-19^\circ$ .

The southern declinations obtained from single slabs and menhirs with an obvious longer axis are much more scattered. This is perhaps hardly surprising in view of the uncertainties inherent in determining an indication from the current disposition of such stones, together with the range of possible purposes for which such stones might have been erected. However there is some evidence that the orientation pattern observed amongst the rows and aligned pairs extends to certain single standing stones, particularly in the Kilmartin area.

The possible influence of the lie of the land upon the orientations of the linear settings in question has been discussed briefly elsewhere.<sup>73</sup> It was concluded that while the orientations of several sites do reflect the local topography, several others clearly do not. It is eminently possible that the lie of the land was taken into account in choosing a convenient situation for a ceremonial site within the territory available to a particular set of builders and when deciding between a rising or setting indication; however geographical factors such as the lie of the land can not on their own explain the declination trends we obtain.

We tentatively conclude that the orientation of many of the stone rows and aligned pairs of stones in Mull and mainland Argyll was of importance to the builders, and that astronomical, and particularly lunar, alignment was an important factor in determining this orientation. In two areas where we find

particular concentrations of such sites – northern Mull and the Kilmartin area of Argyll – it seems that a primary target for orientation was the major standstill Moon in the south. There is also some evidence pointing to a habit of secondary orientation, achieved perhaps by the contrary orientation of individual slabs in a longer alignment (as at Kilmartin), or else by setting up a second structure close by and roughly parallel to the first (as at Duncraraig) or else again by setting up a second structure at a short distance from the first (as at Dervaig and Dunamuck). These secondary structures may have been oriented upon the southern limiting Moon at another point in the 18.6-year cycle, but then it is perhaps somewhat surprising that no declinations higher than  $-21^\circ$  are observed. It is also possible that they were oriented upon the midwinter Sun. (The northern declinations indicated by these secondary structures seem, *pace* Thom,<sup>74</sup> to manifest less of a consistent pattern.) Surveys of the southern profiles indicated by stones *b* and *c* at Ballochroy, and by stone *a* at Clochkeil, for which measurements are currently unavailable, may throw further light on the matter. The design of the Kilmartin site itself may even represent the culmination of a local practice, managing to incorporate two different orientations of significance into a single, more complex arrangement of stones.

It is hoped to discuss elsewhere the wider cultural and astronomical implications of these conclusions. We would, however, emphasize here that the speculations recounted above seem justified only in the light of the results of the original analysis of 300 sites, which singled out for further investigation both the southern limiting lunar declination range and the linear settings of Argyll and Mull. We would be misguided to launch at this stage into unrestricted speculation about the sites in question, although some further cautious interpretations may be justified, especially in the light of cultural evidence.

#### ACKNOWLEDGEMENTS

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3. For a summary see C.L.N. Ruggles, "Megalithic astronomy: The last five years", *Vistas in astronomy*, xxvii (1984), 231-289, p. 246.
4. *Ibid.*, 256.
5. Ruggles, *op. cit.* (ref. 1), ch. 13.
6. See also Ruggles, *op. cit.* (ref. 3), Section 4.2.5 and Figure 9; and Ruggles, *op. cit.* (ref. 1), 282-5.
7. Ruggles, *op. cit.* (ref. 1).
8. L. V. Morrison, "On the analysis of megalithic lunar sightlines in Scotland", *Archaeoastronomy*, no. 2 (1980), S65-77; C.L.N. Ruggles, "A reassessment of the high precision megalithic lunar sightlines, 2: Foresights and the problem of selection", *Archaeoastronomy*, no. 5 (1983), S1-36.
9. Thom, *op. cit.* (ref. 2), 118.
10. Ruggles, *op. cit.* (ref. 1), Table 2.1.
11. *Ibid.*, Sections 2.3 – 2.6. The tally does not include Kintraw (AR5), which was omitted from the earlier analysis on the grounds that it had been excavated in order to test an astronomical hypothesis. It has been reinstated here.

