Università della Terza Età "Cardinale Giovanni Colombo" – Milano

A. A. 2022 - 2023

Corso di Archeoastronomia

Docente:

Adriano Gaspani

Gli *henges*: la delimitazione astronomica dello spazio sacro

I siti sacri preistorici

Architettura

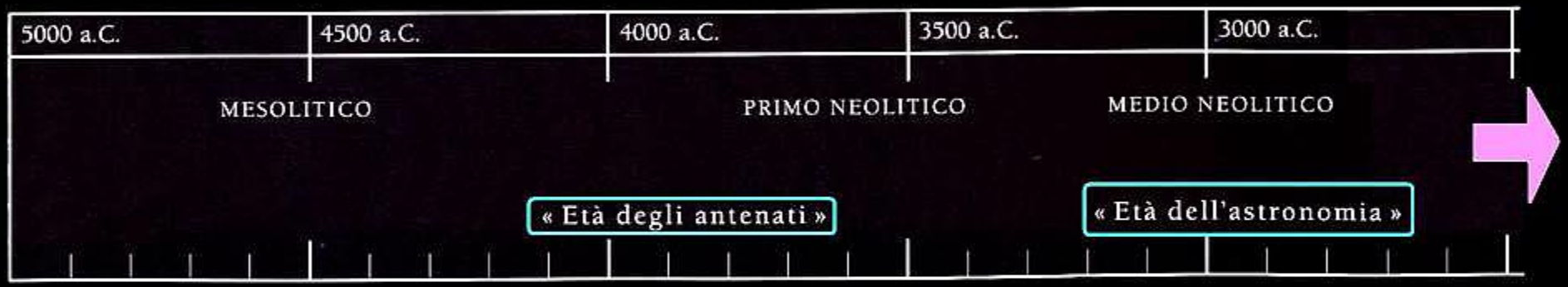
Geometria

Astronomia

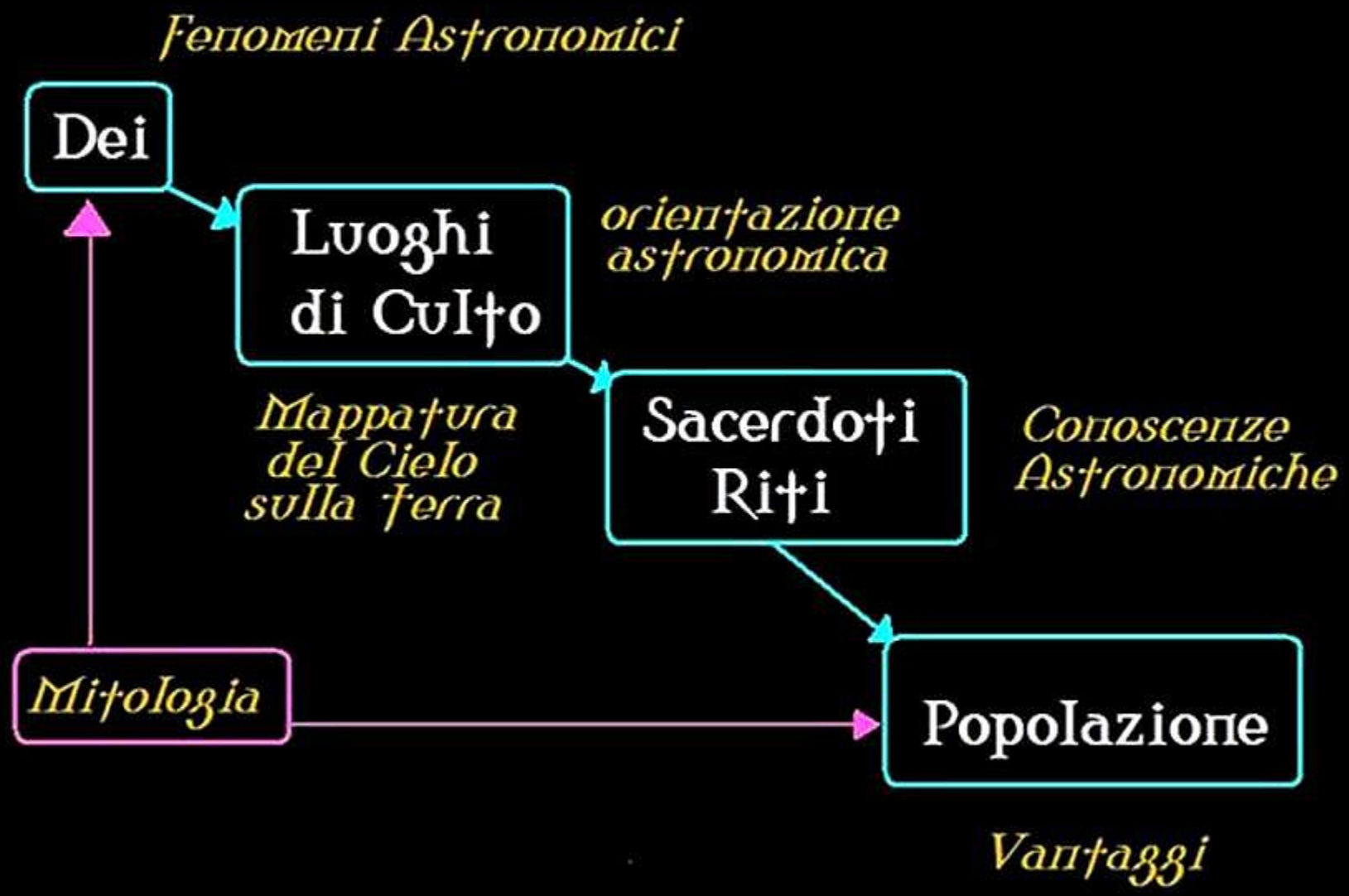
Simbolismo

Divisione cronologica basata sulla priorità degli oggetti astronomici osservati

Divisione cronologica basata sulla ritualità

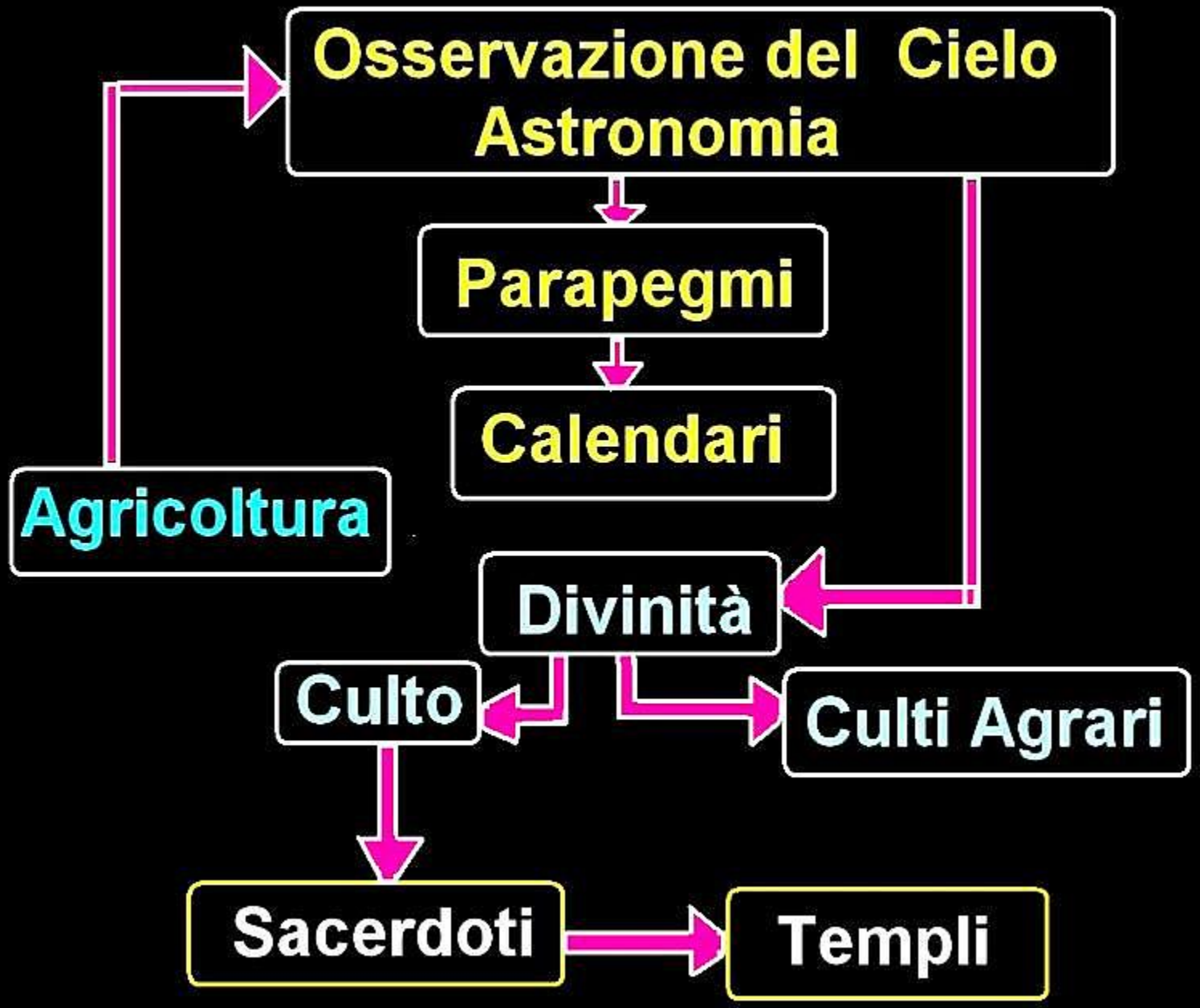


Dominare il Potere Cosmico




Osservazione del Cielo
Culto e Ritualità
Trasposizione del Cielo sulla Terra
Nemeton
Geometria Sacra
Ritualità
Agricoltura
Andamento stagionale
Pianificazione agricola
Misura del tempo e Calendario
Feste e ricorrenze
Mitologia
Rapporto con gli Dei
Origine di un popolo
Discendenza divina
Simbolismo
Storia
Divinazione
Zodiaco lunare/solare
Prinni Lovdin...
Prinni Laget...
Ubicazione direzionale


Stagioni climatiche
Agricoltura
Pianificazione
Osservazione del Cielo
Astronomia


Osservazione del Cielo
Astronomia
Parapegmi
Calendari
Agricoltura
Divinità
Culto
Culti Agrari
Sacerdoti
Templi

Criteri di Mappatura del Cielo sulla Terra

1) Uno spazio da dedicare agli Dei
2) Un mezzo per delimitare lo spazio scelto
3) Alcuni particolari elementi del paesaggio circostante
4) Una forma geometrica che abbia una controparte nel cielo
5) Un punto centrale dell'area delimitata da materializzare
6) Una serie di riferimenti astronomici
7) Una (o più) porte d'accesso all'area delimitata

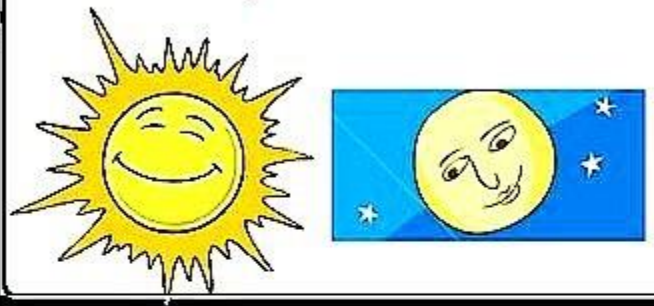
1) Un esponente della classe sacerdotale, intermediario con gli Dei
2) Un particolare rito di consacrazione (complesso...)
3) Una particolare idea cosmologico dell'Universo
4) Una mitologia che stabilisca il collegamento con il divino
5) Una particolare data in cui eseguire il rito di consacrazione
6) Una particolare configurazione degli astri visibili nel cielo

il Rito

Rito

- fondazione del tempio
- consacrazione del tempio
- culto ordinario nel tempio

particolare evento astronomico



Sacerdote

Circoli di Pietre megalitici britannici

Unità di misura

introdotte da Alexander Thom...

La Yarda Megalitica (MY) è una unità di misura ipotetica introdotta da Alexander Thom la quale corriponde a:

1 MY = 2.72 ft = 83 cm

La Megalithic Rod (MR) corriponde a:

1 MR = 2.5 MY = 6.776 ft = 2.075 m

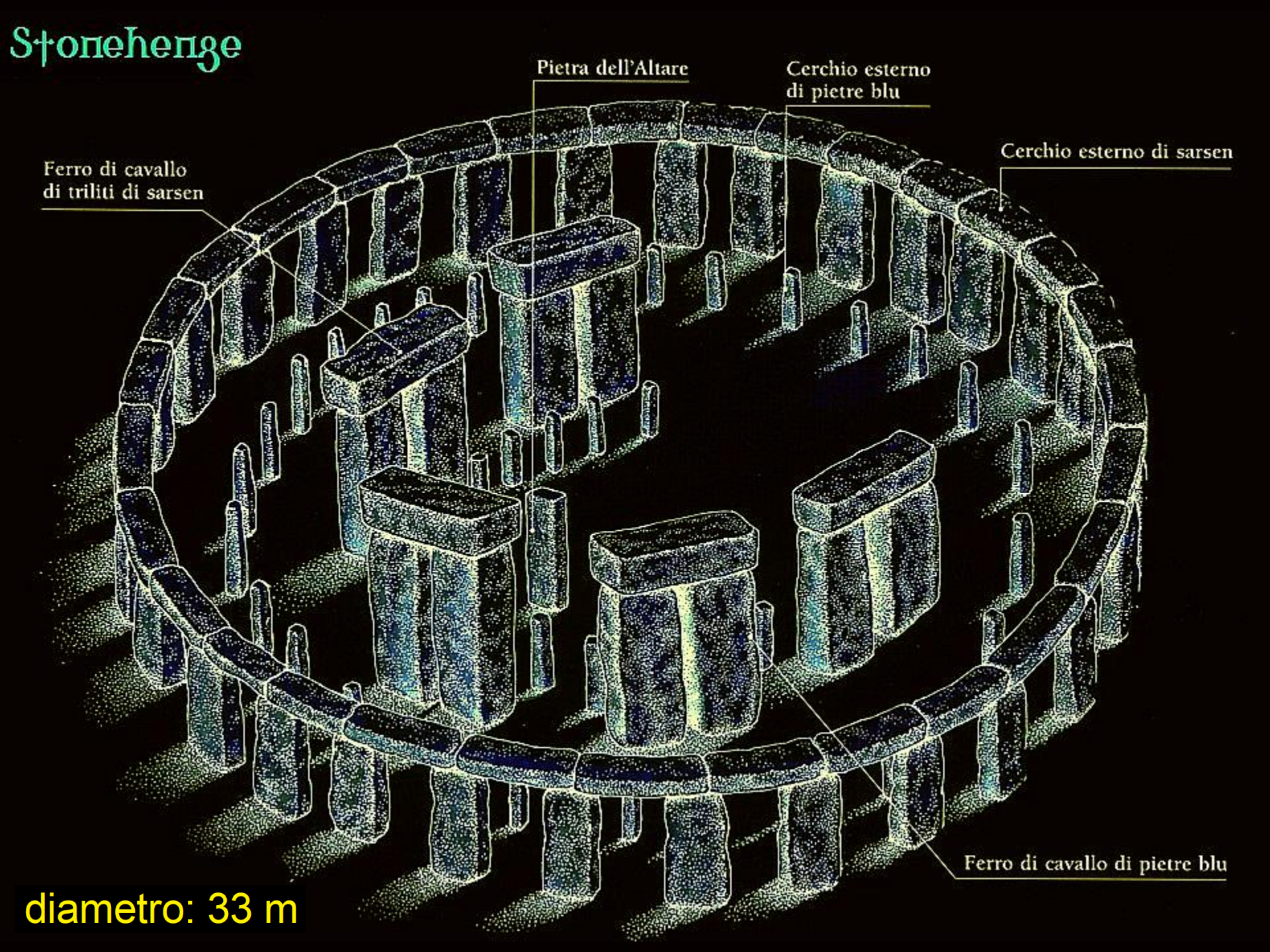
di fatto 1 MY corrisponde in media a 1 passo circa

