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A NEW STUDY OF THE ABERDEENSHIRE RECUMBENT STONE CIRCLES, 1: SITE DATA

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1. *Introduction*

The dangers are well known in studying single instances of astronomically oriented megalithic sites. Any orientation of apparent astronomical significance could have arisen purely by chance, and (at least in the absence of excavation, and arguably even then) there is no conceivable independent *direct* evidence which will clearly resolve the issue. Thus it is always necessary to use a large data sample from many sites and to seek repeated trends. If statistically significant results emerge, then they can be regarded as reliable and combined with other archaeological data in order to frame cultural hypotheses. However, even then, the greatest care must be taken to ensure that the data are chosen fairly (and demonstrably so) and hence that the results of any statistical analysis are in fact meaningful.

We immediately encounter the problem of actually finding a suitable data sample. In an ideal case we might be provided with a well-defined group of demonstrably similar sites confined to a given area, but sufficient in number to provide a reasonable data base, and with a design such that (say) one direction at each site is clearly of special importance. The Recumbent Stone Circles (RSCs) of eastern Scotland[1] come close to this ideal. About one hundred certain or possible RSCs are known, about half of which are in a reasonable state of preservation, confined to an area some 80×50 km. At each site the line joining the centre of the ring and the centre of the recumbent stone provides an obvious principal axis.

In what follows we attempt an objective discussion of the astronomy of the RSCs, based on extensive resurveys and using a rigorous hypothesis-testing approach both in the collection and the interpretation of the site data. Part One, presented here, concentrates on setting out the results of site visits and theodolite surveys undertaken in 1981 and on making explicit the selection decisions made at various stages in the work. Part Two, to follow, will attempt a full discussion and interpretation of these results.

Studies of coherent groups of sites can be seen as complementary to investigations following the approach of Thom's early statistical work.[2] In the latter we analyse much larger, but not necessarily coherent, groups of megalithic sites in a given area. Such groups of sites may well represent a wide span in terms of culture change and a variety of unrelated motivations, and in studying them we can only hope to isolate general trends cutting across these differences. There are other drawbacks too.[3] On the other hand few groups of sites exist that are as ideally suited to orientation analysis as the RSCs, and to restrict ourselves to these might be to pass over important evidence about prehistoric astronomy. For this reason a study of 300 megalithic sites in western Scotland has been undertaken simultaneously to the work described here.[4]

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TABLE 1. Summarized details of Recumbent Stone Circles in eastern Scotland.

Column headings

1 All-figure National Grid reference.
2 Site reference.
3 Site name.
4 Site reference used by Burl.[5]
5 Site reference used by Burl.[6]
6 Site reference used by Thom.[2]
7 Page reference of site plan in Thom, Thom and Burl.[8]
8 Status of site as RSC, according to Burl.[5]
9 Status of site as RSC, independent assessment (see text).
10 Comments.
11 Diameter of ring in metres, or maximum and minimum diameters if non-circular, as given by Burl.[5]
12 Comments.
13 Date of site visit by author during 1981, or reason for the lack of one.
14 Structures at the site recognized by the author in 1981.
15 Notes on further structures.
16 Length in metres of recumbent stone.
17 Heights in metres of east flanker, recumbent and west flanker.
18 Alternative site name.

Key to column 8 (status by Burl)

A Certain RSC.
B Probable RSC (*i.e.* listed as "RSC?").
C Possible RSC (*i.e.* listed as of uncertain status).
N Listed, but not as an RSC.
— Not listed.

Key to column 9 (status, independent assessment)

A Certain RSC.
B Probable RSC.
C Possible RSC.
D Unlikely RSC.

Key to column 10 (comments)

a *Auchcorthie.* Coles[9] refers to a circle known locally and removed *c.* 1840. According to his informant there was a recumbent stone hollow on top.

b *Hatton.* Coles[10] states that there once stood here a circle of seven to eight stones removed by the tenant in 1831. There is no mention of a recumbent stone and no note of its diameter.

c *Culsh.* Coles[11] notes stones removed *c.* 1770 for building the parish church manse. Beveridge[12] describes excavations at the site of a circle removed *c.* 1830. If this was a circle at all, there is no record of its diameter.

d Site now destroyed or unrecognizable according to Burl.[5]

e *Cairn Riv.* A single 2·7 m-long stone known as the Carlin stone remains at this site, which may well be a recumbent stone. Coles[13] reports that once "there stood several great stones—none nearly so great as the Carlin—in a circle".

f *Upper Third.* Coles[14] describes two large stones of whinstone 4ft apart in an E–W line. The Ordnance Survey county series map shows one stone on the southern arc of a circle of 80ft diameter, but the basis for this construction is not clear.

g *Huntly.* A monument known as the "Standing stones of Strathbolgie" was destroyed some time in the last century, and only two standing stones now remain in the market square at Huntly. If it was a circle, the remaining stones indicate a diameter of some 15 m, but it seems that these have been removed from their original positions.[15] The only tenuous evidence that this might have been an RSC is provided by one informant[16] who remembered "a very large stone lying in front of two uprights".

h *Nether Dumeath.* Although Coles[17] refers to a circle of ten stones recently blasted by the tenant farmer, there is no direct evidence that it was an RSC.

j *Clatt sites and Holywell.* The Ordnance Survey map of 1866 marks a seven-stone circle at Holywell and the sites of circles at Clatt Hillhead and Clatt Bankhead. Coles[18] associates a description, apparently of an RSC, given in the National Statistical Account of 1845[19] with Clatt Hillhead, but in fact the details match up with other information about the site at Holywell, and may well refer to that site. The latter was itself destroyed by about 1861. (I am grateful to J. Barnatt for providing this information.)

Key to column 10 (comments)—continued

k *Braehead.* Only the recumbent stone remains, and Coles[20] makes no mention of any direct evidence that there was ever a stone circle here.

l *Broomend.* Keiller[21] mentions a destroyed standing stone site, with large blocks of pink Bennachie granite being built into neighbouring walls. There is no evidence that this was an RSC.

m *Crookmore and Nether Balfour.* There are several descriptions of a site at Crookmore destroyed during the last century,[22] but similarities between these and descriptions of the sites at Druidsfield and Nether Balfour suggest that there could be confusion with either or both of these sites. Only the fact that the Ordnance Survey county series map marked a "site of circle" at Crookmore provides any real evidence that there was a separate site at this location, and only an O.S. name book of 1867[23] apparently provides any definite information on Nether Balfour. (I am grateful to J. Barnatt for providing this information.)

n *Mill of Carden.* Coles[24] noted a stone 9ft high standing in a bedding of (packing) stones. There is no indication from his account that this is the site of an RSC. Keiller[25] later declared that "obviously, to the experienced eye" the menhir was a flanker, but he does not appear to have had any backing for this conclusion from documentary evidence or local sources. The stone had been moved by 1981 and now leans against a dyke.

p *Nether Coullie.* Although Coles[26] lists evidence that the single standing stone here was once part of a circle, the only direct mention of a recumbent stone is by Ritchie,[27] and involves a somewhat subjective interpretation of an informant's account.

q *South Fornet.* Although the two uprights here may well be the flankers of an RSC, there is no direct documentary evidence of a circle here[28] and they may represent the remains of a different structure such as a four-poster.

r *Nether Corskie.* This site consists of two erect stones 3·7 m and 2·2 m tall, some 3 m apart. Coles[29] suggested that they were flankers, and Burl[30] lists the site as a certain RSC, but they may represent the remains of any type of circle, or a four-poster, or be a genuine two-stone setting.

s *Wester Echt.* There is no direct evidence in the informants' accounts quoted by Coles[31] and Ritchie[32] that the original circle here, of which three stones remain, was an RSC. The remaining three uprights form the arc of a ring at least 40 m in diameter, which would be anomalously large for an RSC.

t *Blue Cairn.* This anomalous site consists of a 23 m-diameter cairn with a fine extant kerb. In this kerb on the SW side is a large recumbent stone 3·6 m long and 0·9 m high, but the site bears no other resemblance to an RSC, despite being listed as one by Burl.[33] It could perhaps represent an RSC totally built into a cairn at a later date, but the absence of any other candidates for original circle stones makes this unlikely. It may, however, have been a variant form of RSC.

u *Forvie.* Thom's site B1/27[34] and a reported badly damaged RSC of 20 m diameter some 40 m to its NW appear merely to be two features in a complex of kerb cairns, enclosed cremation cemeteries and a ring cairn.[35]

v *Mundurno.* This is a single standing stone 2 m high. Although Keiller[36] stated that "to the experienced eye [it] is the pillar of an RSC" (*i.e.* a flanker) there appears to be no independent evidence for this.

w *Cotbank of Barras.* The only information on this destroyed site is that reported by Coles.[37] His diagram shows a 15 m-diameter ring of small earthfast stones surrounding a low irregular heap of small stones, which probably represents the kerb of a ring-cairn or robbed barrow.

x *Coilleachur.* This site consists of a badly disturbed 49 m-diameter bank with stones up to 0·4 m tall, and an inner kerb ring.[38] While it has similarities with RSCs there are no stones which could be called uprights. Furthermore its diameter is anomalously large for an RSC, and it would at best have to be considered a variant. It could be a badly robbed barrow.

y *Fortingall South.* This is the southernmost of three adjacent sites, Fortingall E, W and S. The E and W sites each consist of three standing stones, but appear originally to have been variant four-posters, with larger stones at the corners and smaller ones at the midpoints of the sides.[39] The S site consists of three stones, two some 1·2 m high with a third, 0·9 m high set between them. Thus it may represent the remains of a similar setting to the first two, and its interpretation as a variant recumbent and two flankers[40] seems highly questionable.

TABLE 1—*continued*

Key to column 12 (comments)

A Measurement of diameter(s) approximate, according to Burl.[41]
B Approximate. The figure of *c.* 25 m is deduced from Coles,[42] but Burl quotes 31 m.
C Burl's quoted diameter is that of the ring cairn.
F Burl's diameter is in fact a conversion into metric quoted to 0·1 m of a diameter quoted by another author only to the nearest 10ft: hence it is approximate.
U Measurement of diameter(s) uncertain, according to Burl

Key to column 13 (date of visit / reason for lack of one)

NF Not found.
NV Not visited because of status or reported condition of site.
Cr Site inspection prevented by crops.

Key to column 14 (structures)

Col. 1: E East flanker standing (or earthfast stump).
e East flanker fallen.
— East flanker removed or destroyed.
Col. 2: R Recumbent stone standing.
r Recumbent stone fallen.
— Recumbent stone removed or destroyed.
Col. 3: W West flanker standing (or earthfast stump).
w West flanker fallen.
— West flanker removed or destroyed.
Col. 4: Number of other *standing* stones (or earthfast stumps) in ring.