12. H.A.W. Burl, *Rings of stone* (London, 1979), 66.
13. The sites involving stone circles are: Lochbuie in southern Mull (ML28), with a fine 13m-diameter circle, kerb cairn and four outlying menhirs; Strontoiller in Lorn (LN17), with a 20m-diameter ring of boulders situated some 200m away from a fine standing stone and associated ring cairn; and Kilmartin (AR13) with two circles, an outlying group of menhirs and the nearby Nether Largie round cairn. The "possible stone circle" site is Tenga (Loch Frisa), Mull (ML13), where there is a trapezoidal setting of four stones, widely spaced, which may represent the remains of a ring of diameter approximately 35m. For further details see Ruggles, *op. cit.* (ref. 1), chs 7, 8 and 10, and references therein.
14. Ruggles, *op. cit.* (ref. 1), Section 3.3.
15. Ruggles, *op. cit.* (ref. 1), chs 7, 8 and 10 and references therein.
16. Some values quoted where the decimal part is 0 or 5 may only be accurate to about 0.5m, rather than the 0.1m which is implied. For clarification the reader is referred to the site notes in Ruggles, *op. cit.* (ref. 1), chs. 7, 8 and 10, where "some 2.5m tall" as opposed to "2.5m tall" indicates this lower accuracy.
17. Ruggles, *op. cit.* (ref. 1), Section 3.3.
18. By a "rectangular setting" we mean three or four erect slabs around 0.5m tall which form the central parts of the sides of a rectangle about 4m × 3m. There are two examples at Kilmartin (AR13) and one at Barbreck (AR3). Two of the three surround large standing stones. For further details see Ruggles, *op. cit.* (ref. 1), 147-148.
19. Royal Commission on the Ancient and Historical Monuments of Scotland (hereinafter R.C.A.H.M.S.), *Argyll: An inventory of the ancient monuments, 3: Mull, Tiree, Coll and northern Argyll* (Edinburgh, 1980), no. 105.
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41. R.C.A.H.M.S., *op. cit.* (ref. 35), no. 153.
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43. R.C.A.H.M.S., *op. cit.* (ref. 35), no. 34.
44. *Ibid.*, no. 151.
45. *Ibid.*, Fig. 34.
46. Contrast the decision made by the R.C.A.H.M.S. (*op. cit.* (ref. 19), no. 109) and by the present author in 1976 (ref. 1, p. 127 and Table 7.1) with that made in the present paper (Tables 2 & 3).
47. For further details see Ruggles, *op. cit.* (ref. 1), 143, and references therein.
48. Ruggles, *op. cit.* (ref. 1), Table 7.1, 8.1 or 10.1.
49. *Ibid.*, p. 127 and Table 7.1.
50. *Ibid.*, in the final section of the appropriate chapter (7, 8 or 10).
51. Ruggles, *op. cit.* (ref. 8), Figure 7.
52. Ruggles, *op. cit.* (ref. 1), Line 182 (see p. 162).
53. *Ibid.*, Line 186 (see p. 162).
54. *Ibid.*, Line 242.
55. *Ibid.*, Tables 7.1, 8.1, 10.1 and 11.2.
56. *Ibid.*, ch. 4.
57. *Ibid.*, Tables 7.1, 8.1 and 10.1.
58. *Ibid.*, Section 3.2.
59. *Ibid.*, 63.
60. Ruggles, *op. cit.* (ref. 3), Figure 9(b).
61. Ruggles, *op. cit.* (ref. 1), Figure 4.4.
62. *Ibid.*, 128, and references therein.
63. R.C.A.H.M.S., *op. cit.* (ref. 19), no. 113.
64. J. Patrick, "A reassessment of the lunar observatory hypothesis for the Kilmartin stones", *Archaeoastronomy*, no. 1 (1979), S78-85.
65. Ruggles, *op. cit.* (ref. 1), Line 168.
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68. R.C.A.H.M.S., *Argyll: An inventory of the ancient monuments, 2: Lorn* (Edinburgh, 1975), no. 114.
69. The well-known Beacharr long cairn is situated some 30m north of the standing stone. See Henshall, *op. cit.* (ref. 40).
70. M'Laughlin, *op. cit.* (ref. 27).
71. Ruggles, *op. cit.* (ref. 1), chs 12 and 13.
72. *Ibid.*, ch. 1 and Section 13.4.
73. *Ibid.*, 243.
74. Thom, *op. cit.* (ref. 32), Sections 5.2 and 5.6. At both Kilmartin (Temple Wood) and Duncraigaig Thom proposes that what we have identified as the secondary indication was set up to indicate the major standstill Moon to the north. However at Kilmartin he uses notch  $A_1$  as foresight, rather than the direction indicated by stones  $S_3S_4$ ,  $S_1$  or  $S_3S_2$  themselves. See also Ruggles, *op. cit.* (ref. 21), Section 4.4.4 and Figure 4.3.