Stonehenge

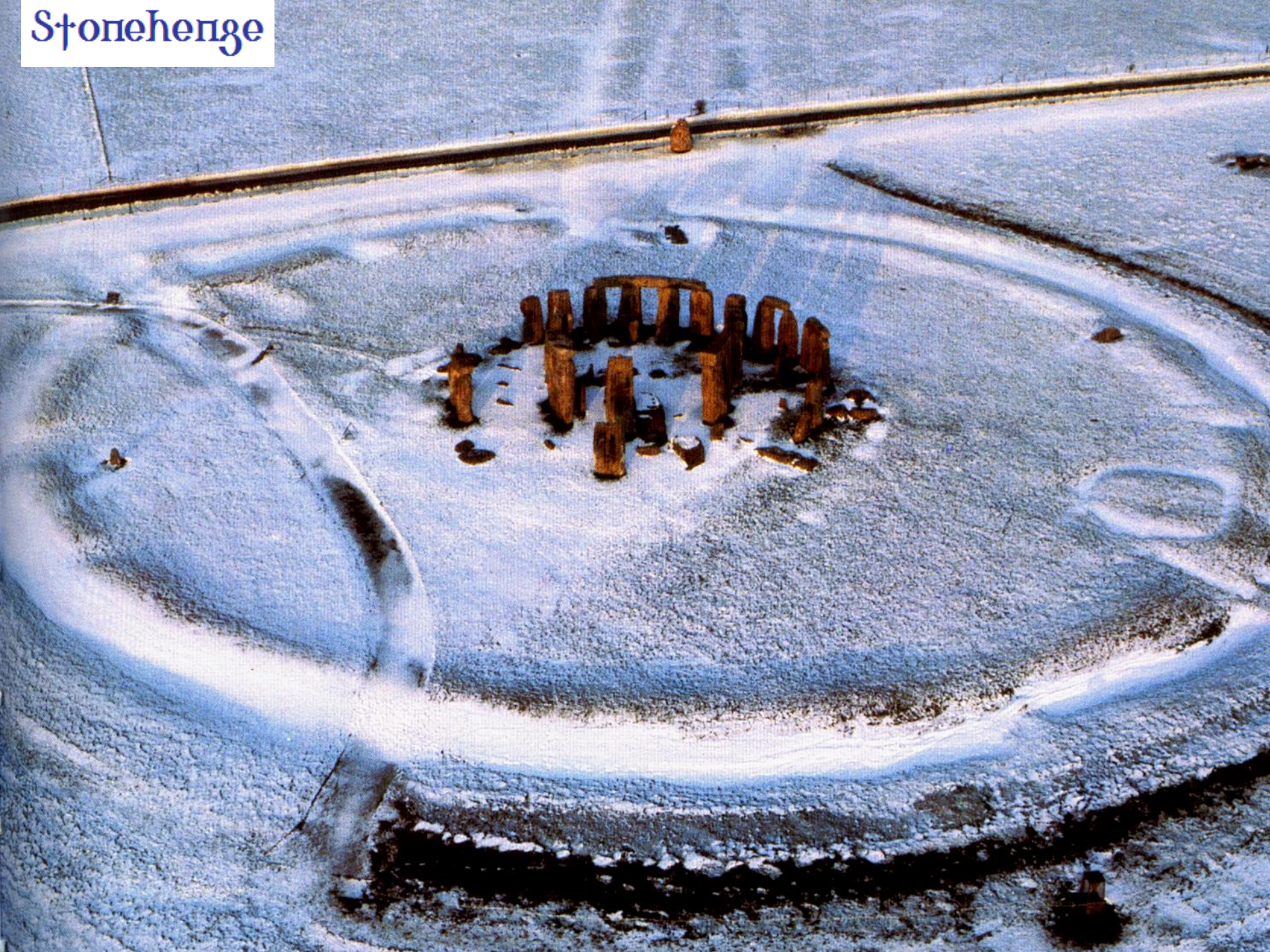

1964
Stonehenge

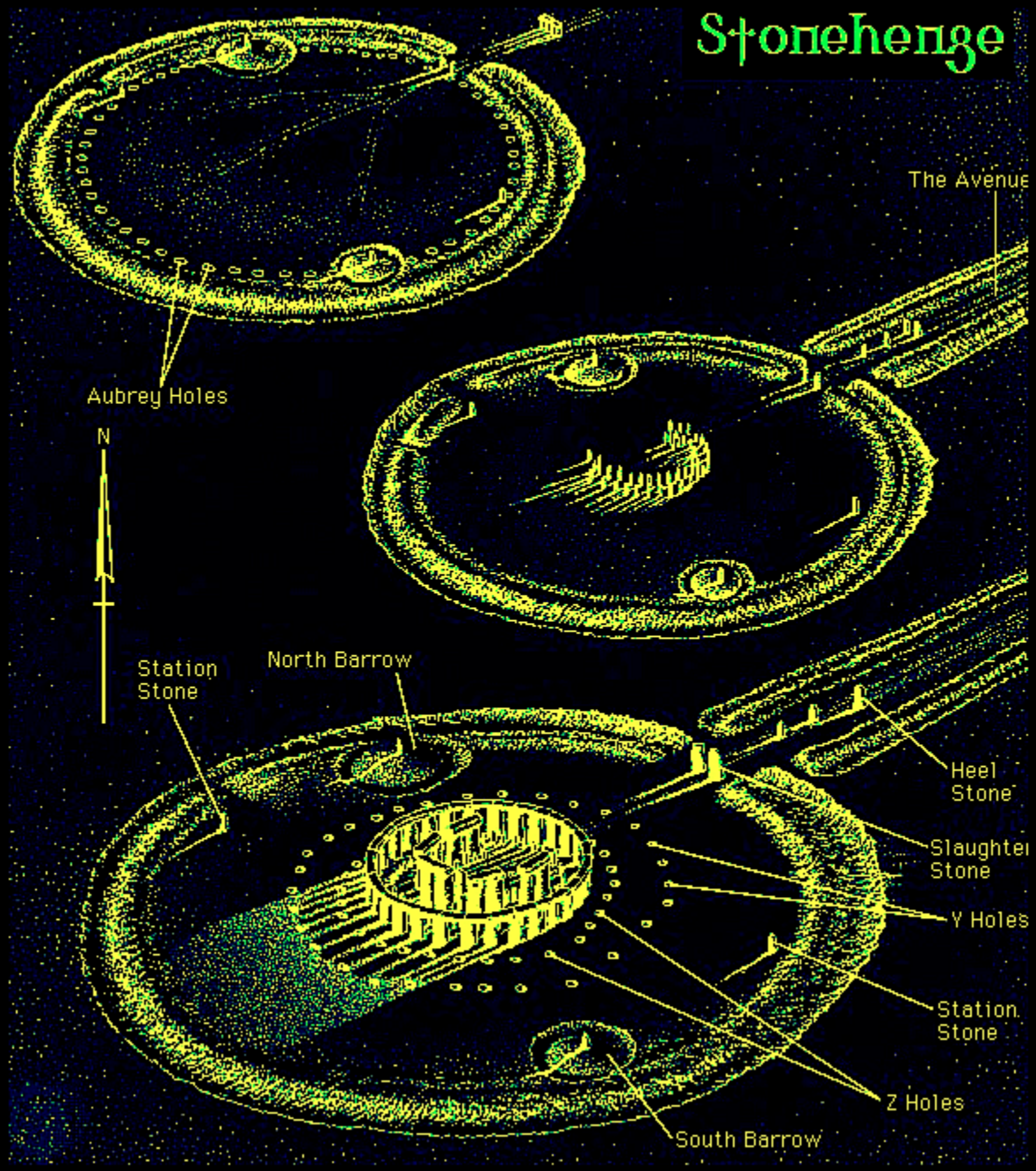
Certo, ammettono gli archeologi dell'English Heritage, senza tutti questi lavori Stonehenge avrebbe un aspetto molto diverso. Pochissime pietre sono ancora esattamente nel posto dove furono erette millenni fa.

«Praticamente ogni pietra fu rieretta, raddrizzata o rinforzata con calcestruzzo tra il 1901 e il 1964»


Stonehenge
Pietra dell'Altare
Cerchio esterno di pietre blu
Cerchio esterno di sarsen
Ferro di cavallo di triliti di sarsen
Ferro di cavallo di pietre blu
diametro: 33 m

Stonehenge





Fase I

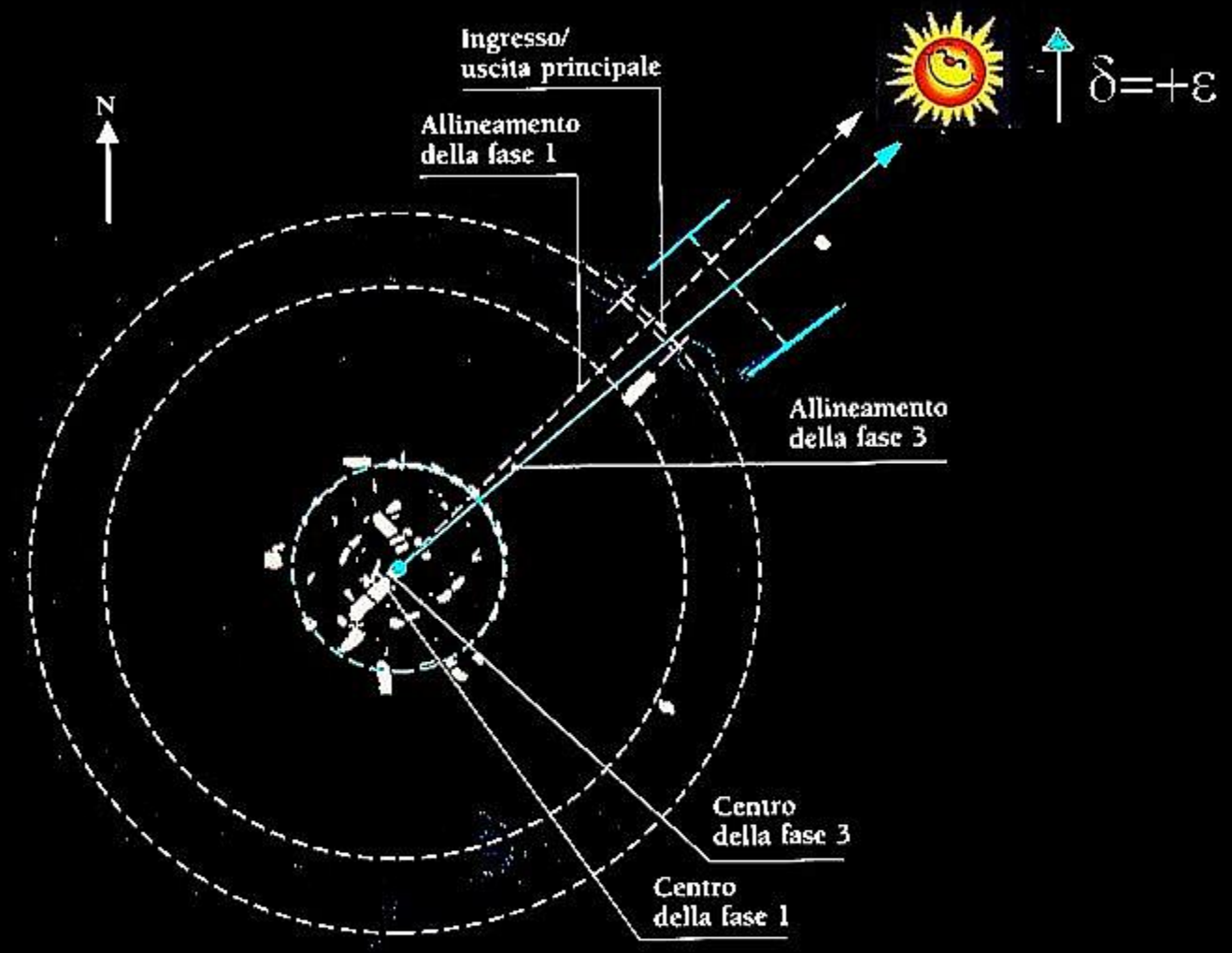
3100 a.C.

Fase II

3000 a.C. - 2600 a.C.

Fase III

2600 a.C. - 1600 a.C.