Key to column 15 (notes on further structures)

b Embanked circle.
i Internal cairn of unknown type.
r Internal ring cairn.
s Possible internal ring cairn.
t Possible embanked circle.
u Excavated central cairn.
x Length of recumbent may be 3·8 m.
y Flankers re-erected.[43]
z After a history of disturbance at the site, the stones were completely removed in 1965 (Thom's survey predates this); and have now been replaced following excavation.[44] The site was visited by the author during this excavation.

Key to columns 16 and 17 (measurements)

.. Measurements by the author considered reliable.
(..) Estimate of the original height of a fallen stone.
[..] Present height of a broken stone.
{..} Measurement by another author.

1	2	3	4	5	6	7	8	9	10	11	12	13	14				15	16		17		18
3289 8641	RSC1	Innesmill	Mor6	—	B5/1	240	B	B		34		30/7	—	—	—	5		—	—	—	—	Urquhart
3608 8611	RSC2	St Brandan's Stanes	Ban11	—	—	—	B	B	d	—		NV										
3797 8587	RSC3	Clochforbie	Ab29	—	—	—	A	A		—		01/8	—	r	—	—		3·7	—	(1·0)	—	
399 858	RSC4	Cortes	Ab34	—	—	—	C	C		—		NV										
4028 8572	RSC5	Berrybrae	Ab11	24 (A)	—	—	A	A		13×11		18/6	E	R	W	2	r	3·2	[0·3]	1·6	2·2	
4043 8573	RSC6	Netherton	Ab83	31 (B)	—	—	A	A		17		06/8	E	R	W	7		2·9	1·7	1·1	1·6	
3937 8545	RSC7	Strichen	Ab102	—	B1/1	156	A	A		13		06/8	E	R	W	4	z	?	?	?	?	
3925 8523	RSC8	Auchcorthie	—	—	—	—	—	B	a	—		NV										

1	2	3	4	5	6	7	8	9	10	11	12	13	14				15	16	17			18
3981 8515	RSC9	Gaval	Ab53	—	—	—	A	A		—		06/8	—	—	—	1		—	—	—	—	
3948 8503	RSC10	Auchmachar	Ab4	—	—	—	A	A		15	A	06/8	E	r	w	1		—	2·5	(1·0)	(2·5)	
3962 8497	RSC11	Loudon Wood	Ab73	10 (A)	—	—	A	A		19		18/6	e	R	W	2	b	3·2	(2·1)	1·2	2·1	
3959 8471	RSC12	Aikey Brae	Ab1	8 (A)	—	—	A	A		17×13		18/6	E	R	w	3	b	4·3	2·2	1·3	(1·9)	
4050 8364	RSC13	Hatton	Ab57	—	—	—	B	C	db	—		NV										
387 848	RSC14	Culsh	Ab39	—	—	—	B	C	dc	9	U	NV										
3881 8448	RSC15	Auchmaliddie	Ab5	—	—	—	A	A		—		06/8	—	r	w	—		3·2	—	(1·4)	(2·0)	Muckle Stone
3674 8466	RSC16	Cairn Riv	Ab21	—	—	—	A	B	e	29	A	Cr										Carlin Stone
3707 8445	RSC17	Corrydown	Ab33	39 (C)	—	—	A	A		23	A	01/8	—	R	w	—		2·5	—	1·4	(2·0)	
3664 8438	RSC18	Harestane	Ban4	—	—	—	B	B	d	18	F	NV										
3686 8434	RSC19	Pitglassie	Ab88	37 (C)	—	—	A	A		18	F	Cr	—	R	—	—		{2·5}	—	{1·4}	—	
3699 8425	RSC20	Mains of Hatton	Ab74	38 (C)	B1/25	188	A	A		20		Cr										Charlesfield
3726 8405	RSC21	Rappla Burn	Ab91	—	—	—	B	B	d	—		NV										
3736 8402	RSC22	Rappla Wood	Ab92	—	—	—	B	B		15	U	NF										
3550 8487	RSC23	Rothiemay	Ban10	16 (A)	B4/4	238	A	A		28		13/6	—	R	—	4		4·4	—	1·3	—	Milltown
3531 8456	RSC24	Arnhill	Ab3	49 (C)	—	—	A	A		18	A	31/7	—	R	—	—		3·5	—	1·5	—	
3601 8458	RSC25	Yonder Bognie	Ab118	28 (B)	B1/23	184	A	A		24		01/8	e	R	W	4	cr	3·4	(1·6)	1·6	1·9	
3588 8445	RSC26	Cairnton	Ab22	43 (C)	—	—	A	A		—		31/7	—	R	W	—		2·9	—	1·5	2·3	
362 841	RSC27	Frendraught	Ab50	—	—	—	A	A	d	26	U	NF										
3677 8394	RSC28	Upper Third	Ab109	—	—	—	B	C	df	—		NV										
346 842	RSC29	Gingomyres	Ab54	—	—	—	A	A	d	18	A	NV										
3529 8399	RSC30	Huntly	Ab63	—	—	—	B	C	g	14	U	13/6	—	—	—	2		—	—	—	—	
3425 8378	RSC31	Nether Dumeath	Ab82	—	—	—	B	B	dh	12	A	NV										
3484 8269	RSC32	Upper Ord	Ab108	—	—	—	B	B		23	U	02/8	—	—	—	2		—	—	—	—	
3510 8271	RSC33	Corrstone Wood	Ab32	47 (C)	B1/21	—	A	A		—		02/8	e	r	W	—		4·0	(2·2)	(1·2)	2·2	Mains of Drumminor
3528 8265	RSC34	Clatt, Hillhead	Ab28	—	—	—	A	C	dj	23	U	NV										
3529 8270	RSC35	Clatt, Bankhead	Ab27	—	—	—	A	C	dj	—		NV										
3549 8270	RSC36	Holywell	Ab61	—	—	—	N	B	dj	24	A	NV										
3552 8279	RSC37	Ardlair	Ab2	2 (A)	B1/18	182	A	A		12		02/8	E	R	W	1	r	2·8	1·5	1·5	1·5	Holywell
364 832	RSC38	Culsalmond	Ab38	—	—	—	B	B	d	—		NV										
3599 8299	RSC39	Candle Hill, Insch	Ab23	45 (C)	—	—	A	A		13		15/6	e	r	w	1	i	4·0	(1·6)	(1·6)	(1·9)	
3624 8294	RSC40	Inschfield	Ab66	48 (C)	B1/14	178	A	A		27		13/6	E	r	—	—		4·2	2·6	(1·7)	—	
3601 8287	RSC41	Stonehead	Ab100	50 (C)	—	—	A	A		—		13/6	E	R	W	—		4·0	1·8	1·4	2·3	
3608 8284	RSC42	Dunnideer	Ab45	—	—	—	A	A		—		07/8	—	R	—	—	y	{2·8}	{2·0}	{1·7}	{3·0}	
3619 8273	RSC43	Wantonwells	Ab110	20 (A)	B1/12	174	A	A		—		07/8	e	R	—	—		{3·0}	{2·7}	{2·1}	—	
3592 8255	RSC44	Braehead	Ab15	34 (B)	—	—	A	B	k	—		07/8	—	R	—	—		{3·1}	—	{1·8}	—	
363 825	RSC45	Broomend	Ab17	—	—	—	B	C	dl	—		NV										
3604 8242	RSC46	Loanend	Ab69	35 (B)	—	—	A	A		—		07/8	—	R	—	1		{4·2}	—	{1·9}	—	
3616 8222	RSC47	Druidstone	Ab43	46 (C)	—	—	A	A		17	U	07/8	e	—	w	3		—	{2·0}	—	{2·0}	
3617 8198	RSC48	Cothiemuir Wood	Ab35	18 (A)	—	—	A	A		21×19	U	01/7	E	R	W	4	b	4·0	2·8	1·5	2·8	
3593 8195	RSC49	Old Keig	Ab86	21 (A)	—	—	A	A		26	U	12/6	E	R	W	1	cu	5·2	2·9	2·0	2·7	
3588 8184	RSC50	Crookmore	Ab36	—	—	—	A	C	dm	—		NF										
3552 8205	RSC51	Corrie Cairn	Ab31	—	—	—	C	C		19	U	NV										
3578 8177	RSC52	Druidsfield	Ab42	36 (C)	—	—	A	A		15	F	14/6	E	—	W	—		—	2·0	—	2·2	
3539 8172	RSC53	Nether Balfour	Ab79	—	—	—	A	B	dm	—		NV										
3584 8138	RSC54	North Strone	Ab85	29 (B)	—	—	A	A		20×19	U	14/6	E	r	w	3	b	1·4	[0·7]	(0·6)	(0·8)	
3679 8280	RSC55	Old Rayne	Ab87	15 (A)	B1/13	176	A	A		26	U	Cr										

TABLE 1—*concluded*

1	2	3	4	5	6	7	8	9	10	11	12	13	14				15	16		17		18
3659 8268	RSC56	Hatton of Ardoyne	Ab58	25 (A)	—	—	A	A		24		15/6	E	R	—	3	br	2·2	2·3	1·3	—	
3693 8261	RSC57	Mill of Carden	Ab77	—	—	—	A	C	n	—		07/8	—	—	—	—		—	—	—	—	
3745 8296	RSC58	New Craig	Ab84	12 (A)	—	—	A	A		—		15/6	E	R	W	—		3·7	2·5	1·5	2·0	
3747 8288	RSC59	Loanhead of Daviot	Ab70	14 (A)	B1/26	190	A	A		21		02/7	E	R	W	8	r	3·4	[1·8]	1·6	2·3	
3823 8249	RSC60	Sheldon of Bourtie	Ab94	—	B1/8	166	B	B		33		Cr										
3801 8250	RSC61	Kirkton of Bourtie	Ab67	11 (A)	B1/7	164	A	A		22	U	02/7	E	R	—	2		4·9	2·7	1·8	—	
3735 8241	RSC62	Balquhain	Ab10	9 (A)	B1/11	172	A	A		20	A	Cr										
3732 8208	RSC63	Easter Aquorthies	Ab47	13 (A)	B1/6	162	A	A		20		01/7	E	R	W	9	b	3·8	2·1	1·2	2·4	
3706 8189	RSC64	Chapel o'Sink	Ab26	—	B1/16	180	B	B		—	C	30/6	—	—	—	—		—	—	—	—	Westerton
3709 8156	RSC65	Nether Coullie	Ab81	—	—	—	A	B	p	—		30/6	—	—	—	1		—	—	—	—	
3715 8125	RSC66	Castle Frazer	Ab25	19 (A)	B2/3	198	A	A		20		05/8	E	R	W	4	br	2·2	2·9	1·6	2·5	
3767 8132	RSC67	South Ley Lodge	Ab98	44 (C)	B2/14	218	A	A		30	U	30/6	E	R	W	—		2·4	1·7	1·2	1·6	Leylodge
3782 8109	RSC68	South Fornet	Ab97	42 (C)	—	—	A	B	q	27		30/6	E	—	W	—	i	—	1·9	—	1·8	
3749 8096	RSC69	Nether Corskie	Ab80	—	—	—	A	C	dr	—		Cr	E	—	W	—		—	{2·2}	—	{3·7}	
3739 8084	RSC70	Wester Echt	Ab112	—	—	—	A	C	s	29	U	16/6	—	—	—	3		—	—	—	—	
3699 8064	RSC71	Midmar Kirk	Ab76	22 (A)	B2/17	222	A	A		17		17/6	E	R	W	5		4·5	2·4	0·9	2·4	
3716 8058	RSC72	Sunhoney	Ab103	23 (A)	B2/2	196	A	A		25		17/6	E	r	W	9	br	4·5	2·3	(1·0)	1·9	
3643 8135	RSC73	Whitehill	Ab115	17 (A)	B2/18	224	A	A		22	U	01/7	e	R	W	2	r	2·9	(1·9)	1·2	2·2	Tillyfourie Hill
3625 8092	RSC74	Auld Kirk o'Tough	Ab6	27 (B)	—	—	A	A		25	B	07/8	—	—	—	—		—	—	—	—	
3651 8077	RSC75	Tomnagorn	Ab104	32 (B)	B2/16	220	A	A		22		17/6	E	R	W	4	r	2·2	1·8	1·2	[0·8]	
3603 8035	RSC76	Balnacraig	Ab9	—	—	—	A	A		14		05/8	—	R	—	2	r	{3·0}	—	{1·4}	—	
3486 8034	RSC77	Tomnaverie	Ab105	26 (A)	B2/9	210	A	A		17		16/6	e	r	w	4	r	3·2	(1·8)	(1·0)	(1·8)	
3411 8063	RSC78	Blue Cairn	Ab13	33 (B)	—	—	A	D	t	23		02/8	—	R	—	—	i	3·6	—	0·9	—	
4010 8260	RSC79	Forvie	Ab49	—	B1/27	—	C	D	u	20		NV										
3934 8243	RSC80	Hill of Fiddes	Ab60	—	—	—	A	A		14	U	08/8	—	R	W	—	b	{2·9}	—	{1·3}	{2·0}	
3952 8163	RSC81	Potterton	Ab89	—	—	—	A	A		—		Cr	e	R	w	—		{2·7}	{2·6}	{1·8}	{2·7}	
3940 8131	RSC82	Mundurno	Ab78	—	—	—	B	C	v	—		08/8	—	—	—	1		—	—	—	—	
3860 8133	RSC83	Dyce	Ab46	5 (A)	B2/1	194	A	A		18		29/6	E	R	W	8	r	3·4	2·9	(1·6)	3·0	Tyrebagger
3855 8023	RSC84	Binghill	Ab12	41 (C)	—	—	A	A		10		10/8	—	R	w	2	r	2·3	—	1·1	(1·3)	
3902 7964	RSC85	Old Bourtreebush	Kin13	—	B3/2	228	A	A		31×23	U	29/6	—	—	—	4		—	—	—	—	Aquhorthies N
3901 7963	RSC86	Auchquhorthies	Kin1	3 (A)	B3/1	226	A	A		23		29/6	—	R	W	5	r	2·7	—	1·3	1·6	Aquhorthies S
3754 8941	RSC87	Cairnfauld	Kin2	—	B2/11	—	B	B		23		05/8	—	—	—	4		—	—	—	—	
372 7940	RSC88	Tilquhillie	Kin16	—	—	—	A	A	d	—		NF										
3722 7921	RSC89	Esslie the Lesser	Kin9	6 (A)	B2/5	202	B	B		13		05/8	—	r	W	4	cr	1·9	—	(1·1)	1·4	
3717 7916	RSC90	Esslie the Greater	Kin8	4 (A)	B2/8	200	A	A		25×23		04/8	E	R	W	5	r	2·8	[1·0]	1·2	[1·5]	
3725 7912	RSC91	Garrol Wood	Kin10	1 (A)	B2/6	204	A	A		18×15		04/8	e	r	W	7	cr	2·6	(1·7)	(1·0)	1·8	
3795 7950	RSC92	Raes of Clune	Kin15	7 (A)	B3/7	232	A	A		17		04/8	E	R	W	3	s	2·8	1·3	1·1	1·5	
3827 7791	RSC93	Cotbank of Barras	Kin5	—	—	—	B	D	dw	18	F	NV										
3816 7772	RSC94	The Camp	Kin4	40 (C)	—	—	B	B		24		09/8	—	r	—	—	r	1·9	—	(1·2)	—	
3819 7754	RSC95	Millplough	Kin12	—	—	—	B	B	d	—		NV										
3565 7781	RSC96	Colmeallie	Ang4	30 (B)	—	—	A	A		15	F	09/8	E	r	w	5	rx	2·8	1·7	(1·4)	(2·0)	
3541 7693	RSC97	Newbigging	Ang9	—	—	—	B	B	d	17	A	NV										
2845 7466	RSC98	Coilleachur	Per 11	—	—	—	B	C	x	49	A	NV										
2746 7469	RSC99	Fortingall South	Per24	—	P1/6	336	B	D	dy	23	U	NV										

2. *The Selection of Sites for Investigation*

Ninety-seven sites are noted as certain, probable or possible RSCs by Burl.[5] We have listed them in Table 1, ordering them geographically and inserting our own site identifiers RSC1, RSC2, etc. Burl's site reference numbers, ordered by county and site name, are given in column 4. In a subsequent study of RSC orientations on the basis of existing surveys[6] Burl used a different system of site reference numbers, ordered by the reliability of the surveys and the quoted azimuths of the main axis of each site. These newer site reference numbers are given in column 5 of Table 1. Where a survey by A. Thom exists of the site, a reference to this is also given in the table.

When a site has been destroyed or is in a poor state of preservation, whether it is in fact a good candidate for an RSC will be debatable: decisions will depend upon the interpretation of descriptions by antiquarians, the situation of the site, its diameter (where known, deduced or quoted in the past) and the like. Such decisions inevitably involve a greater or lesser degree of subjective interpretation by the present-day investigator. For this reason, sites have been classified independently by the author as certain, probable, possible or unlikely candidates for RSCs on the basis of first-hand inspection and reference to original sources. (I am most grateful to J. Barnatt for supplying details of his own unpublished site observations and measurements, and for helping with this work.) The resulting classifications are shown in column 9 of Table 1, alongside those of Burl in column 8, and two sites considered to be probable RSCs but which are not included by Burl have been added to the table. Further details are given in the comment column 10 where obvious discrepancies arise. (A number of other sites considered to be possible candidates for RSCs, of equal status to those classified as such by Burl and included in Table 1, have not been added to the list.) The alternative assessments of archaeological status will be borne in mind in the interpretations that follow in Part Two, but in selecting sites for inspection and survey those given by Burl were used exclusively.

During the summer of 1981 visits were attempted to each of the seventy certain and twenty-four probable RSCs listed by Burl, with the exception of eighteen stated to be destroyed (Burl's list does not distinguish between destroyed and "unrecognisable" sites, and I am grateful to him for making further information available). In four of the remaining seventy-six cases the site could not be located: at Crookmore (RSC50) only piles of large broken pieces of rock were visible, and in the other three cases no traces of any kind were found at the given grid references. A further eight sites were in fields under crop and could not be approached for further study, leaving sixty-four that were successfully examined. Full details are given in column 13 of Table 1.

Where a site was inspected in 1981, details and measurements have been inserted in columns 16 and 17 of Table 1. Where crops permitted the form of a site to be determined from a distance, but prevented close enough approach for measurements to be made, those made early this century by Coles[7] are included in the table. The same is done at seven sites visited late in the season where survey was ruled out by lack of available time. We note that measurements of stone heights depend upon the determination of present ground level, which may vary around the stone; thus these should not always be taken as exact.