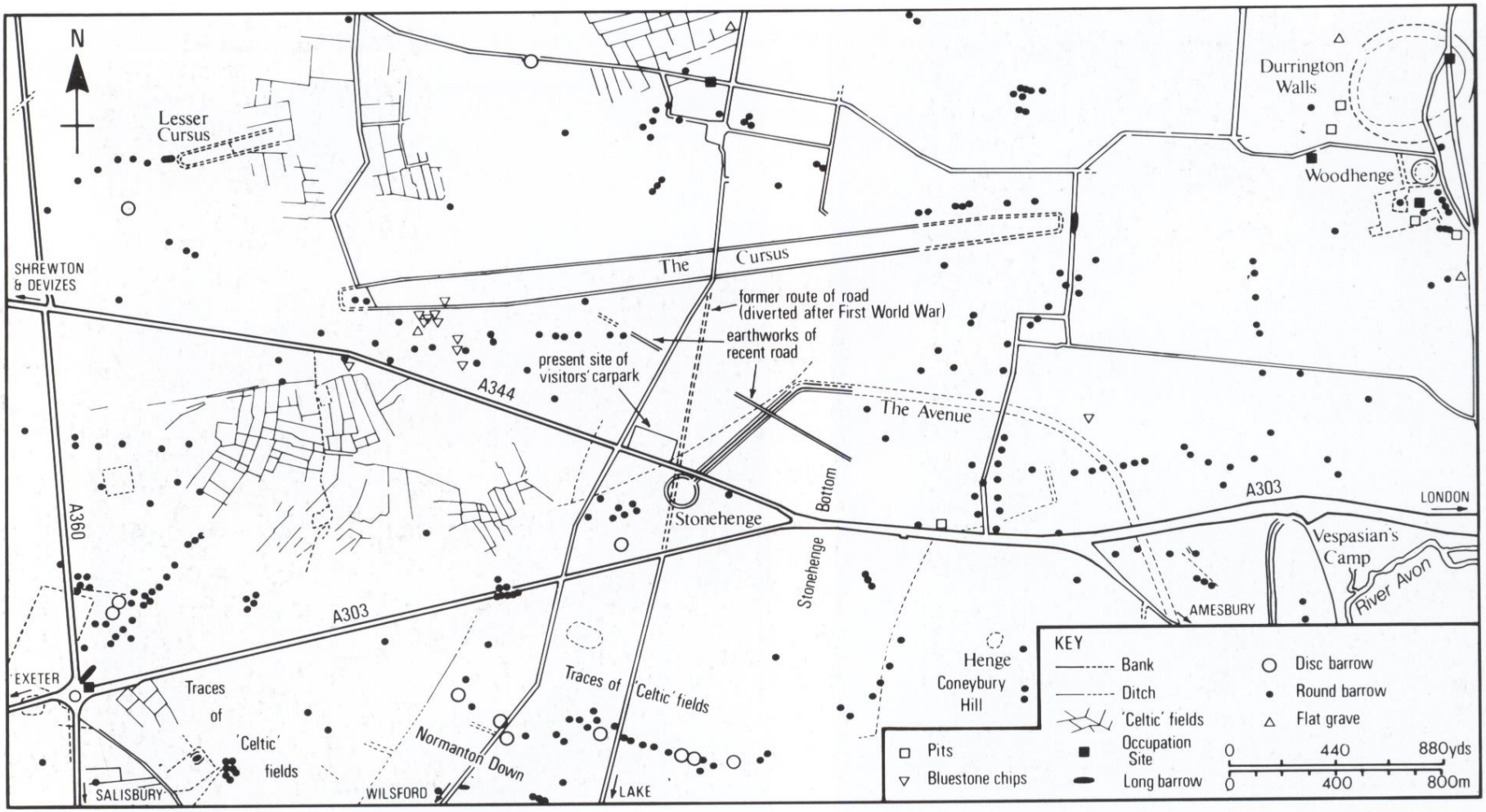
Diametro struttura : 33 m
Diametro fossato : 185 m

Stonehenge

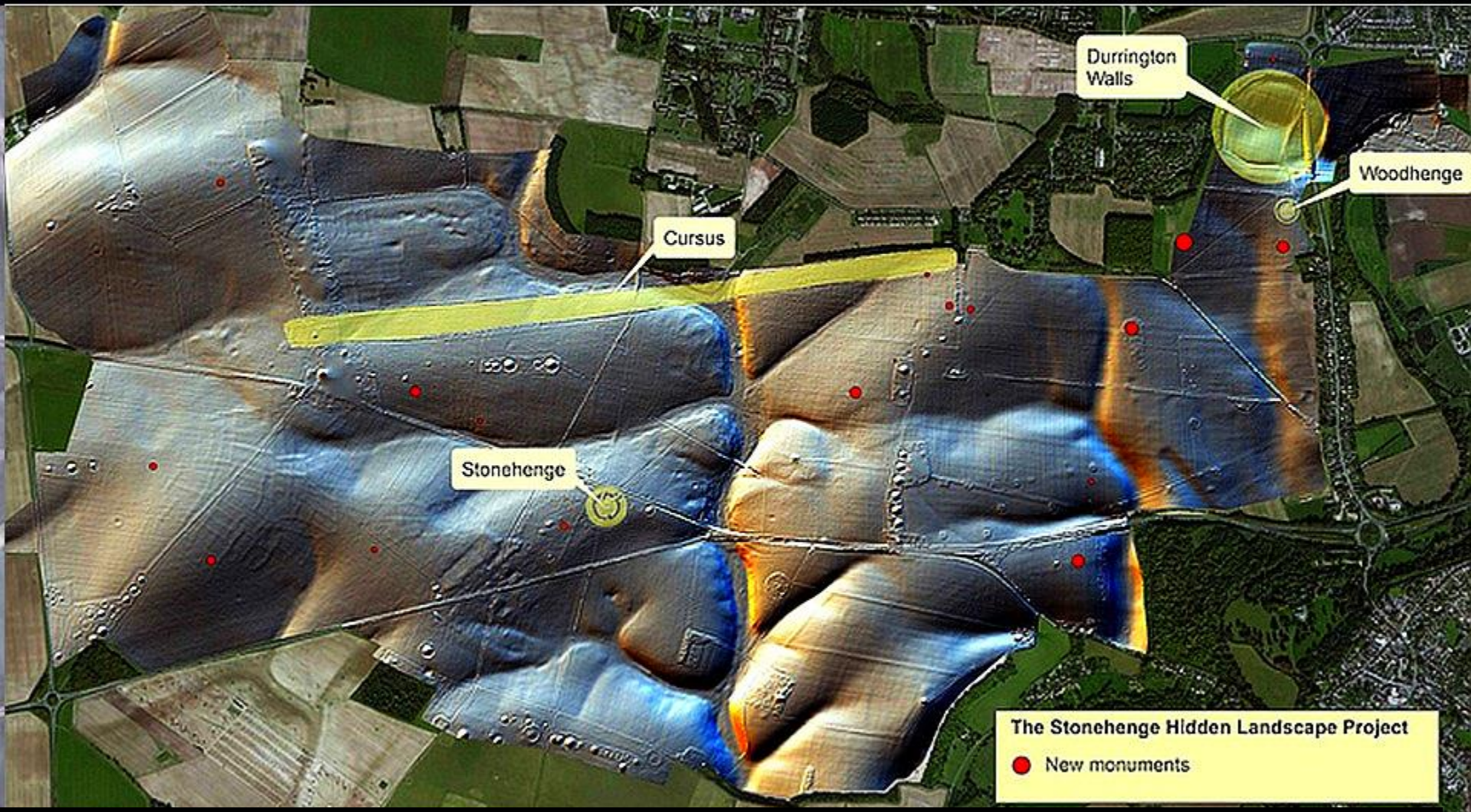
Allineamento con l'alba
Con il suo ingresso principale verso nordest, Stonehenge probabilmente doveva allinearsi con l'alba del solstizio d'estate. Il monumento di pietra della fase 3 perfezionò l'allineamento.