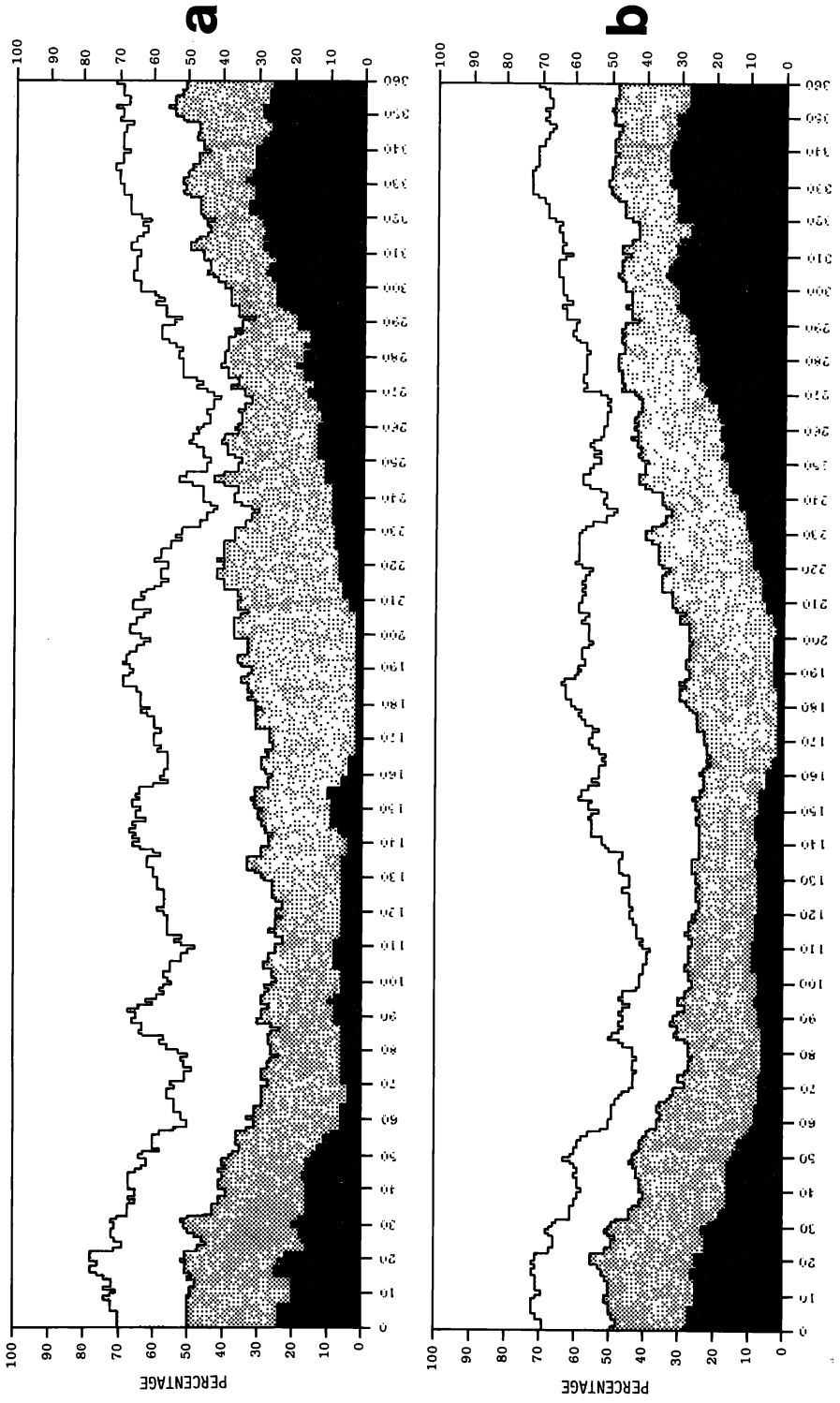

FIG. 1. Horizon scans by azimuth. For each 1° interval in azimuth we plot the percentage of horizons in category 'A' (up to 1 km, black), 'B' (1–3 km, dark shading), 'C' (3–5 km, light shading), and 'D' (over 5 km, white):
(a) shows directly measured data only;
(b) also includes data calculated from Ordnance Survey maps.

3. *Situations of Sites and Distances of Horizons*

With only two exceptions, all the sites visited were found to be located on flat ground, hill tops or south- or southeast-facing slopes. The exceptions, Easter Aquorthies (RSC63) and Esslie the Greater (RSC90), are both located just to the north side of a ridge. This could reflect a preference for non-nearby horizons to the south and east, and so wherever a site was located and accessible, an "horizon scan" was carried out. This consisted of dividing horizon distances into four categories: 'A' (up to 1 km), 'B' (1–3 km), 'C' (3–5 km) and 'D' (over 5 km). The horizon was scrutinized and azimuths of junctions between different categories were noted to the nearest degree. The theodolite was used wherever a survey was being undertaken anyway (see Section 4 below) and a prismatic compass was used in other cases. Where trees obscured parts of the horizon, these were assigned to category 'X' (distance unknown). On-site identifications of hills and estimates of distances were later checked on 1-inch Ordnance Survey maps, and adjustments were made where necessary. The results of these horizon scans are shown in Figure 1a. Azimuths have been divided into 1° intervals. In each interval the data in category 'X' have been disregarded and the percentage of the remainder falling in each of categories 'A', 'B', 'C' and 'D' are plotted.

Horizon scans were constructed from the 1-inch Ordnance Survey at all other sites where the National Grid reference was known to 100 m. In addition, category 'X' data from visited sites were reduced to 'A', 'B', 'C' or 'D' from map work. In the case of these data, however, there will some uncertainty since it is not possible accurately to determine where nearby horizons obscure more distant ones. In Figure 1b these new data are included along with the directly measured distances.

The most obvious general trend that emerges from an inspection of Figure 1 is a distinct preference for non-nearby horizons towards the south. The percentage of horizons in category 'A' drops from near 30 per cent around due north to under 5 per cent around due south. The preference against nearby horizons is not symmetrical about this minimum, but instead extends towards the east. The proportion of horizons in Category A does not rise above 10 per cent between azimuths of around 60° (ENE) and 230° (SW). At the same time, there is no convincing evidence that there existed a preference for very distant, as opposed to moderately distant, horizons in any particular direction. In the case of directly measured data, distant (Category 'D') horizons account for between 50 per cent and 60 per cent of the total between azimuths of 230° (SW) and 270° (W), rather than 30 per cent to 50 per cent, as elsewhere; however, this effect becomes almost indistinguishable when the calculated data are added, and thus it seems unlikely to be significant.

4. *Orientations of the Sites*

Various authors have quoted values for RSC orientations, or else have produced plans from which they can be measured. H. A. W. Burl has kindly prepared a list of the available values, adding a number of his own measurements using hand-held magnetic compass, and they are listed in columns 6–14 of Table 2. These values should be regarded as a revision of those used in

providing the data for his recent study of RSC azimuths.[52] The "most reliable" azimuths assumed by Burl in that analysis are given in column 5.

On closer examination, however, it becomes clear that there are at each site not one but two candidates for a primary orientation of astronomical significance, and that surveys by previous authors had sometimes confused the two. One is the line from the centre of the site through the centre of the recumbent stone (hereinafter the "Centre Line") and the other is the line perpendicular to the longest axis of the recumbent stone (hereinafter the "Perpendicular Line"). At any particular site, depending on its present state, it is possible to define either line, or both: and where only the latter exists, this has often been presented as the former. However, at sites where both exist it can be seen that the long axis of the recumbent stone often appears to have been set considerably off the line tangential to the ring, and the two orientations may differ by almost 20°. In what follows we consider both the Centre and Perpendicular orientations, and analyse them separately. In each case the data set will consist of those sites where the axis in question can be defined.

Surveys were carried out at sites examined during the summer of 1981 wherever the condition of the site merited it. A Kern DKM-1 microptic theodolite was used.[53] The results are listed in columns 3 and 4 of Table 2 for the Centre Line and Perpendicular Line respectively.

Inevitably there are uncertainties in defining either the Centre Line or Perpendicular Line azimuth, and their magnitude depends upon the state of the site. In the former case, where a ring is circular and several stones remain *in situ*, the RSC centre may be accurately definable, but otherwise a good deal of subjective interpretation may be involved. Where there exists an internal cairn or ring cairn this may influence the decision: if this is placed away from the ring centre we may have to decide which 'centre' is the appropriate one, and if too few stones exist to define a centre we have to decide whether to take the position of an internal feature as such. In the case of the Perpendicular Line the accuracy of the orientation of the assumed recumbent stone axis will depend upon how regular its shape is and whether it has moved. The decision as to the exact position of the centre of the recumbent stone, which is relevant to both the Centre and Perpendicular azimuths, also depends upon its shape and where the assumed ends are taken. Thus seldom is it possible reliably to define either axis to an accuracy of 1° or better. We have quoted measured azimuths to 0°·5, but mark with an asterisk those cases where this figure is subject to considerable uncertainty.

In a number of cases it is not possible to determine even an approximate value for the Centre or Perpendicular Line azimuth. This happens, for example, at sites where at most one or two circle stones remain (Centre Line indeterminable) or where the recumbent stone has fallen or been removed (Perpendicular Line indeterminable). Such cases can generally be identified from the site descriptions given in Table 1, but this is not always the case. At sites such as Corrydown (RSC17), although no circle stone now stands, an approximate Centre Line has been established on the basis of the estimated original positions of a number of fallen circle stones. In some cases such as Clochforbie (RSC3) the recumbent stone, even though fallen, is regular enough to permit a reasonable guess at the original orientation of its longest

TABLE 2. Comparison of surveyed primary azimuths with those given by other authors.

Column headings

1 Site reference.
2 Site reference by Burl.[6]
3 Centre Line azimuth to nearest half-degree.
  * Significant uncertainty due to state of site (*e.g.* in determining the centre of the ring, or the axis of the recumbent stone).
  (..) Deduced from groundplan rather than measured direct, so some error possible.
  [..] Azimuth from the present author's fieldwork in 1981 using prismatic compass only.
  {..} Data from other authors' surveys only.
4 Perpendicular Line azimuth to nearest half-degree.
  Notation as in column 3.
5 Most reliable azimuth quoted by Burl.[6]
6 Azimuth from Thom.[8]
7 Azimuth from Lockyer.[45]
8 Azimuth from Keiller.[46]
9 Azimuth from Burl (previously unpublished fieldwork).
10 Azimuth from Coles.[47]
11 Azimuth from Craig.[48]
12 Azimuth from Kilbride-Jones.[49]
13 Azimuth from Ogston.[50]
14 Azimuth from Childe.[51]

(Table 2 will be found on pages S66 and S67.)

TABLE 3. Horizon parameters for inside of east flanker (1), east end of recumbent (2), centre of recumbent (C), west end of recumbent (3) and inside of west flanker (4), as seen from the ring centre (Centre Line).

Round brackets (azimuths and declinations) indicate that azimuth values were deduced from a surveyed groundplan rather than measured direct, so that some error is possible.

Square brackets (altitudes and declinations) indicate that altitude values were deduced from 1-inch Ordnance Survey maps rather than measured direct, so that some error is possible.

Division 1 of the table contains data from reliably preserved sites. Division 2 contains data from sites where there is significant uncertainty owing to the state of the site (*e.g.* in the determination of the centre point). Division 3 contains data from the surveys of other authors only.

(Table 3 will be found on page S68.)

TABLE 4. Horizon parameters for inside of east flanker (1), east end of recumbent (2), centre of recumbent (C), west end of recumbent (3) and inside of west flanker (4), as seen from 10 m behind the recumbent on the Perpendicular Line.

Round and square brackets and the divisions of the table have the same significance as in Table 3.

(Table 4 will be found on page S69.)

TABLE 2 (for caption, see page S65).

1	2	3	4	5	6	7	8	9	10	11	12	13	14
		°	°	°	°	°	°	°	°	°	°	°	°
RSC3	—	—	[219]*	—	—	—	—	—	201	—	—	—	—
RSC5	24 (A)	231·0	231·0	232	—	241	—	232	206	—	—	—	—
RSC6	31 (B)	185·0	185·0	198	—	—	—	198	174	—	—	—	—
RSC7	—	161·0*	{158 }	—	158	—	—	158	—	—	—	—	—
RSC10	—	—	[201]*	—	—	—	—	—	206	—	—	—	—
RSC11	10 (A)	(194·0)	(190·0)	192	—	192	189	190	203	—	—	—	—
RSC12	8 (A)	185·5*	185·5	184	—	184	189	184	198	—	—	—	—
RSC15	—	—	[181]*	—	—	—	—	—	188	—	—	—	—
RSC17	39 (C)	{186 }*	[196]*	180	—	—	—	—	186	—	—	—	—
RSC19	37 (C)	—	{170 }	170	—	—	170	—	—	—	—	—	—
RSC20	38 (C)	{165 }*	—	173	165	—	—	—	166	—	—	—	—
RSC23	16 (A)	216·5*	202·5*	197	197	—	—	213	230	—	—	—	—
RSC24	49 (C)	188·5*	195·5*	203	—	—	—	—	208	—	—	—	—
RSC25	28 (B)	182·5*	173·5	168	155	—	175	170	175	—	—	—	—
RSC26	43 (C)	—	182·0*	189	—	—	189	—	183	—	—	—	—
RSC33	47 (C)	—	(210·5)*	197	—	—	—	—	204	—	—	—	—
RSC37	2 (A)	159·0*	147·0	160	160	151	—	—	163	—	—	—	—
RSC39	45 (C)	163·5	—	195	—	—	202	161	184	—	—	—	—
RSC40	48 (C)	—	202·0*	201	215	201	—	198	221	—	—	—	—
RSC41	50 (C)	—	214·0	217	—	218	—	208	206	—	—	—	—
RSC42	—	—	[191]*	—	—	—	—	—	195	—	—	—	—
RSC43	20 (A)	—	{202 }	202	202	202	—	203	201	—	—	—	—
RSC44	34 (B)	—	{202 }*	204	—	203	—	—	201	—	—	—	—
RSC46	35 (B)	—	{225 }*	229	—	—	221	229	202	—	—	—	—
RSC47	46 (C)	{199 }*	—	196	—	—	—	—	199	—	—	—	—
RSC48	18 (A)	(200·0)	(196·0)	198	—	199	—	—	170	—	—	—	—
RSC49	21 (A)	212·5	(209·5)	229	—	202	—	205	212	—	—	—	211
RSC52	36 (C)	—	170·0*	168	—	—	168	168	—	—	—	—	—

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1	2	3	4	5	6	7	8	9	10	11	12	13	14
		°	°	°	°	°	°	°	°	°	°	°	°
RSC54	29 (B)	180·0	191·5*	185	—	—	—	187	156	—	—	—	—
RSC55	15 (A)	{195 }	—	196	196	—	—	—	199	—	—	—	—
RSC56	25 (A)	219·5	236·5	234	—	237	—	216	203	—	—	—	—
RSC58	12 (A)	—	202·5	195	—	201	202	201	204	—	—	—	—
RSC59	14 (A)	(200·0)	(187·0)	196	196	198	202	—	180	—	196	—	—
RSC61	11 (A)	—	(199·0)	194	194	195	—	192	210	—	—	—	—
RSC62	9 (A)	{190 }	{190 }	189	189	—	—	184	175	—	—	—	—
RSC63	13 (A)	(195·5)	(195·5)	196	196	—	180	195	195	—	—	—	—
RSC66	19 (A)	203·0	203·0	202	202	201	—	200	185	—	—	—	—
RSC67	44 (C)	—	197·0	194	208	194	—	—	180	—	—	—	—
RSC68	42 (C)	—	183·5*	188	—	188	—	—	—	—	—	—	—
RSC69	—	—	{180 }	—	—	—	—	—	180	—	—	—	—
RSC71	22 (A)	231·0	226·0	230	230	227	—	228	251	—	—	—	—
RSC72	23 (A)	231·0	224·5	231	231	233	—	230	227	—	—	—	—
RSC73	17 (A)	(203·0)	(187·0)	197	197	—	—	196	193	—	—	—	—
RSC75	32 (B)	202·5	(204·0)	199	—	195	202	200	219	—	—	—	—
RSC76	—	[224]*	—	—	—	—	—	—	—	—	—	—	—
RSC77	26 (A)	235·5	—	235	235	—	—	232	235	—	—	235	—
RSC78	33 (B)	[207]*	—	201	—	—	216	—	—	201	—	193	—
RSC80	—	—	[206]	—	—	—	—	—	164	—	—	—	—
RSC81	—	—	?	—	—	—	—	—	—	—	—	—	—
RSC83	5 (A)	178·5	178·5	180	180	—	—	—	193	—	—	—	—
RSC84	41 (C)	(187·0)	(194·0)	187	—	—	—	—	187	—	—	—	—
RSC86	3 (A)	174·0	174·0	172	172	—	—	—	175	—	—	—	—
RSC89	6 (A)	183·5*	—	180	180	—	180	—	—	—	—	—	—
RSC90	4 (A)	176·0	(183·0)	176	176	185	180	—	172	—	—	—	—
RSC91	1 (A)	(157·5)	150·5	155	155	—	—	—	160	—	—	—	—
RSC92	7 (A)	(183·0)	(168·0)	181	181	—	—	—	171	—	—	—	—
RSC94	40 (C)	179·0*	—	186	—	—	—	—	186	—	—	—	—
RSC96	30 (B)	202·5*	—	190	—	—	—	190	—	—	—	—	—

TABLE 3 (for caption, see page S65).

	Azimuth					Altitude					Declination				
	1	2	C	3	4	1	2	C	3	4	1	2	C	3	4
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
RSC91 1(A)	(143·0)	(143·0)	(157·5)	(172·5)	(172·5)	2·0	2·0	2·0	2·4	2·4	(−24·2)	(−24·2)	(−28·6)	(−30·6)	(−30·6)
RSC39 45(C)	—	148·0	163·5	182·0	—	—	1·0	0·6	0·4	—	—	−26·6	−31·0	−32·8	—
RSC86 3(A)	—	167·5	174·0	183·0	183·0	—	[−0·6]	[−0·2]	0·0	0·0	—	[−33·4]	[−33·6]	−33·4	−33·4
RSC90 4(A)	167·5	169·5	176·0	183·5	184·0	3·6	3·8	3·6	2·2	2·2	−28·8	−28·8	−29·6	−31·0	−31·0
RSC83 5(A)	(166·5)	—	178·5	—	(195·5)	0·2	—	[0·6]	—	[0·6]	(−32·2)	—	[−32·6]	—	(−31·4)
RSC54 29(B)	174·5	176·5	180·0	184·5	185·0	0·8	0·6	0·6	0·6	0·6	−32·2	−32·6	−32·6	−32·6	−32·6
RSC92 7(A)	(171·0)	(174·0)	(183·0)	—	(193·5)	[3·2]	[3·2]	[2·2]	—	[3·2]	(−29·6)	(−29·8)	(−31·0)	—	(−29·0)
RSC6 31(B)	176·0	177·0	185·0	193·5	194·0	0·8	0·8	1·0	1·0	1·0	−32·0	−32·0	−31·6	−30·8	−30·8
RSC84 41(C)	—	(175·0)	(187·0)	(199·5)	—	—	[0·6]	[0·6]	[0·8]	—	—	(−32·6)	(−32·4)	(−30·4)	—
RSC11 10(A)	—	(183·0)	(194·0)	(204·0)	(204·0)	—	[0·4]	[1·0]	[0·8]	[0·8]	—	(−32·6)	(−30·8)	(−29·0)	(−29·0)
RSC63 13(A)	(181·0)	(185·0)	(195·5)	(206·5)	(208·0)	−0·2	0·4	0·8	0·6	0·6	(−33·6)	(−32·6)	(−31·0)	(−28·8)	(−28·4)
RSC48 18(A)	(189·0)	(190·5)	(200·0)	(208·0)	(212·5)	[1·0]	[1·0]	[0·8]	[0·6]	[0·8]	(−31·6)	(−31·6)	(−30·2)	(−28·4)	(−26·8)
RSC59 14(A)	(190·0)	(190·0)	(200·0)	(211·0)	(212·0)	0·6	0·6	[0·2]	[0·4]	[0·6]	(−32·0)	(−32·0)	(−30·8)	(−27·6)	(−27·2)
RSC75 32(B)	194·0	194·0	202·5	209·5	—	1·6	1·6	1·6	1·4	—	−30·6	−30·6	−28·8	−27·2	—
RSC96 30(B)	190·5	—	202·5	—	219·0	6·4	—	5·8	—	7·8	−26·2	—	−24·8	—	−18·0
RSC66 19(A)	196·5	196·5	203·0	209·0	210·0	1·8	1·8	1·8	1·4	1·2	−29·8	−29·8	−28·4	−27·2	−27·2
RSC73 17(A)	—	(196·5)	(203·0)	(210·0)	(211·5)	—	[3·0]	[2·4]	[2·6]	[2·6]	—	(−28·6)	(−27·8)	(−25·8)	(−25·2)
RSC49 21(A)	196·5	200·0	(212·5)	225·0	225·0	0·8	0·8	0·8	1·6	1·6	−30·8	−30·2	(−26·8)	−21·4	−21·4
RSC56 25(A)	215·5	215·5	219·5	224·0	—	1·2	1·2	0·8	0·8	—	−25·4	−25·4	−24·2	−22·6	—
RSC5 24(A)	—	215·5	231·0	243·0	247·0	—	0·8	0·8	0·8	0·6	—	−25·6	−19·4	−13·8	−12·0
RSC71 22(A)	213·5	218·5	231·0	245·0	245·5	5·6	5·6	3·8	2·2	2·0	-21·8	−20·0	−16·8	−11·6	−11·6
RSC72 23(A)	219·5	220·5	231·0	241·5	242·0	4·2	4·2	4·4	4·8	4·8	−21·0	−20·6	−16·2	−11·0	−10·8
RSC77 26(A)	—	223·0	235·5	246·5	—	—	1·6	1·4	2·2	—	—	−22·2	−17·0	−10·8	—
RSC7 —	143·5	—	161·0	—	179·0	2·0	—	1·4	—	1·2	−24·0	—	−29·4	—	−31·6
RSC37 2(A)	142·0	147·0	159·0	172·0	174·0	0·8	1·4	1·6	2·0	1·8	−24·8	−26·0	−29·0	−30·6	−31·0
RSC94 40(C)	—	172·5	(179·0)	185·0	—	—	−0·4	0·0	0·2	—	—	−33·8	(−33·6)	−33·4	—
RSC25 28(B)	—	169·5	182·5	190·5	193·5	—	1·2	1·0	1·2	1·2	—	−31·0	−31·8	−31·0	−30·6
RSC89 6(A)	—	(174·0)	(183·5)	192·5	—	—	2·0	2·8	2·2	—	—	(−31·0)	(−30·4)	−30·2	—
RSC12 8(A)	(167·5)	(170·5)	185·5	(202·5)	—	0·2	0·2	0·6	1·8	—	(−32·0)	(−32·4)	(−32·2)	(−28·4)	—
RSC24 49(C)	—	181·5	188·5	196·5	—	—	1·0	1·2	1·6	—	—	−31·8	−31·2	−29·8	—
RSC23 16(A)	—	207·5	216·5	225·0	—	—	1·2	1·2	1·2	—	—	−27·6	−24·8	−21·6	—
RSC20 38(C)		158·5	165·0	171·5			[0·2]	[0·2]	[0·2]			[−30·4]	[−31·6]	[−32·4]	
RSC17 39(C)		179·5	186·0	192·5			[0·6]	[0·6]	[0·4]			[−32·4]	[−32·2]	[−31·8]	
RSC62 9(A)		179·0	190·0	201·0			[3·0]	[3·0]	[2·2]			[−30·0]	[−29·4]	[−28·4]	
RSC55 15(A)		186·0	195·0	204·0			[4·0]	[3·8]	[3·2]			[−28·6]	[−27·8]	[−26·6]	
RSC47 46(C)		189·0	199·0	209·0			[0·2]	[0·4]	[0·6]			[−32·6]	[−30·8]	[−28·0]	
RSC78 33(B)		199·0	207·0	215·0			[3·8]	[4·2]	[7·2]			[−27·4]	[−25·0]	[−19·8]	

TABLE 4 (for caption, see page S65).