Salisbury Plain

Salisbury Plain



Salisbury Plain

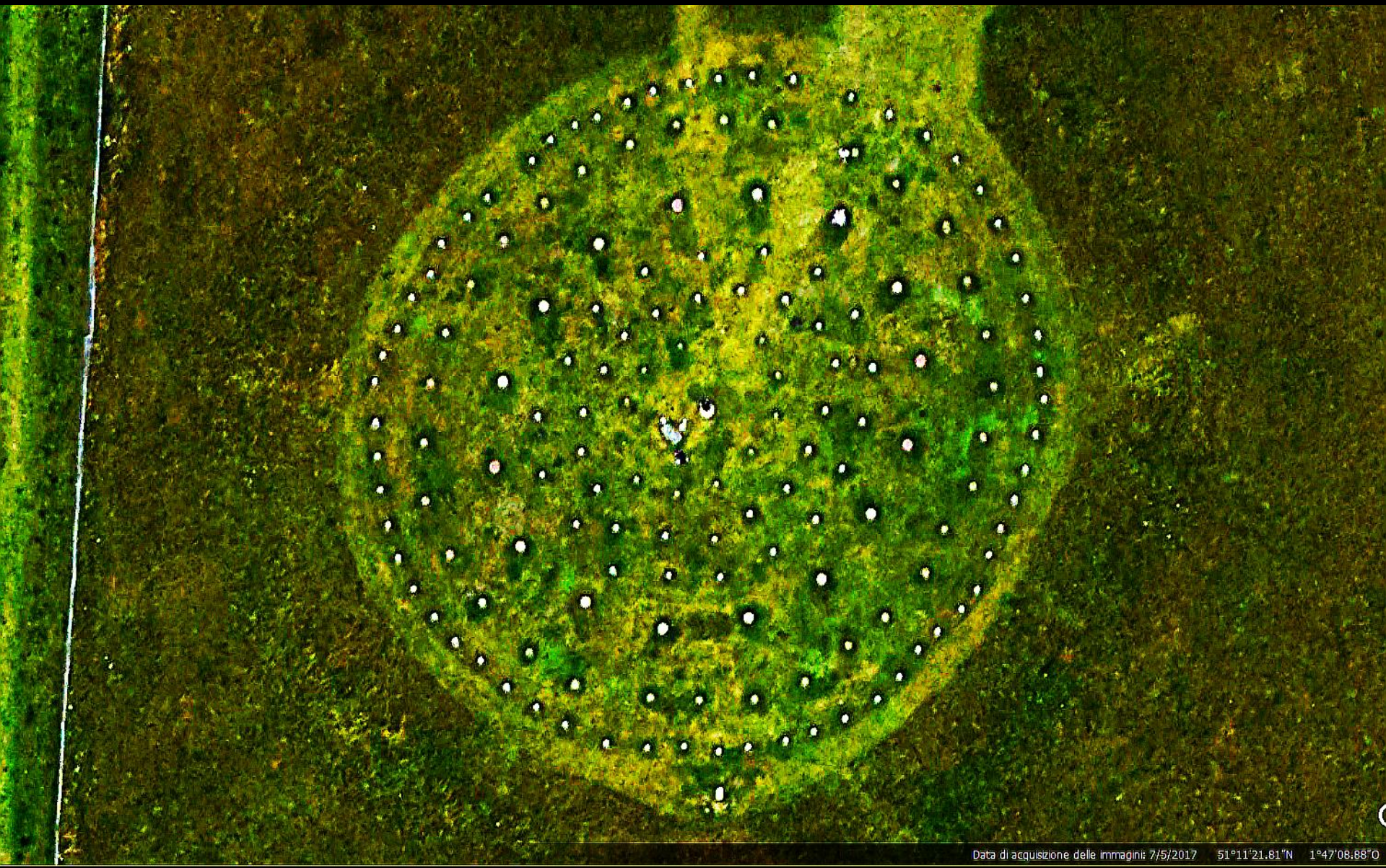


G.P.R. - Ground Penetrating Radar

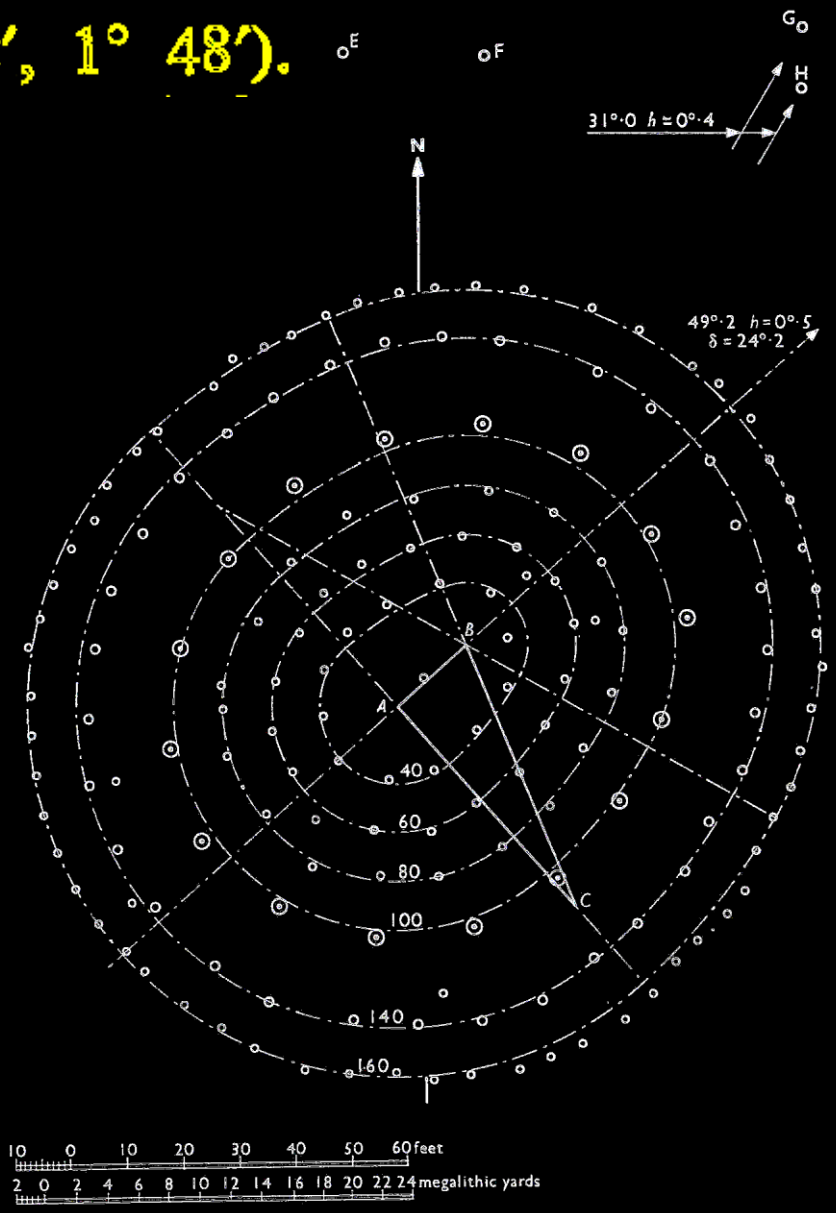
Woodhenge

Woodhenge

Woodhenge


Data di acquisizione delle immagini: 7/5/2017 51°11'21.81"N 1°47'08.88"O

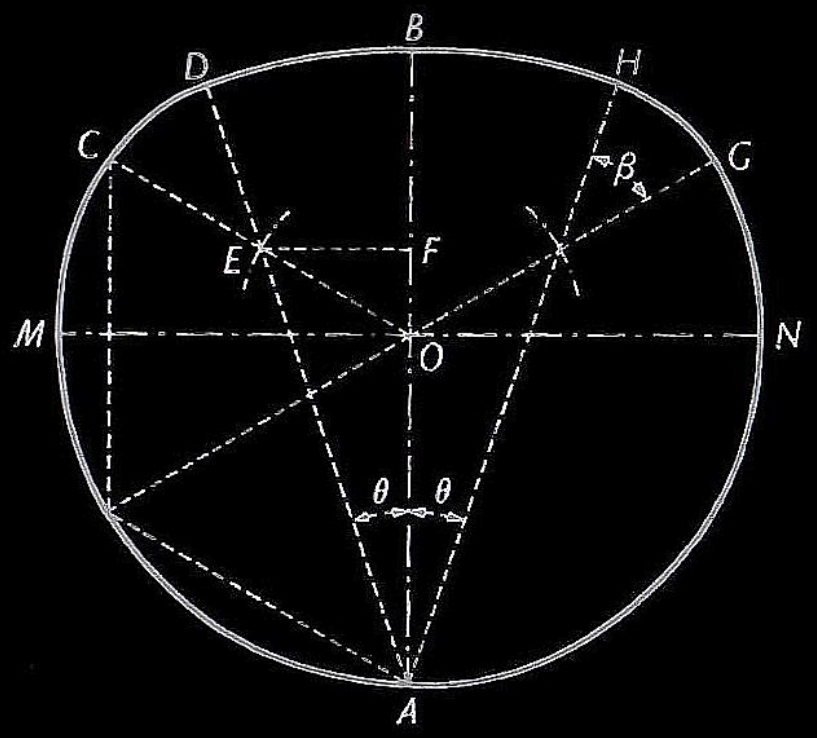
Woodhenge, S 5/4 (51° 12′, 1° 48′).



Woodhenge, S 5/4 (51° 12′, 1° 48′). Construction superimposed: $AB = 6$, $AC = 17\frac{1}{2}$, $CB = 18\frac{1}{2}$ MY; r = radii struck from $A = (P - 9{\cdot}08) \div 2\pi$; $P = 40$, 60, 80, 100, 140, and 160 MY (P = perimeter).

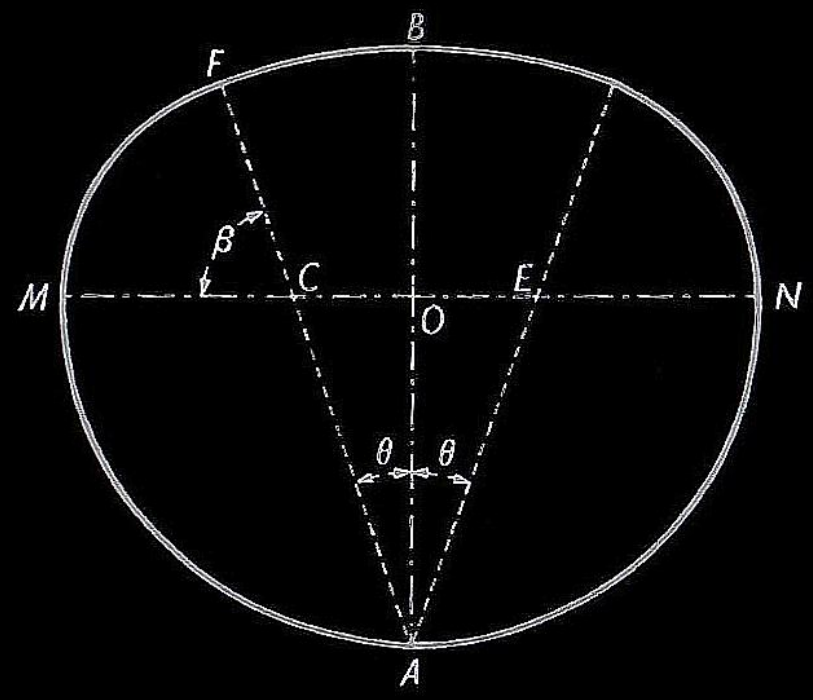
Morfologia Geometrica
...e Informazione

Cerchi schiacciati



Flattened circle. Type A.

$$\text{perimeter}/MN = \pi' = \frac{5\pi}{6} + \frac{\sqrt{7}}{2} \times \theta = 3{\cdot}0591,$$

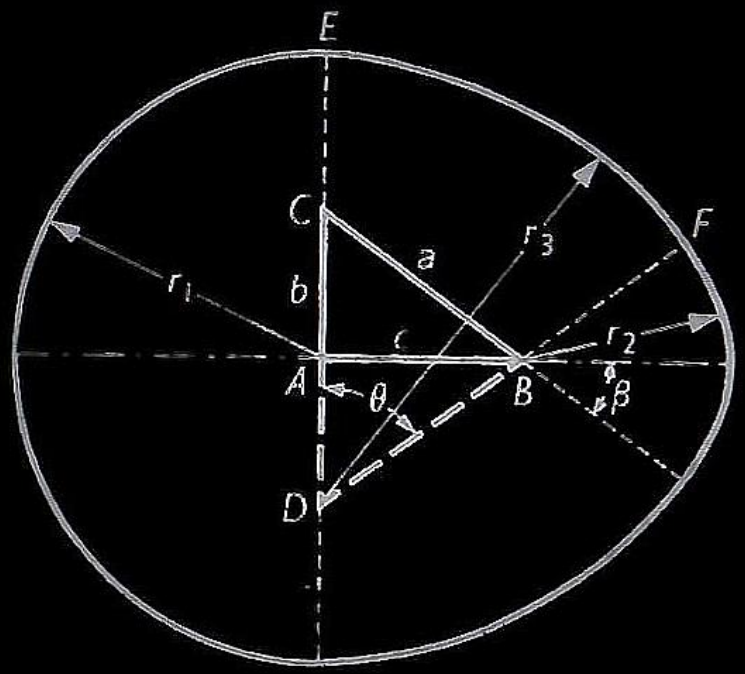


Flattened circle. Type B.

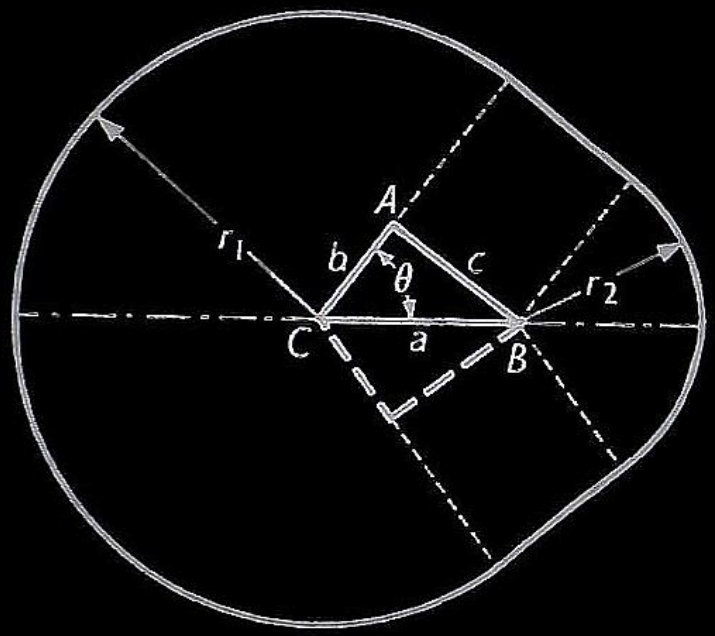
$$\pi' = \text{perimeter}/MN = \frac{5\pi}{6} + \frac{\sqrt{10}}{3}\theta = 2{\cdot}9572,$$

$$\tan\theta = \tfrac{1}{3},$$

Ovali (Egg-shaped)



Egg-shaped circle. Type I.



Egg-shaped circle. Type II.

Perchè è importante conoscere la lunghezza del perimetro di un circolo di pietre

Entropia :

$$S = K \cdot p$$

Informazione :

$$I = e^{K \cdot p}$$

p = perimetro
K = costante

quindi:
Conoscendo il perimetro di un circolo di pietre
è possibile misurare quanta informazione contiene

si può dimostrare che:

$$I = e^{K \cdot 2 \cdot \pi \cdot \bar{r}}$$

(e = 2.718...)

$\bar{r}$ = raggio medio della struttura curvilinea

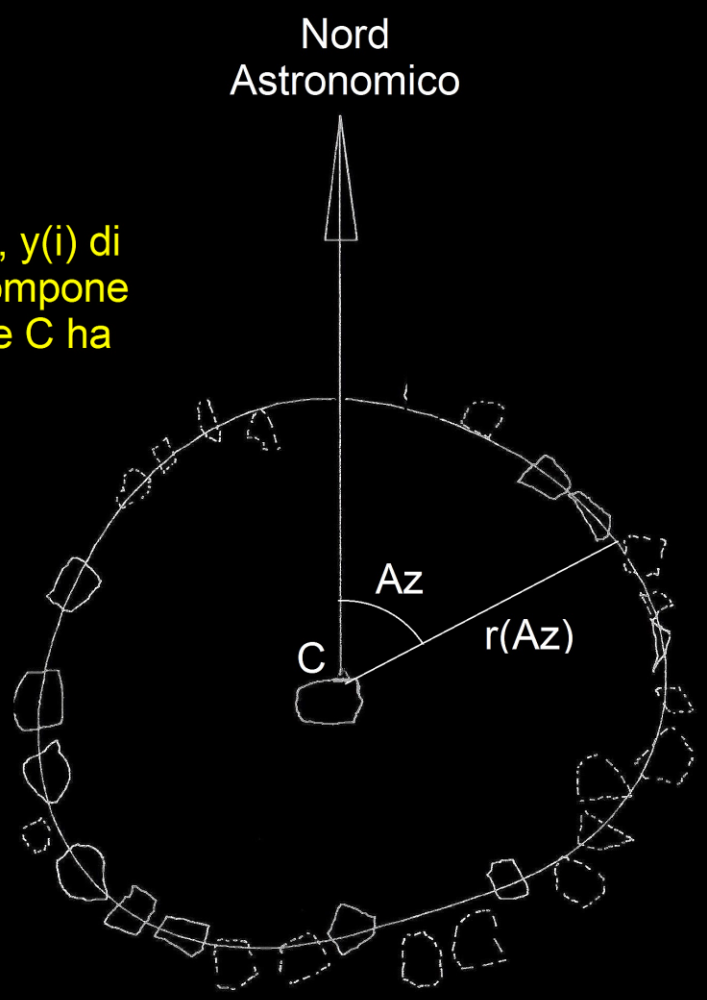
Più il circolo di pietre è grande e complesso, più informazione contiene...

Carrowmore (Irlanda)
Cairn 04

Note le coordinate x(i), y(i) di ciascuna pietra che compone il cromlech, il centroide C ha coordinate:

$$Xc = \frac{1}{N} \cdot \sum_{i=1}^{N} x(i)$$

$$Yc = \frac{1}{N} \cdot \sum_{i=1}^{N} y(i)$$



C = centroide C(Xc,Yc)
Az = Azimut astronomico
r(Az) = raggio vettore

$$\bar{r} = \frac{1}{N} \cdot \sum_{i=1}^{N} r(i)$$

con:

$$r(i) = \sqrt{(x(i) - Xc)^2 + (y(i) - Yc)^2)}$$

Note le coordinate x(i), y(i) di ciascuna pietra che compone il cromlech, il centroide C ha coordinate:

$$Xc = \frac{1}{N} \cdot \sum_{i=1}^{N} x(i)$$

$$Yc = \frac{1}{N} \cdot \sum_{i=1}^{N} y(i)$$

l'i-esimo raggio vettore r(i) :

$$r(i) = \sqrt{(x(i) - Xc)^2 + (y(i) - Yc)^2)}$$

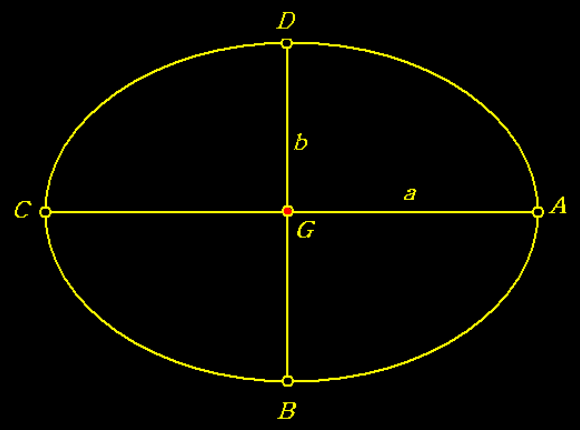
$\bar{r}$ = raggio medio della struttura curvilinea $\bar{r} = \frac{1}{N} \cdot \sum_{i=1}^{N} r(i)$