	Azimuth					Altitude					Declination				
	1	2	C	3	4	1	2	C	3	4	1	2	C	3	4
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
RSC37 2(A)	138·5	141·0	147·0	155·0	155·5	0·8	0·8	1·4	1·2	1·2	−23·6	−24·4	−26·0	−28·4	−28·6
RSC91 1(A)	(144·0)	(144·0)	150·5	(157·5)	(157·5)	2·0	2·0	2·2	2·0	2·0	(−24·6)	(−24·6)	−26·4	(−28·6)	(−28·6)
RSC92 7(A)	(158·0)	(160·5)	(168·0)	—	(177·0)	[3·2]	[3·0]	[3·2]	—	[2·2]	(−27·4)	(−28·2)	(−29·2)	—	(−31·0)
RSC25 28(B)	—	(165·5)	173·5	(179·5)	(181·5)	—	1·6	1·4	1·6	1·2	—	(−30·0)	−31·2	(−31·2)	(−31·6)
RSC86 3(A)	—	(166·5)	174·0	(181·5)	—	—	[−0·6]	[−0·2]	−0·2	—	—	(−33·2)	[−33·6]	(−33·8)	—
RSC83 5(A)	(168·5)	—	(178·5)	—	193·0	[0·2]	—	[0·6]	—	[0·8]	(−32·4)	—	(−32·6)	—	[−31·4]
RSC90 4(A)	(176·5)	(176·5)	(183·0)	(190·0)	(190·0)	3·6	3·6	2·4	2·6	2·6	(−29·6)	(−29·6)	(−30·8)	(−30·0)	(−30·0)
RSC6 31(B)	176·0	177·0	185·0	193·5	194·0	0·8	0·8	1·0	1·0	1·0	−32·0	−32·0	−31·6	−30·8	−30·8
RSC12 8(A)	—	(174·5)	185·5	(197·5)	—	—	0·2	0·6	1·6	—	—	(−32·6)	(−32·2)	(−29·6)	—
RSC59 14(A)	(178·5)	(178·5)	(187·0)	(196·5)	(197·5)	[0·0]	[0·0]	[0·2]	[0·4]	[0·4]	(−33·2)	(−32·2)	(−32·8)	(−31·2)	(−31·0)
RSC73 17(A)	—	(180·5)	(187·0)	(194·0)	(195·5)	—	[1·8]	[2·8]	[3·0]	[3·0]	—	(−31·4)	(−30·0)	(−29·0)	(−28·8)
RSC11 10(A)	—	(181·0)	(190·0)	(198·0)	(198·0)	—	[0·2]	[1·0]	[0·8]	[0·8]	—	(−32·8)	(−31·4)	(−30·4)	(−30·4)
RSC84 41(C)	—	(188·0)	(194·0)	(200·0)	—	—	[0·6]	[0·8]	[0·8]	—	—	(−32·4)	(−31·4)	(−30·4)	—
RSC63 13(A)	(182.5)	(185·5)	(195·5)	(205·5)	(207·0)	−0·2	0·4	0·8	0·6	0·6	(−33·6)	(−32·6)	(−31·0)	(−29·0)	(−28·6)
RSC48 18(A)	(185·0)	(187·0)	(196·0)	(204·0)	(208·0)	[1·4]	[1·2]	[0·8]	[0·8]	[0·6]	(−31·6)	(−31·6)	(−31·0)	(−29·2)	(−28·4)
RSC67 44(C)	189·5	191·0	197·0	200·0	204·5	1·6	1·6	2·0	2·0	2·0	−31·0	−30·8	−29·6	−29·0	−27·8
RSC61 11(A)	(183·0)	(183·0)	(199·0)	(216·5)	—	2·6	2·6	1·4	0·0	—	(−30·2)	(−30·2)	(−29·6)	(−26·2)	—
RSC58 12(A)	193·5	194·0	202·5	(211·5)	(211·5)	0·6	0·6	0·4	0·8	0·8	−31·6	−31·4	−30·0	(−27·0)	(−27·0)
RSC66 19(A)	197·0	197·0	203·0	208·5	209·5	1·8	1·8	1·8	1·6	1·2	−29·8	−29·8	−28·4	−27·2	−27·4
RSC75 32(B)	(199·0)	(199·0)	204·0	(210·0)	—	1·6	1·6	1·6	1·4	—	(−29·6)	(−29·6)	−28·4	(−27·0)	—
RSC49 21(A)	(192·0)	(196·0)	(209·5)	(223·0)	(223·0)	0·8	0·8	0·8	1·4	1·4	(−31·6)	(−31·0)	(−27·8)	(−22·4)	(−22·4)
RSC41 50(C)	198·5	206·0	214·0	225·5	226·5	2·4	3·2	3·4	1·4	1·4	−28·6	−26·2	−23·6	−21·2	−20·8
RSC72 23(A)	(212·0)	(212·0)	224·5	(237·5)	(237·5)	5·4	5·4	4·6	4·4	4·4	(−22·4)	(−22·4)	−18·8	(−13·2)	(−13·2)
RSC71 22(A)	213·0	215·5	226·0	237·0	237·0	5·6	5·8	4·4	3·4	3·4	−22·0	−20·8	−18·4	−14·4	−14·4
RSC5 24(A)	—	(223·0)	231·0	(237·0)	(239·0)	—	0·8	0·8	0·8	0·8	—	(−22·8)	−19·4	(−16·6)	(−15·6)
RSC56 25(A)	231·0	231·0	236·5	242·5	—	0·8	0·8	1·2	1·2	—	−19·6	−19·6	−16·6	−13·8	—
RSC52 36(C)	157·5	—	170·0	—	181·0	2·0	—	1·6	—	1·8	−28·3	—	−31·0	—	−31·2
RSC26 43(C)	—	(172·0)	182·0	(190·0)	(190·5)	—	1·0	0·8	1·0	1·0	—	(−31·6)	−32·2	(−31·4)	(−31·4)
RSC68 42(C)	176·5	—	183·5	—	190·5	0·2	—	0·2	—	0·2	−33·0	—	−33·0	—	−32·6
RSC54 29(B)	186·0	188·5	191·5	195·5	197·0	0·8	1·0	0·8	0·6	0·8	−32·2	−31·8	−31·6	−31·4	−30·8
RSC24 49(C)	—	187·5	195·5	202·5	—	—	1·2	1·6	2·6	—	—	−31·4	−30·0	−27·4	—
RSC40 48(C)	190·5	191·0	202·0	213·5	—	1·0	1·0	1·4	1·8	—	−31·4	−31·4	−29·0	−25·4	—
RSC23 16(A)	—	191·5	202·5	213·0	—	—	1·0	1·4	1·0	—	—	−31·2	−28·8	−26·2	—
RSC33 47(C)	—	(198·0)	(210·5)	(222·0)	—	—	[2·2]	[0·8]	[1·2]	—	—	(−29·0)	(−27·4)	(−22·8)	—
RSC7 —		150·5	158·0	165·5			1·8	1·6	1·2			−26·4	−28·6	−30·4	
RSC62 9(A)		179·0	190·0	201·0			[3·0]	[3·0]	[2·2]			[−30·0]	[−29·4]	[−28·4]	
RSC17 39(C)		188·5	196·0	203·5			[0·8]	[0·4]	[0·6]			[−31·8]	[−31·2]	[−29·4]	
RSC43 20(A)		193·0	202·0	211·0			[1·8]	[1·8]	[1·4]			[−30·2]	[−28·6]	[−26·6]	
RSC44 34(B)		193·0	202·0	211·0			[2·6]	[3·8]	[3·0]			[−29·4]	[−26·6]	[−25·0]	
RSC46 35(B)		213·5	225·0	236·5			[4·0]	[3·6]	[1·8]			[−23·2]	[−19·4]	[−16·0]	

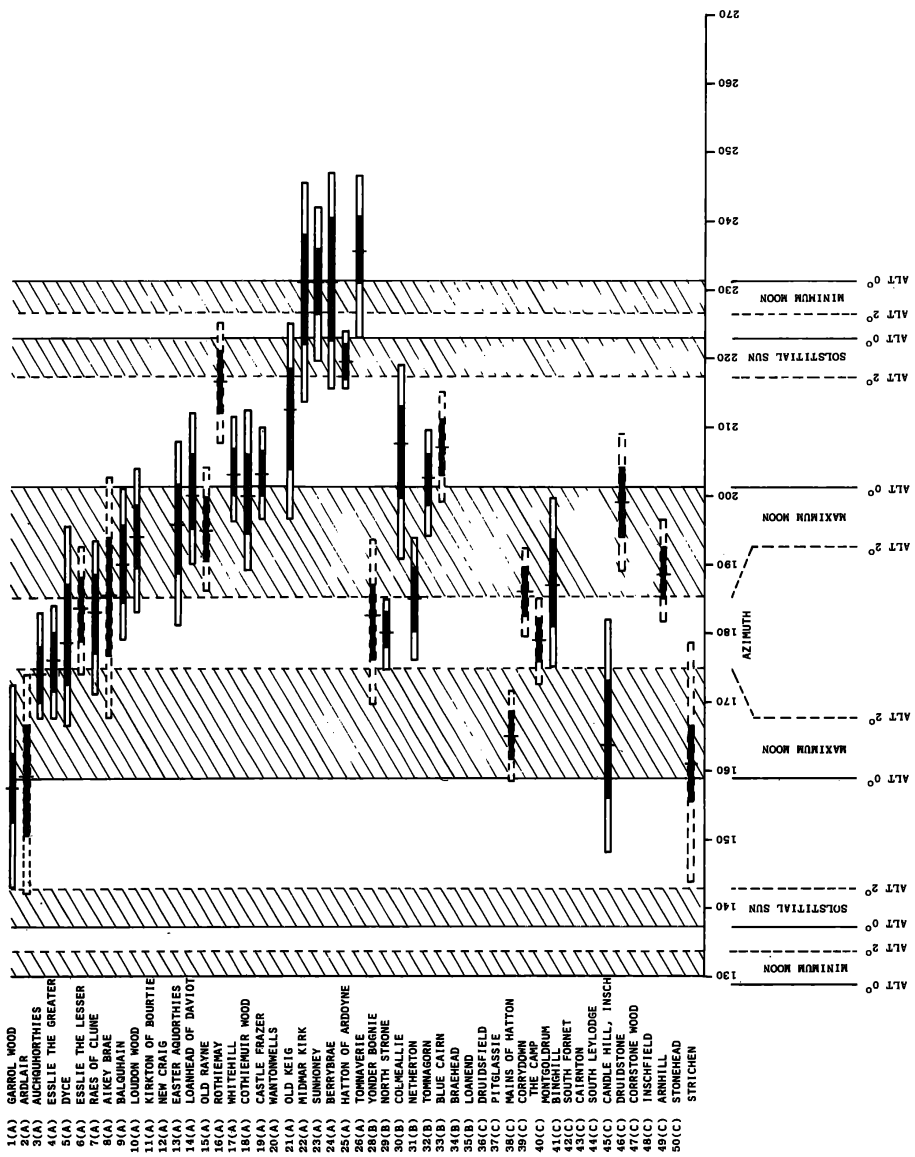

FIG. 2. Azimuths indicated by the recumbent stone on the 'centre' axis. Sites, with minor changes, are those considered by Burl.[6] Bars represent the extent of the recumbent stone as viewed from the ring centre. Their dark central parts represent its extent as viewed from the opposite side of the ring. Central strokes represent the indication of the recumbent stone centre. Broken borders to bars indicate uncertain data due to the state of the site. Shaded areas show the azimuths of solar and lunar rising and setting points of possible significance between 0° and 2° altitude.

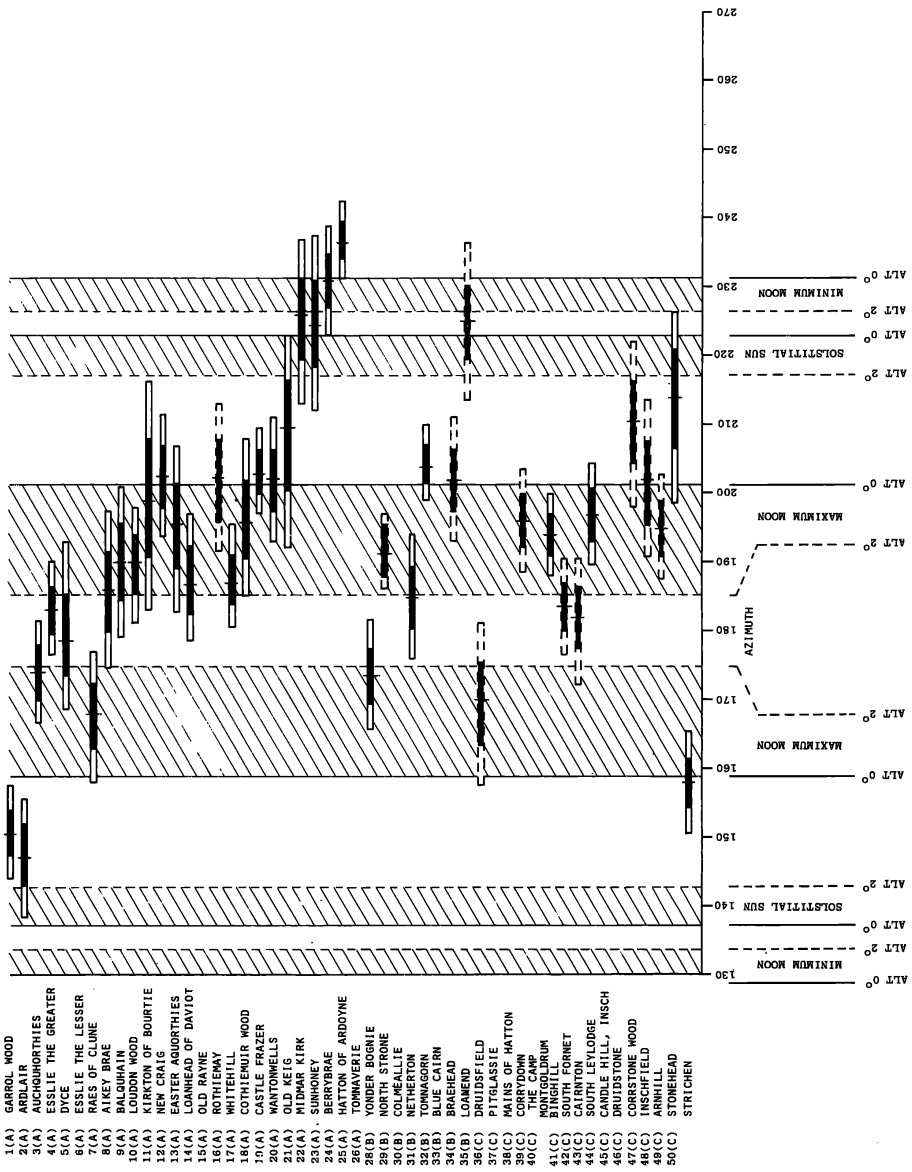

FIG. 3. Azimuths indicated by the recumbent stone on the 'perpendicular' axis. Comments as for Figure 2, except that the bars now represent the extent of the recumbent stone as viewed from a distance of 10 m, and their dark central parts its extent as viewed from a distance of 20 m.

axis; and where, as at Druidsfield (RSC52), the recumbent stone has completely disappeared but the flankers remain *in situ*, a guess can also sometimes be made. However, in other cases such as Balnacraig (RSC76), even when the recumbent stone is standing it is so irregular that a longest axis orientation cannot be determined within wide bounds.

It was not always possible or convenient to place the theodolite on the exact Centre or Perpendicular axis in order to determine its orientation. Where a site was surrounded by forest and no distant landmarks could be seen, the relevant azimuths were deduced from a surveyed groundplan of the site rather than measured directly, and some error is possible as a result. Such cases are marked in Table 2 by round brackets.

The site list in Table 2 has been expanded to include not only surveyed sites but all sites where at least one of the recumbent stone or flankers remains. At the additional sites azimuths have been quoted from measurements by the author using prismatic compass only (square brackets) or using the figure considered most reliable from the existing work of other authors (curly brackets). A total of fifty-eight sites are included in Table 2. Fifty-five of these can be identified from the descriptions in Table 1; a further three where descriptions were not obtained because of crops (RSC20, RSC55 and RSC62) have been added on the basis of those given by other authors.

The primary orientations display a highly significant general trend: whether we consider the Centre Line or the Perpendicular Line, the azimuths obtained in the direction from the site interior towards the recumbent stone all fall, without a single exception, within an azimuth band about 90° in width centred upon SSW.[54]

5. *Indicated Azimuths*

The Centre and Perpendicular Line azimuths given in columns 3 and 4 of Table 2 have been plotted in Figures 2 and 3 respectively. Azimuths of the recumbent stone centres are shown by the vertical strokes in the centre of each horizontal bar. The borders of the bars are shown pecked where the values are uncertain owing to the present state of the site. The sites are now labelled and ordered using Burl's system[55] in order to facilitate direct comparison with his data and his interpretation of it (see Part Two to follow). Reliable data are only available at one additional site, Strichen (RSC7), and this has been added. One site, Auld Kirk o'Tough (RSC74; 27 (B)), has been omitted because the only available values depend upon estimating the position of the recumbent stone (which had already disappeared) in Coles's plan.[56]

There are a number of other orientations of possible significance at the RSCs, such as the azimuths of the ends (rather than the centre) of the recumbent stone and of the inner edges of the flankers, as viewed from the ring centre or other positions. In the great majority of cases the flankers cut the horizon as viewed from approximate eye-height in the interior of the ring, whereas the recumbent stone between them lies beneath the horizon. At a few sites though, all three stones are well below the horizon. Examples are Ardlair (RSC37), where the flankers are no taller than the height of the recumbent, and Midmar Kirk (RSC71), where the horizon is at high altitude. At only one site in the entire sample, Dunnideer (RSC42), does it seem that the recumbent stone