Entropia: $S = K \cdot 2 \cdot \pi \cdot \bar{r}$

Informazione: $I = e^{K \cdot 2 \cdot \pi \cdot \bar{r}}$

Casi particolari

ellisse di semiassi a,b



$$I = e^{K \cdot \pi \cdot (a+b)}$$

linea di monoliti lunga L

$$I = e^{K \cdot \pi \cdot L/2}$$

L

$\bar{r}$ = raggio medio della struttura curvilinea

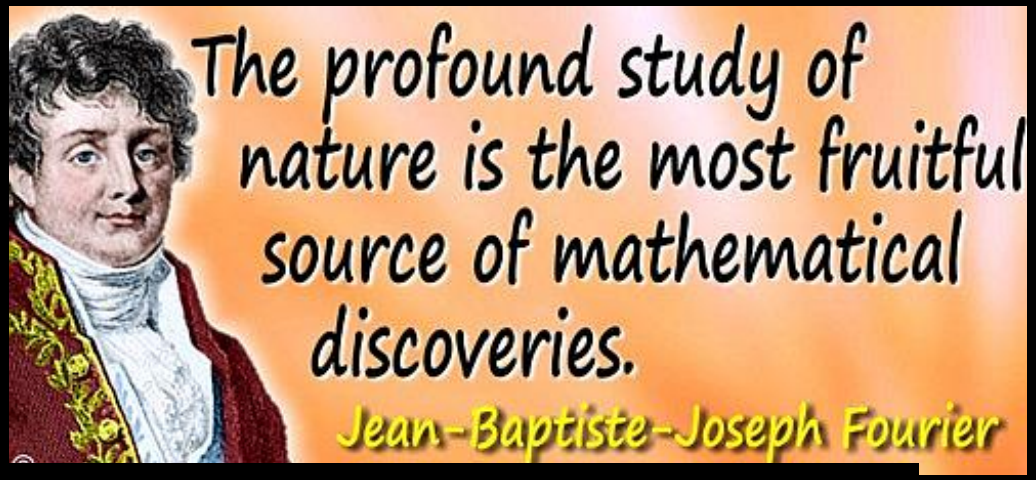
$$\bar{r} = \frac{1}{2 \cdot \pi} \cdot \int_0^{2\pi} r(Az) \cdot dAz$$

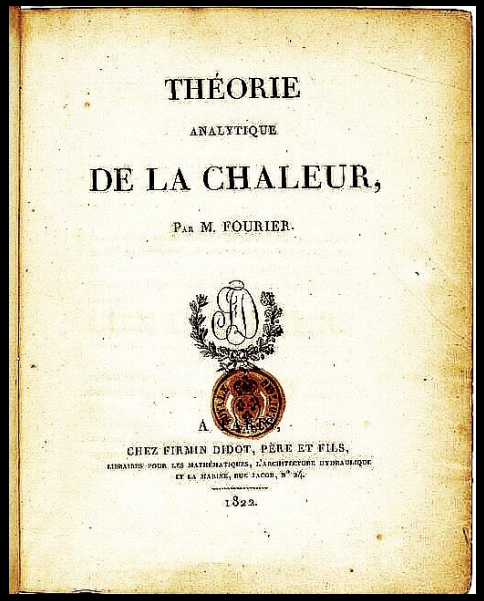
Informazione:

$$I = e^{K \cdot \int_0^{2\pi} r(Az) \cdot dAz}$$

scegliendo opportunamente
la costante K, l'informazione
è espressa in bits

ma si può fare di meglio...



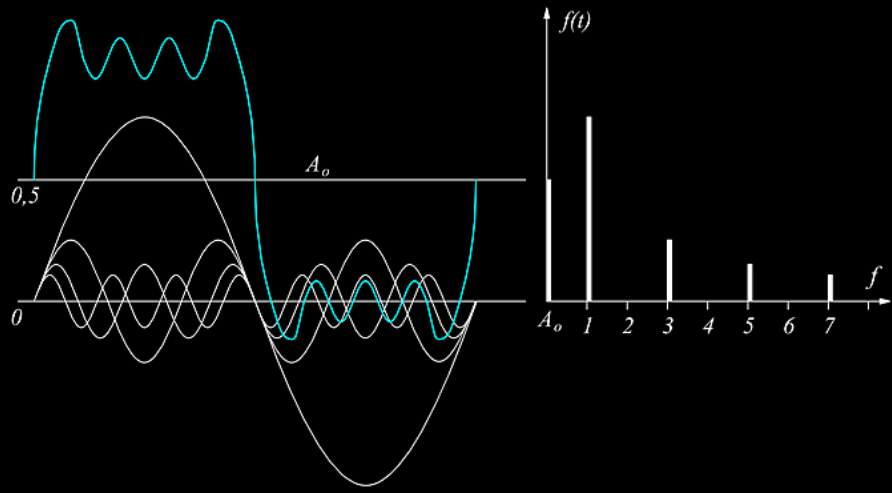

THÉORIE
ANALYTIQUE
DE LA CHALEUR,
PAR M. FOURIER.
CHEZ FIRMIN DIDOT, PÈRE ET FILS,
1822.

$$f(t) = \frac{a_0}{2} + \sum_{n=1}^{N} \left[a_n \cos(nt) + b_n \sin(nt)\right]$$

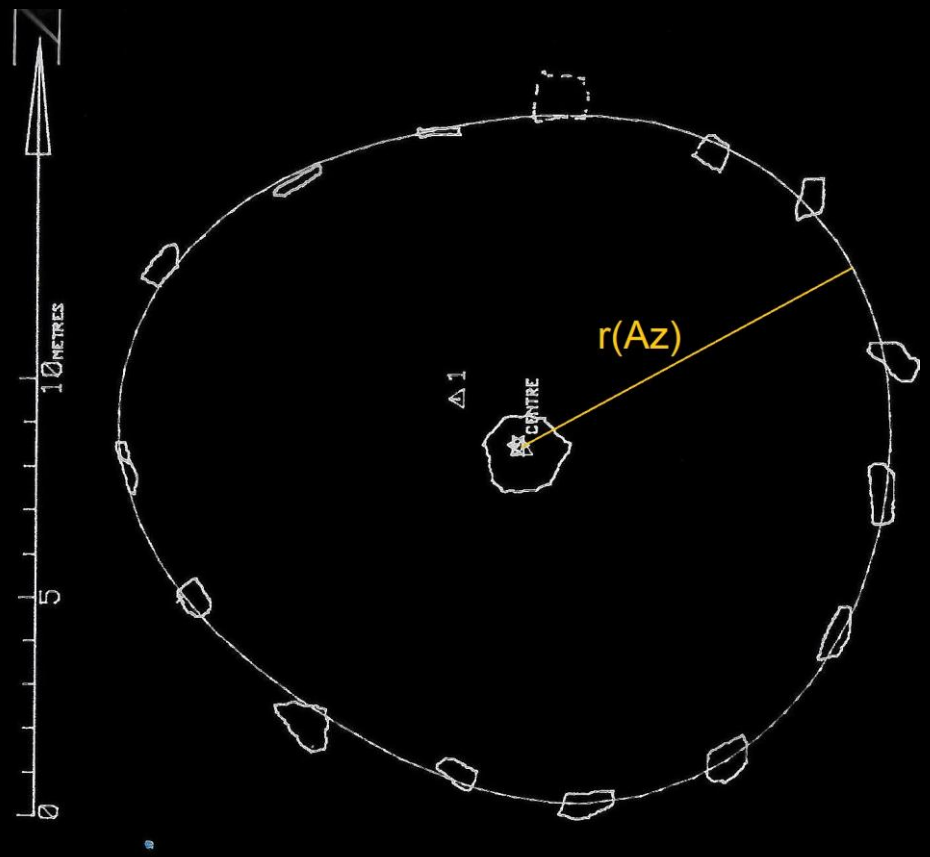
$$a_0 = \frac{2}{T} \int_{-T/2}^{T/2} f(x)\,\mathrm{d}x$$

$$a_n = \frac{2}{T} \int_{-T/2}^{T/2} f(x) \cos\left(\frac{2\pi}{T} nx\right) \mathrm{d}x$$

$$b_n = \frac{2}{T} \int_{-T/2}^{T/2} f(x) \sin\left(\frac{2\pi}{T} nx\right) \mathrm{d}x$$



Analisi di Fourier

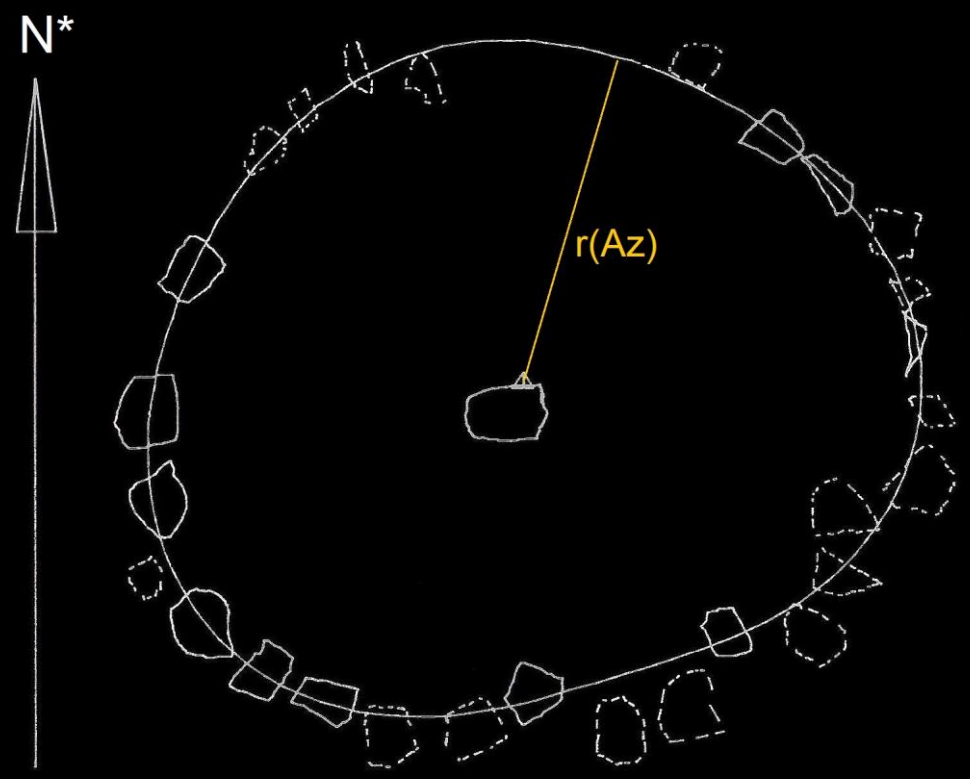


Kenmare stone circle (Ireland)

$$r(Az) = A + B \cos(Az-Ao) + C \cos(2\,(Az-Ao)) + D \cos(3\,(Az-Ao))$$

A = 8.22 m ; B = 0.0 m ; C = 0.48 m ; D = - 0.41 m ; Ao = 0°.2

Analisi di Fourier



Carrowmore (Irlanda)
Cairn 04

$$r(Az) = A + B \cos(Az-Ao) + C \cos(2\,(Az-Ao)) + D \cos(3\,(Az-Ao))$$

A = 5.88 m ; B = 0.0 m ; C = -0.47 m ; D = 0.32 m ; Ao = 1°.9


Carrowmore (Irlanda)
Cairn 04

Se si usa una Serie di Fourier per descrivere il profilo del circolo di pietre si ha:

$$r(Az) = A + B\cos(Az-Ao) + C\cos(2\,(Az-Ao)) + D\cos(3\,(Az-Ao)) + \ldots$$

allora:

$$I = e^{K \cdot 2 \cdot \pi \cdot A} \quad \text{bits}$$

(e = 2.718...)


Dinnever Hill, S 1/8 (50° 35′·4, 4° 38′·8).
Stannon Stone Circle

Stannon Stone Circle

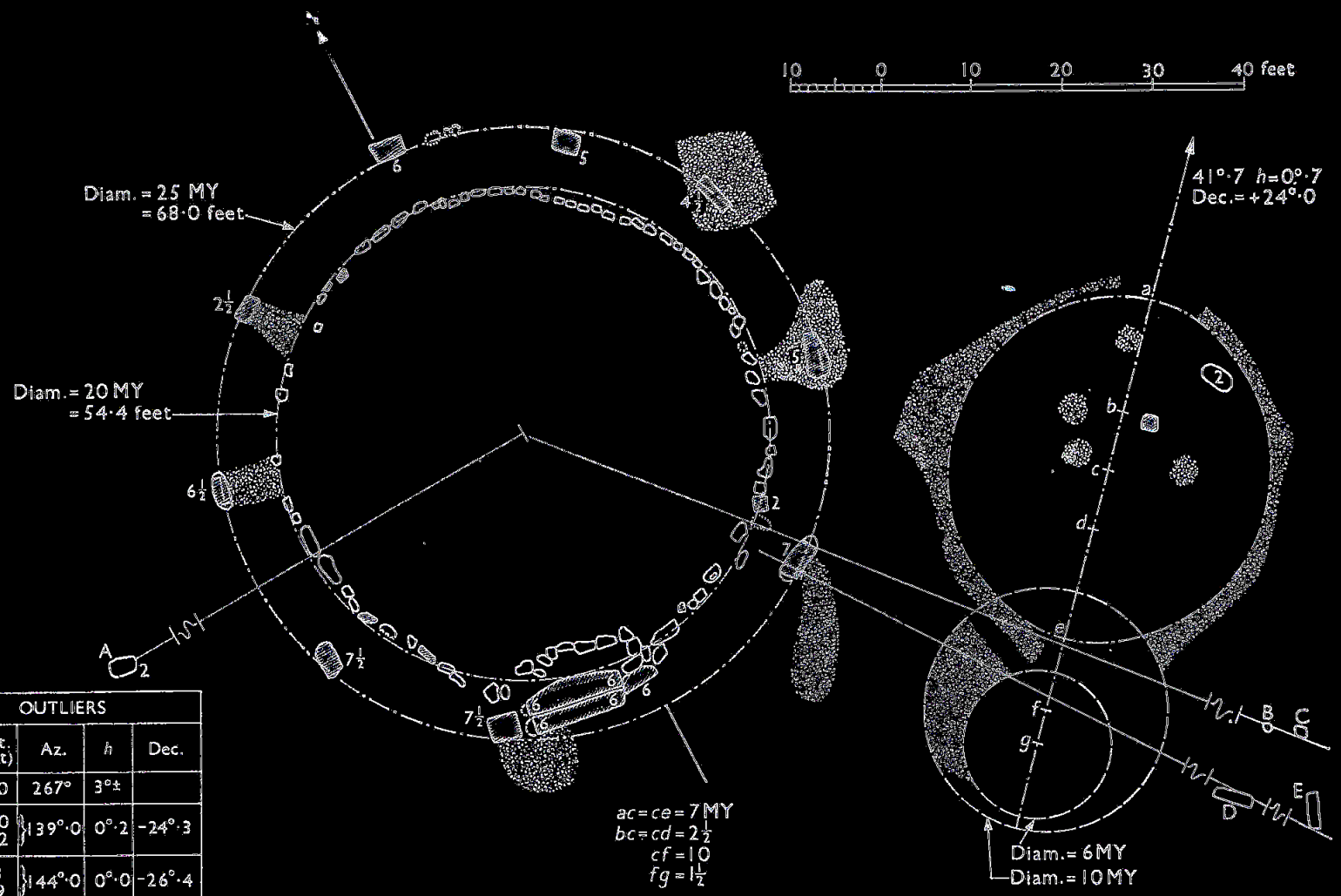
Dinnever Hill, S 1/8 (50° 35′·4, 4° 38′·8).

Stannon Stone Circle

Loanhead of Daviot Stone circle

Loanhead of Daviot Stone circle

Loanhead, B 1/26 (57° 21′, 2° 25′).

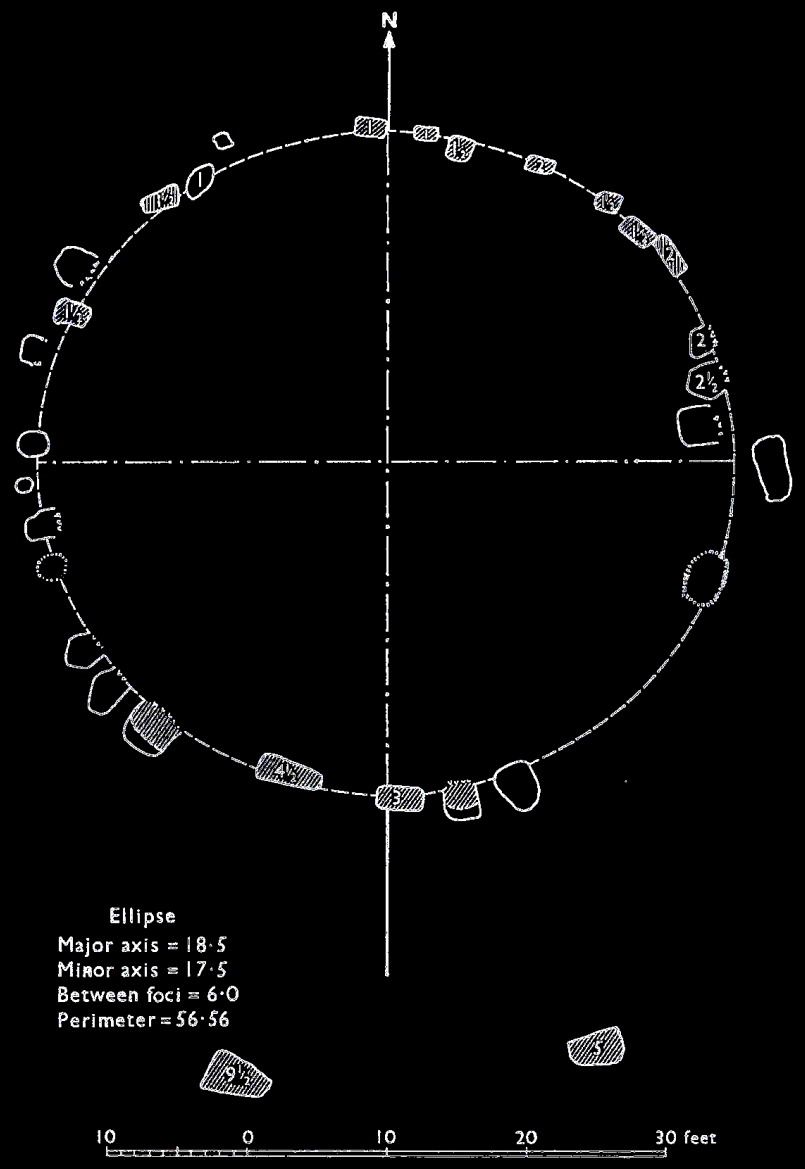


OUTLIERS				
	Dist. (feet)	Az.	h	Dec.
A	94·0	267°	3°±	
B	114·0	139°·0	0°·2	−24°·3
C	117·2			
D	188	144°·0	0°·0	−26°·4
E	229			

Loanhead, B 1/26 (57° 21′, 2° 25′).

Loanhead of Daviot Stone circle

Daviot, B 7/5 (57° 26′·4, 4° 07′·2).

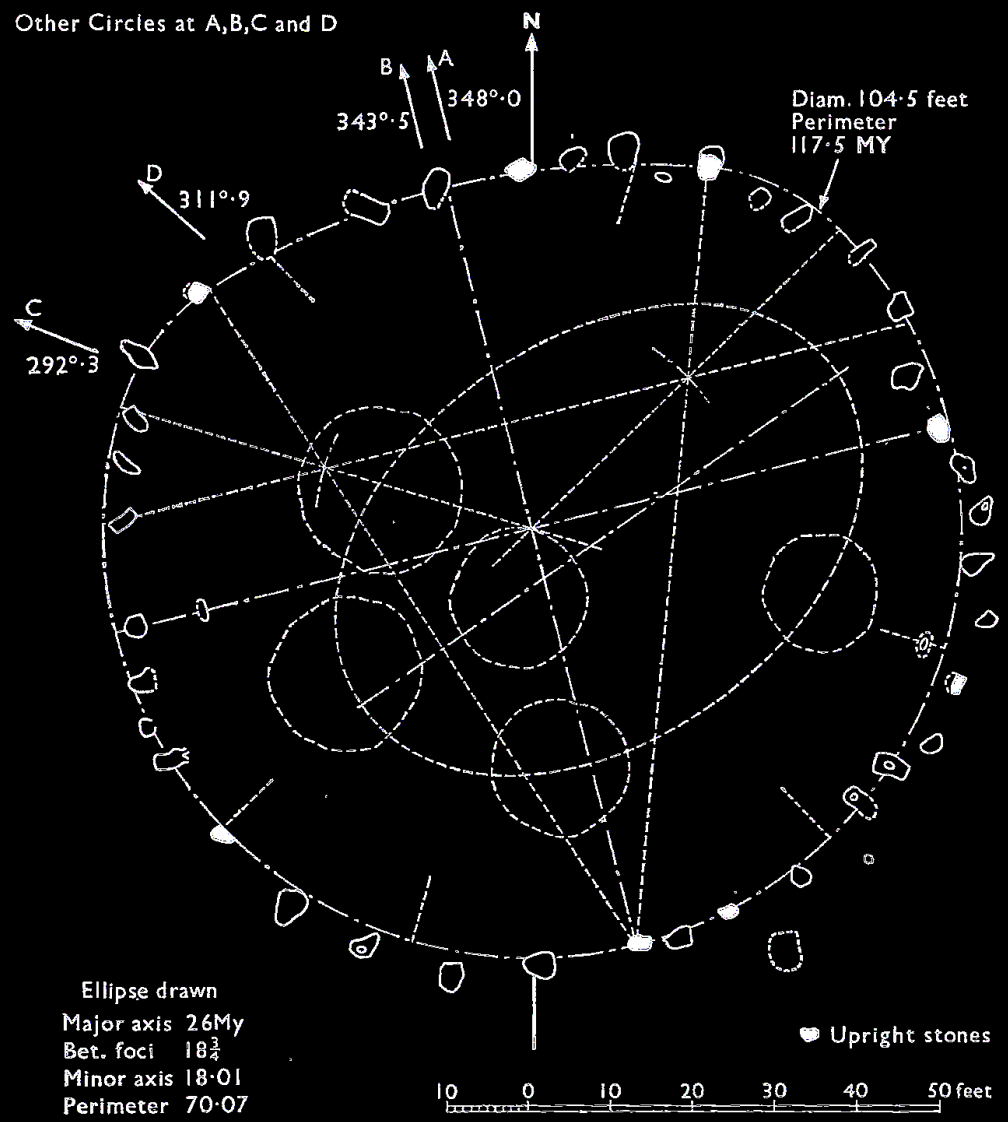


Daviot, B 7/5 (57° 26′·4, 4° 07′·2).

Burnmoor Stone Circles

Burnmoor Stone Circles

Burnmoor E, L 1/6 (54° 24′·6, 3° 16′·5).

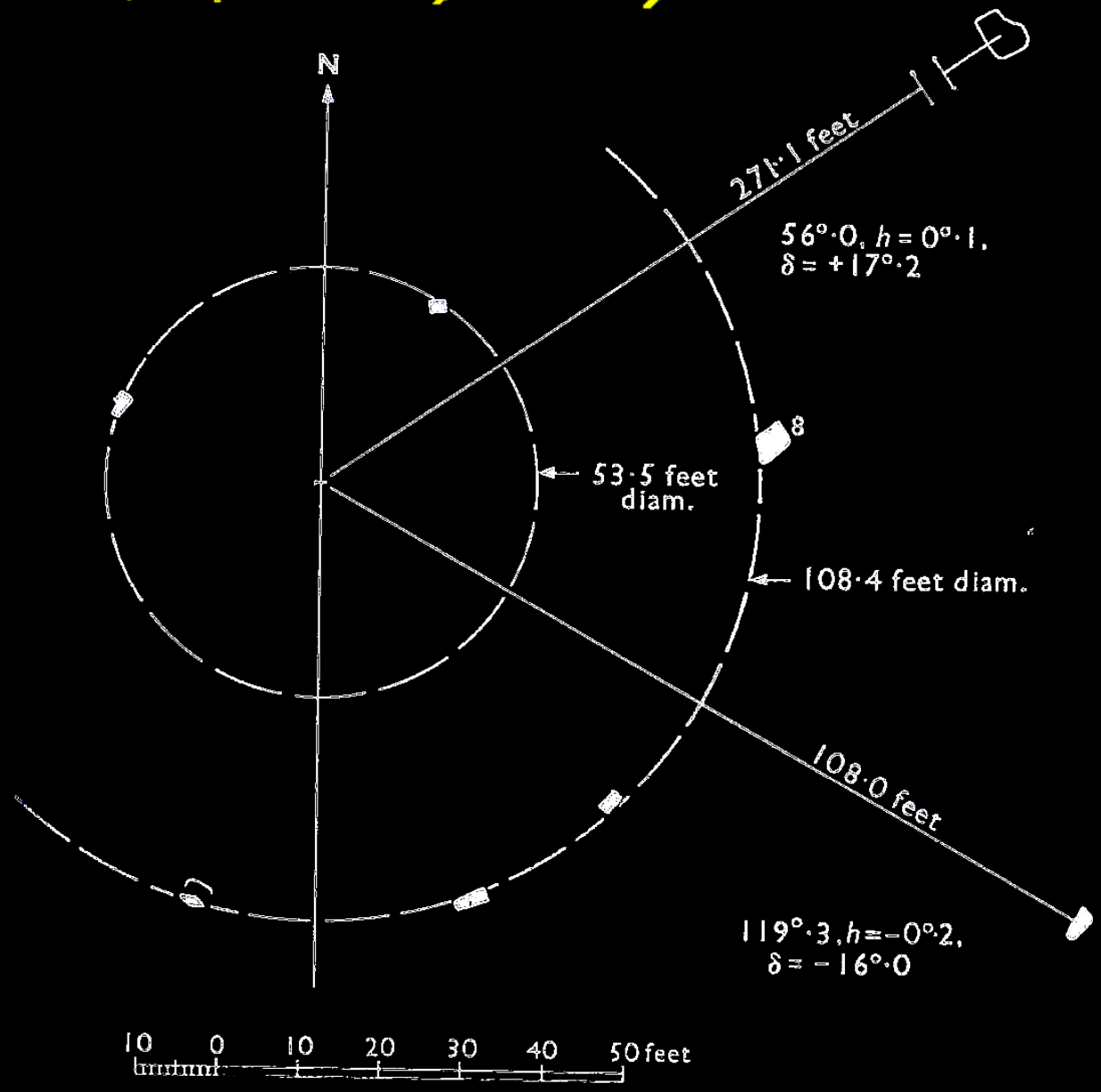


Burnmoor E, L 1/6 (54° 24′·6, 3° 16′·5).

Sheldon Stone Circle

Sheldon Stone Circle

Sheldon, B 1/8 (57° 19′, 2° 18′).