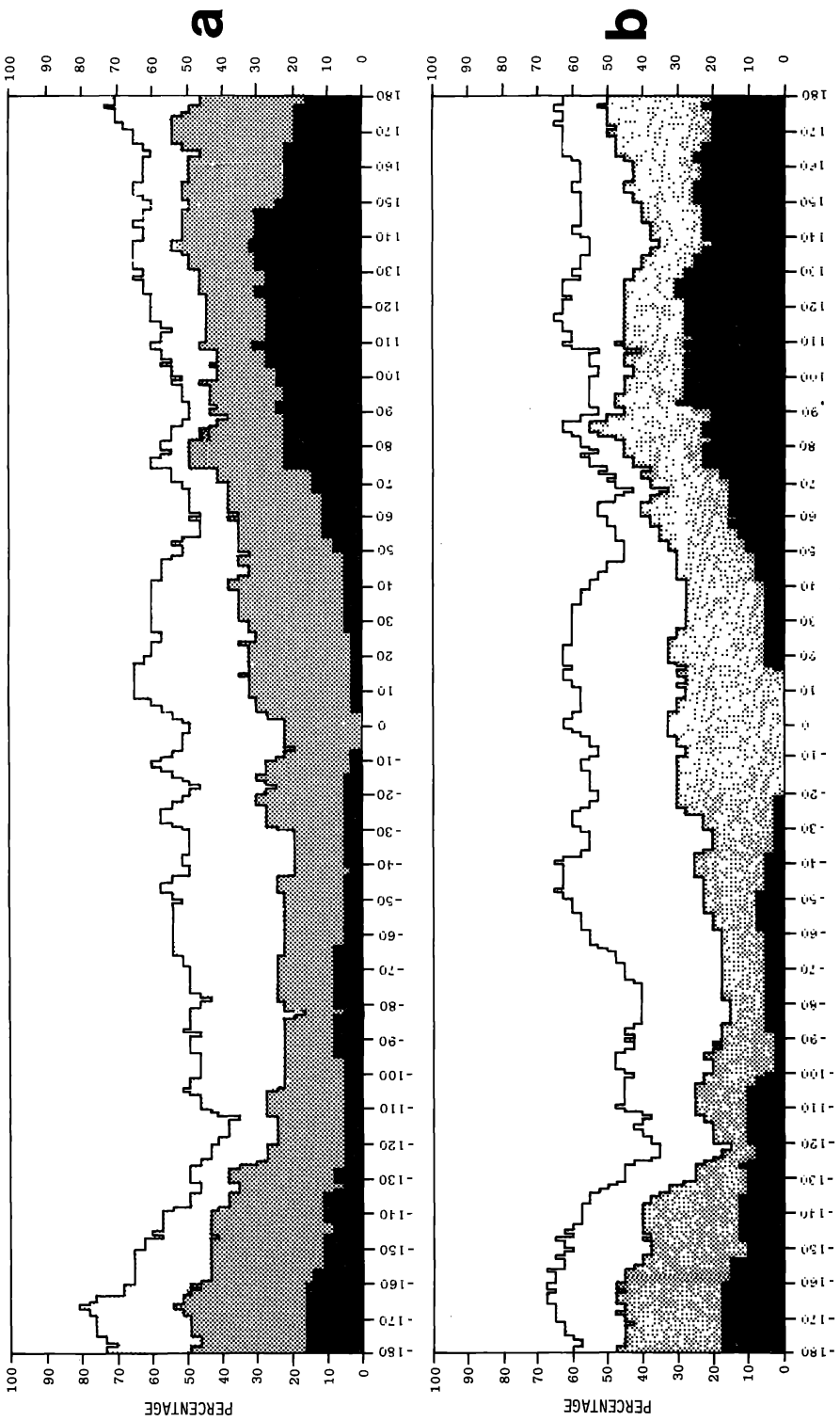

FIG. 4. Horizon scans relative to the principal axes of sites. For each 1° interval in azimuth relative to principal axis (the latter being taken in the sense from inside the site towards the recumbent stone) we plot the percentage of horizons in category 'A' (up to 1 km, black), 'B' (1–3 km, dark shading), 'C' (3–5 km, light shading), and 'D' (over 5 km, white):
(a) shows the data plotted relative to the 'centre' axis;
(b) shows the data plotted relative to the 'perpendicular' axis.
In both cases all data (measured and calculated) are included.

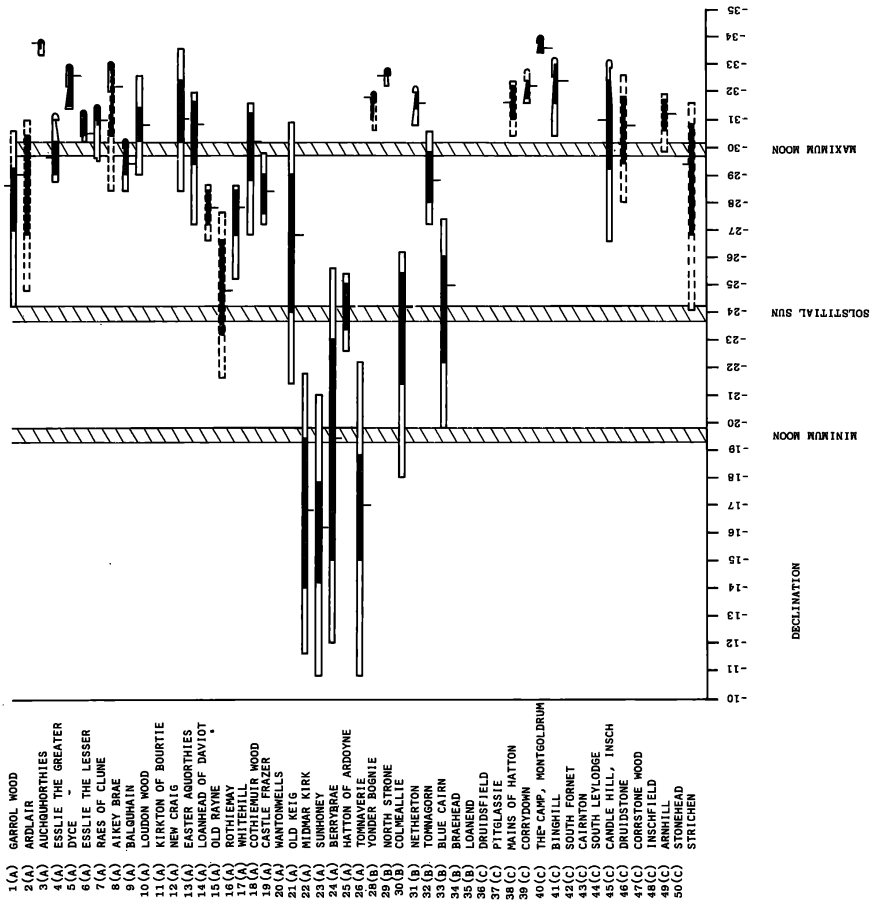

FIG. 5. Declinations indicated by the recumbent stone on the 'centre' axis. Sites, with minor changes, are those considered by Burl.[6] Bars represent the extent of the recumbent stone as viewed from the ring centre. Central strokes represent the indication of the recumbent stone centre, and also show whether the line is rising (upward stroke) or setting (downward stroke). Where an indication extends through due south the bar is shown doubled over, its furthest extent to the right representing the lowest declination reached. Shaded areas show the declinations between the two limbs of the maximum and minimum (major and minor standstill) Moon and the solstitial Sun.

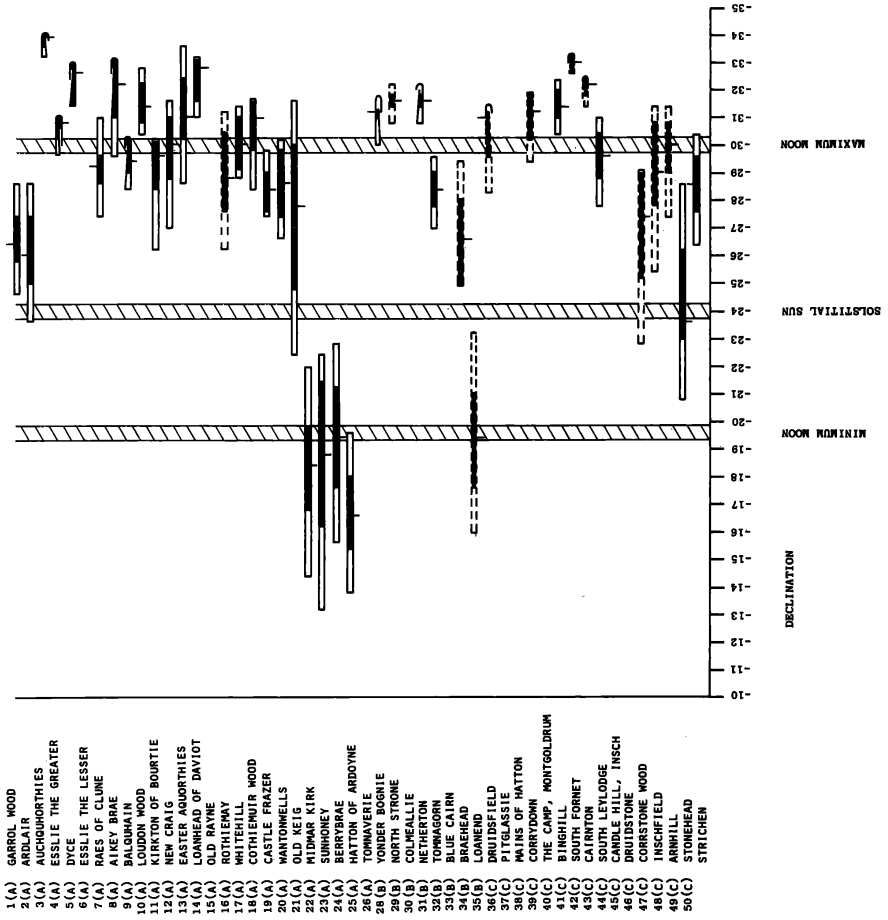

FIG. 6. Declinations indicated by the recumbent stone on the 'perpendicular' axis. Comments as for Figure 5, except that the bars now represent the extent of the recumbent stone as viewed from a distance of 10 m, and their dark central parts its extent as viewed from a distance of 20 m.

obscured the horizon to its SSW. Thus the inner edges of the flankers appear to 'partition off' a stretch of horizon, hereinafter the 'indicated horizon', which the recumbent stone lies beneath; and it is not unlikely that this entire stretch of horizon, rather than just its centre point, might have been of significance.

In Table 3 we list the azimuths of the centre and ends of the recumbent stone and of the inner edges of the flankers, as viewed from the ring centre, wherever the latter can be identified. In Table 4 we do the same for the Perpendicular Line, but here we encounter the problem of where the viewing position should be taken. A reasonable hypothesis to test, if the Perpendicular Line was significant, is that its construction proceeded independently of (and thus probably preceded) that of the ring itself; bearing this in mind we adopt a simple distance criterion and take the observing position to be a standard 10 m behind the recumbent stone (in the direction of the site interior).

These extra data have been included in Figures 2 and 3 in somewhat simplified form: where both the azimuth of one end of the recumbent stone and also that of the adjacent inside of a flanker are simultaneously available, the flanker azimuth only has been taken. These azimuths are shown as the ends of the bars in the respective figures, so that each bar represents the entire width of the indicated horizon at the site concerned. In order to show the effect of choosing a different observing position on the Centre or Perpendicular Line, the extent of the indicated horizon as seen respectively from the far side of the ring on the Centre Line, and from 20 m behind the recumbent stone on the Perpendicular Line, have been shown in Figures 2 and 3 respectively by black central parts within each bar.

6. *Horizon Distances and Site Orientations*

Having determined the Centre and Perpendicular Line azimuths where this is possible, we now return briefly to the question of horizon distances. Where either azimuth is known we can now convert absolute azimuths to azimuths relative to that of the principal axis concerned. These relative azimuths are then divided into 1° intervals as before, and for each interval the percentage of data in each distance category is noted. The results are displayed in Figures 4a (azimuths relative to Centre Line) and 4b (relative to Perpendicular Line). Data calculated from Ordnance Survey maps have been included in both graphs wherever surveys were not possible.

It is immediately clear that there is a complete avoidance of nearby (category 'A') horizons in the general direction of the primary axis; in the case of the Centre Line the boycott extends over a total of 11°, and in the case of Perpendicular Line it extends over some 37°. We can compare these figures with the width of the indicated horizon at different sites. When viewed from the ring centre (outer widths of bars in Figure 2) this varies from about 8° to about 35°; thus in most cases there is no category 'A' horizon within the entire horizon above the recumbent stone. When viewed along the Perpendicular Line from 10 m behind the recumbent stone, for which the range of widths of the indicated horizon is similar, the avoidance of nearby horizon within the indicated horizon becomes total. As was observed in Section 3, there appears to be no preference for a particularly distant (as opposed to merely non-local) horizon.