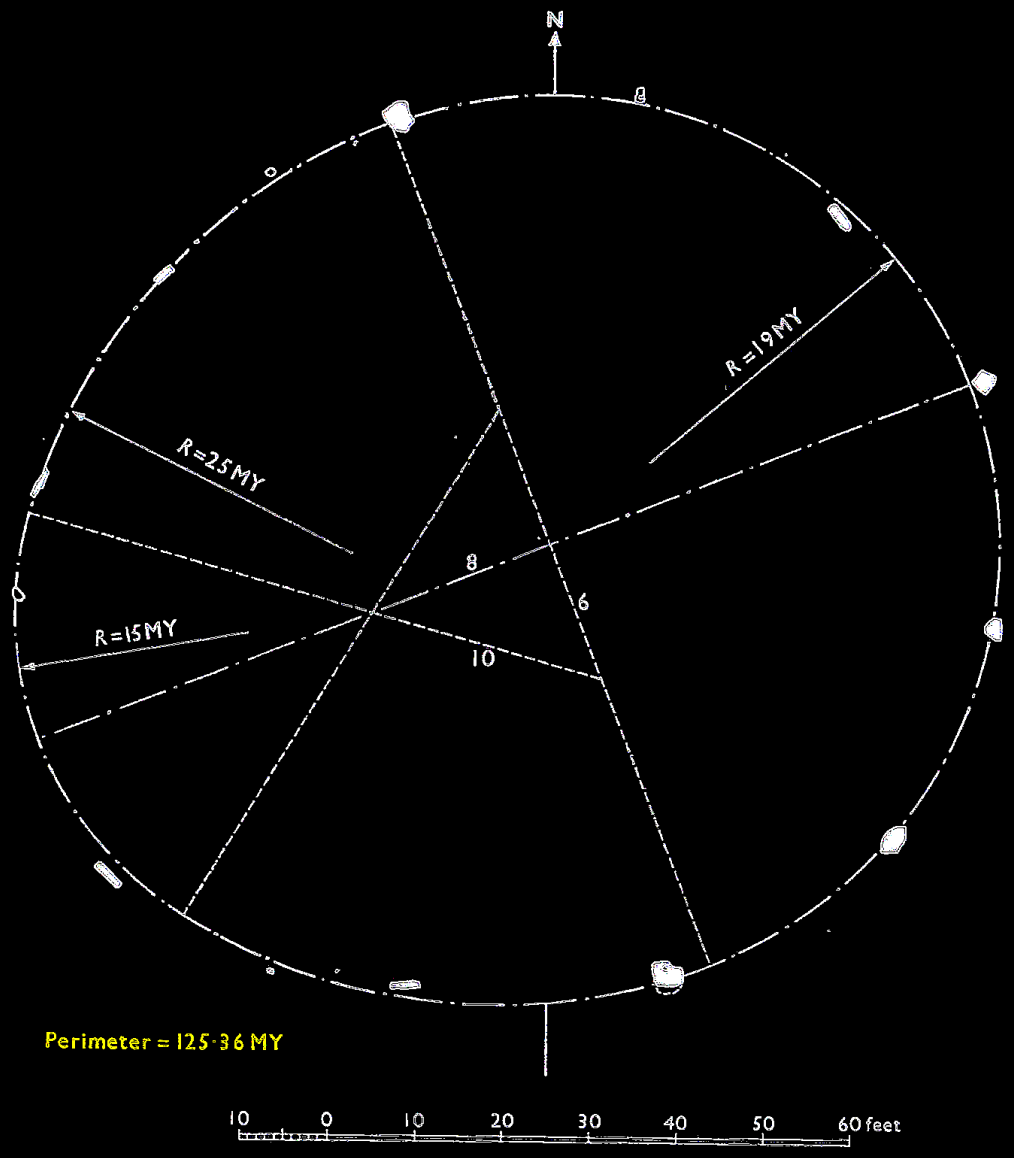
Sheldon, B 1/8 (57° 19′, 2° 18′).

Clava Cairns

Clava Cairns

Clava Cairns

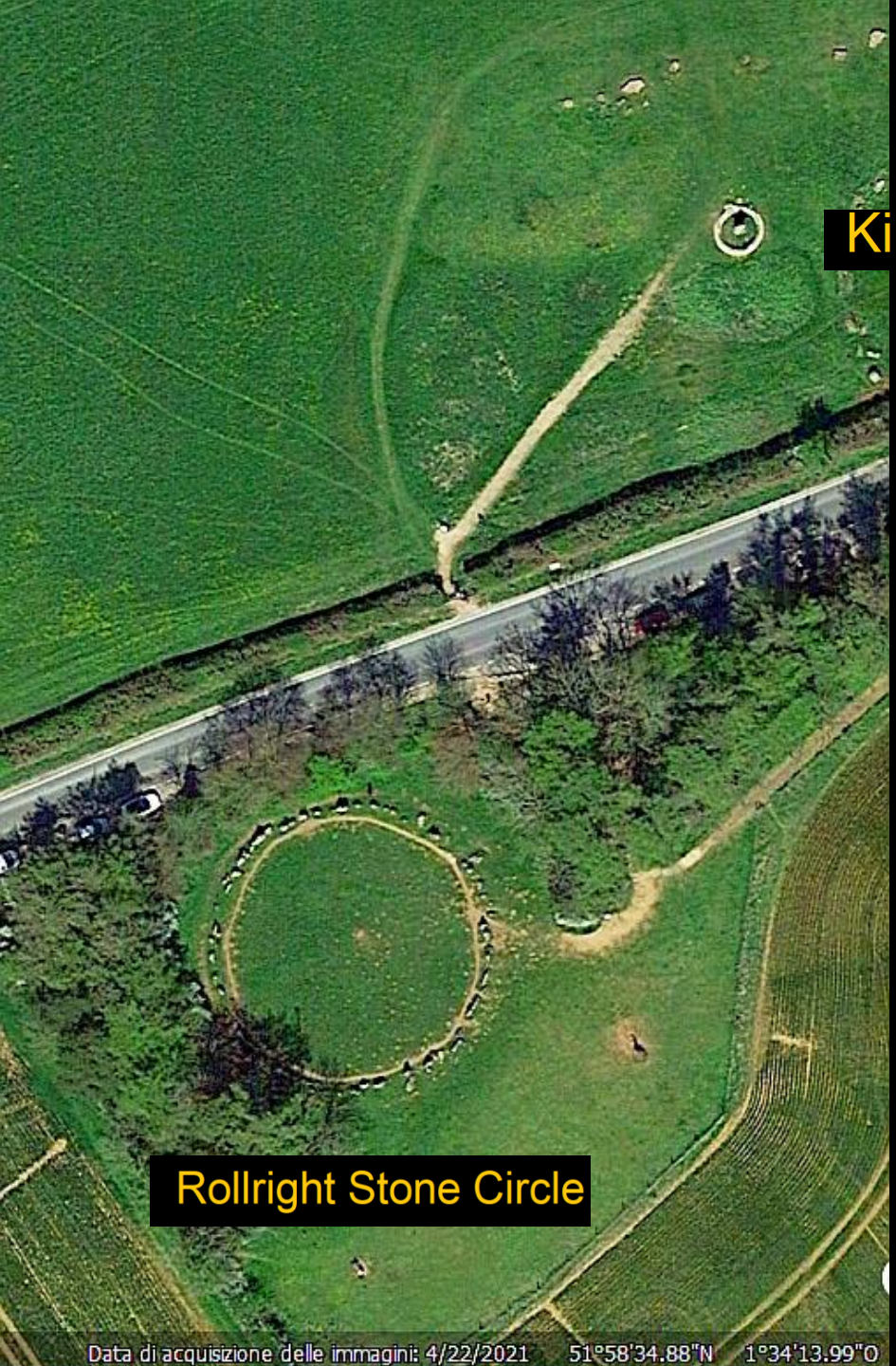
Clava, B 7/1 (57° 29′, 4° 5′).



Clava, B 7/1 (57° 29′, 4° 5′).

Rollright Stone Circle

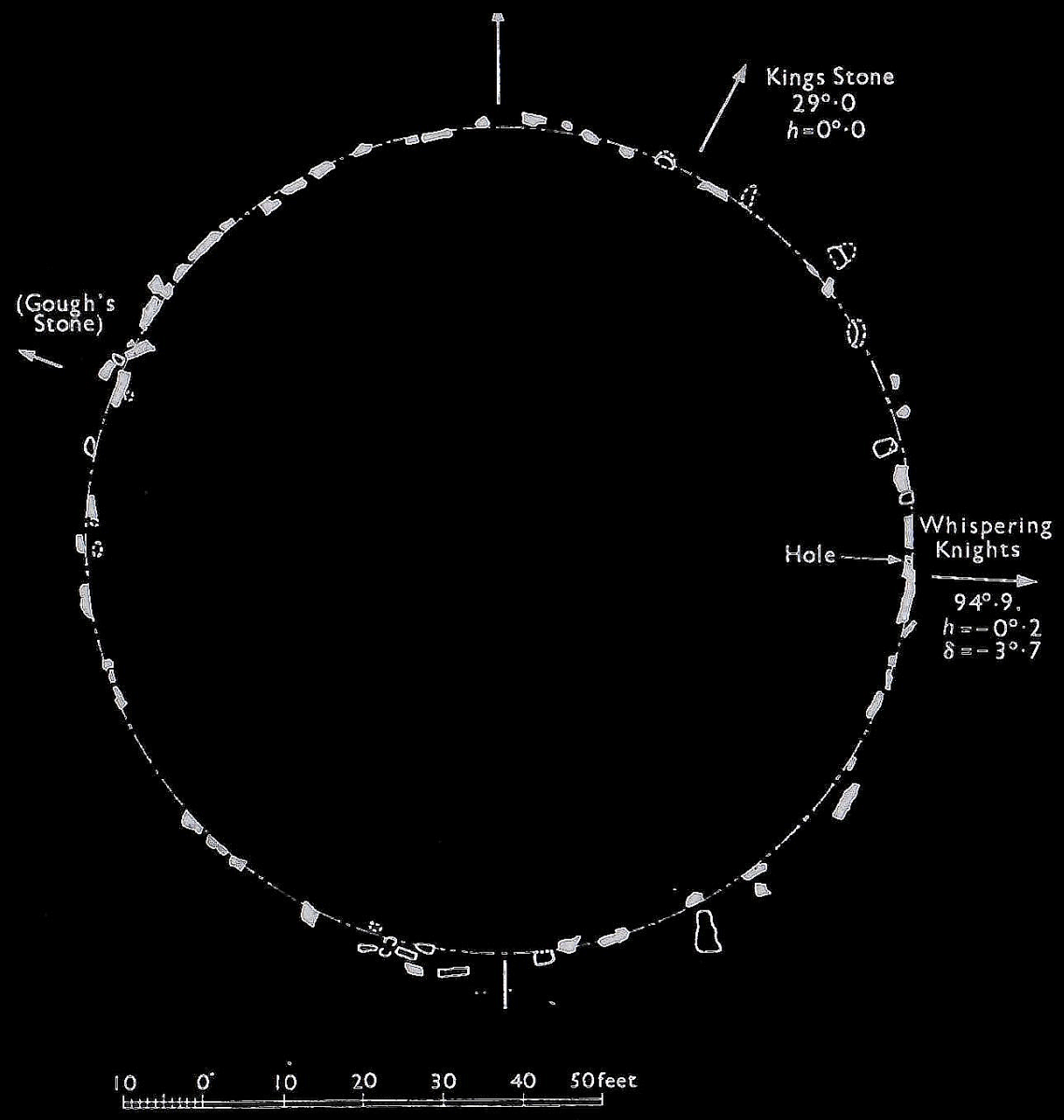
Rollright Stone Circle



1645-1662

Rollright Stone Circle

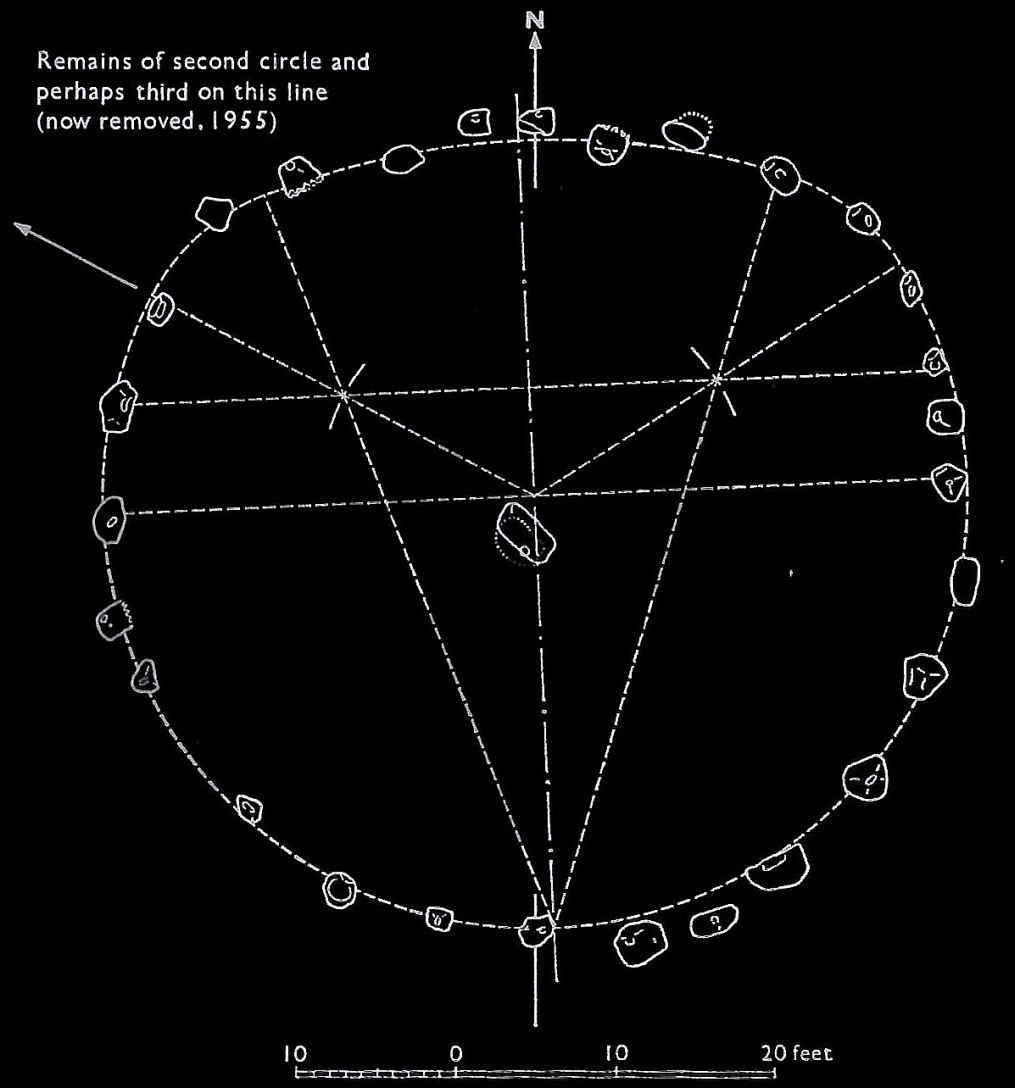
Rollright, S 6/1 (51° 58′, 1° 34′).



Cambret Moor (Glenquicken) Stone Circle

Cambret Moor (Glenquicken) Stone Circle

Cambret Moor, G 4/12 (55° 53′ 47″, 4° 19′ 28″).

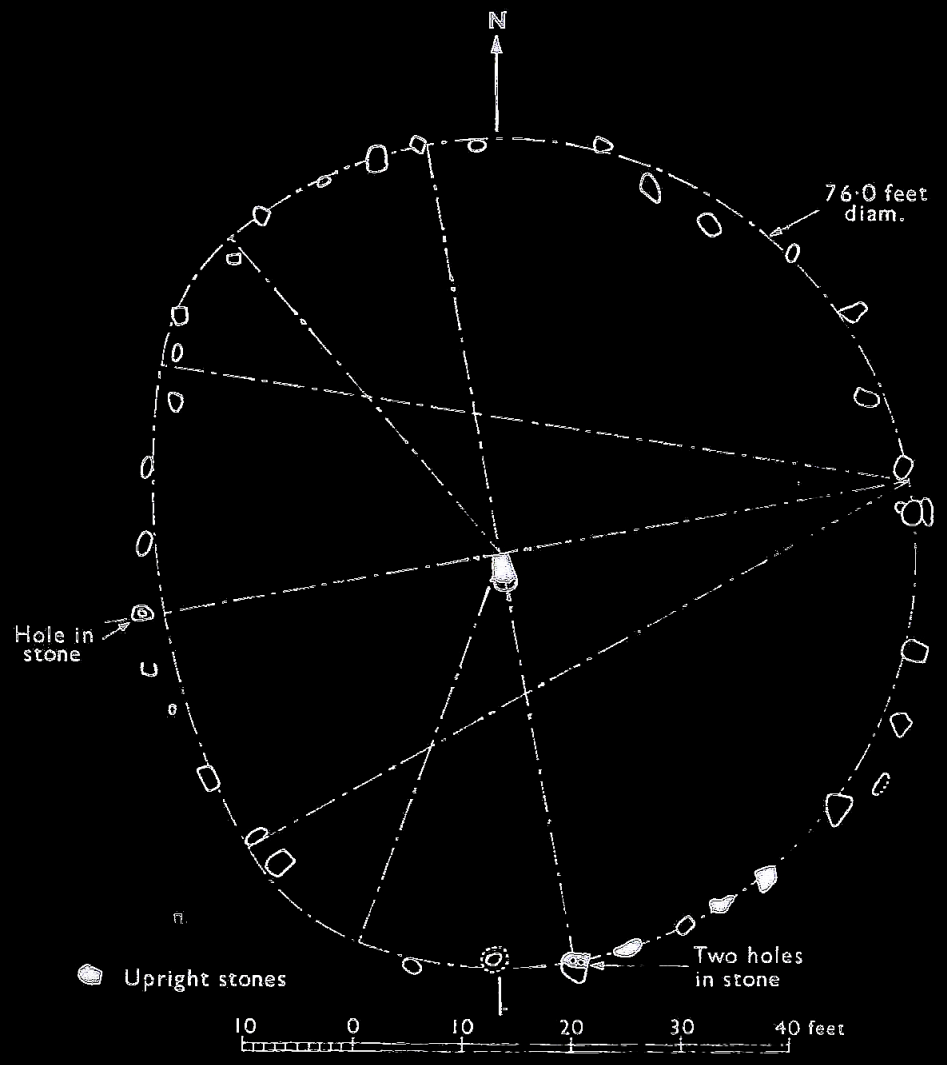


Cambret Moor, G 4/12 (55° 53′ 47″, 4° 19′ 28″).

Black Marsh (Hoarstones) Stone Circle

Black Marsh (Hoarstones) Stone Circle

Black Marsh, D 2/2 (52° 35′·5, 2° 59′·9).



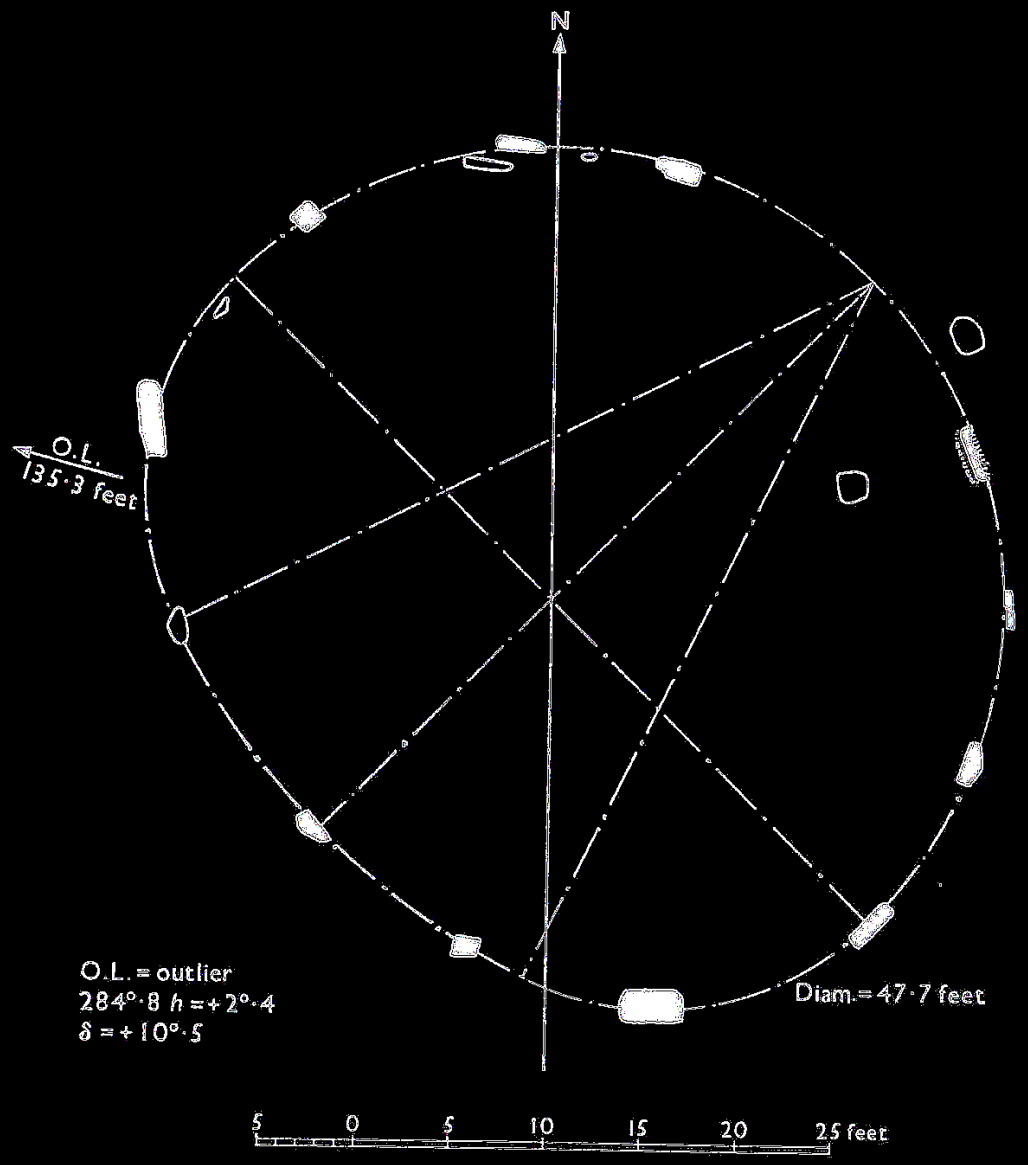
Black Marsh, D 2/2 (52° 35′·5, 2° 59′·9).

Barbrook Stone Circle

Barbrook Stone Circle

Barbrook Stone Circle

Bar Brook, D 1/7 (53° 16′·6, 1° 34′·9).

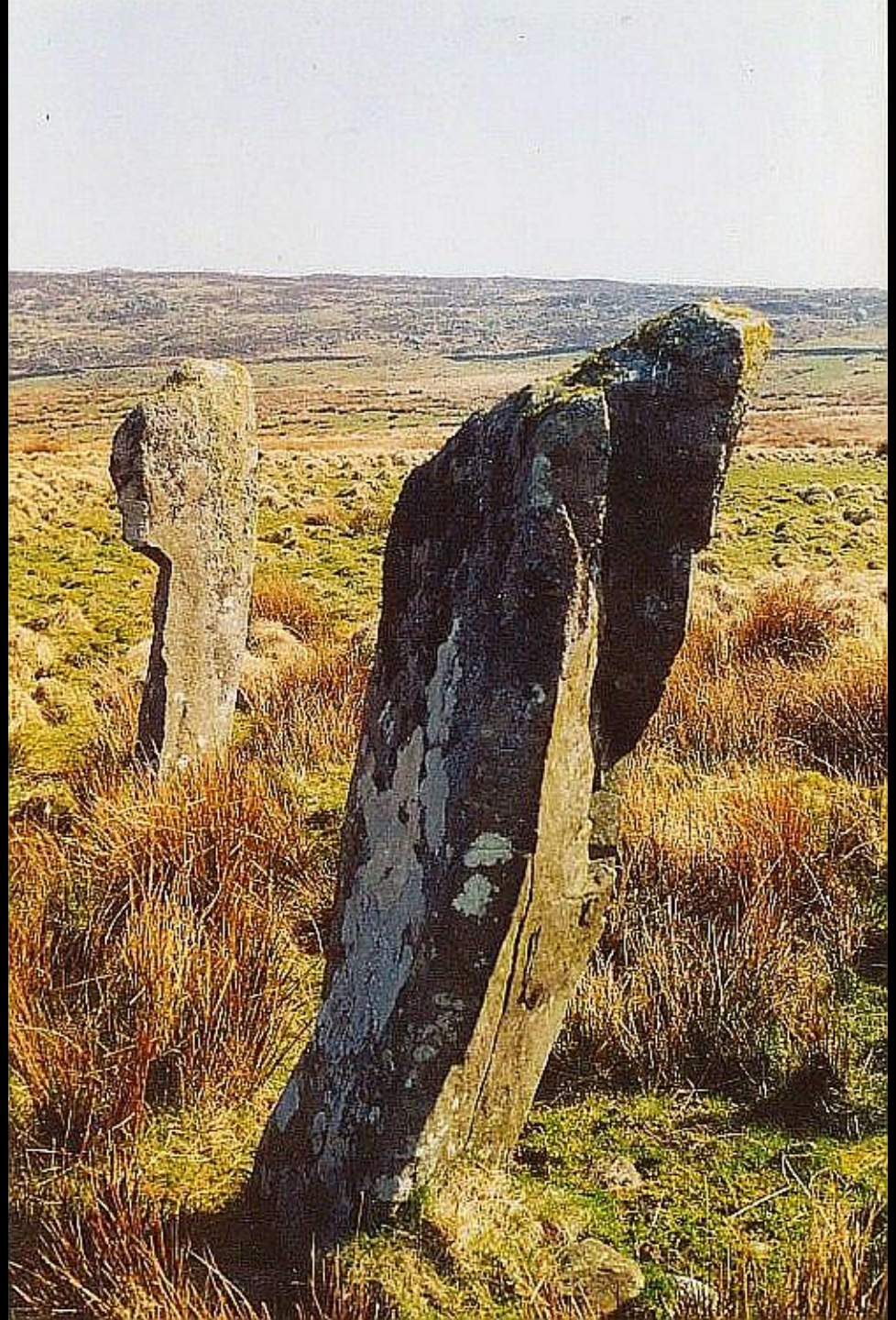


Bar Brook, D 1/7 (53° 16′·6, 1° 34′·9).

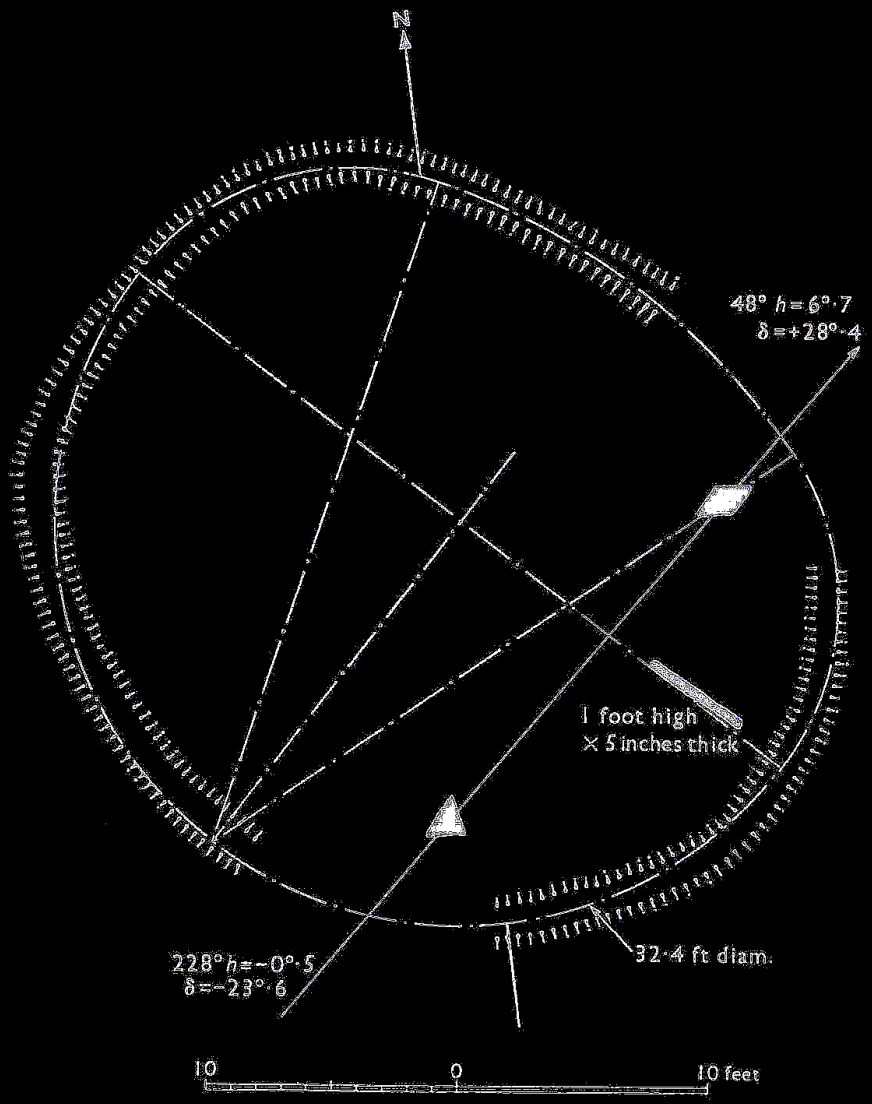
The Thieves


Image © 2023 Maxar Technologies
Data di acquisizione delle immagini: 6/20/2022
55°00'46.67"N 4°29'50.22"O

The Thieves



Thieves, G 4/2 (55° 01′, 4° 35′).

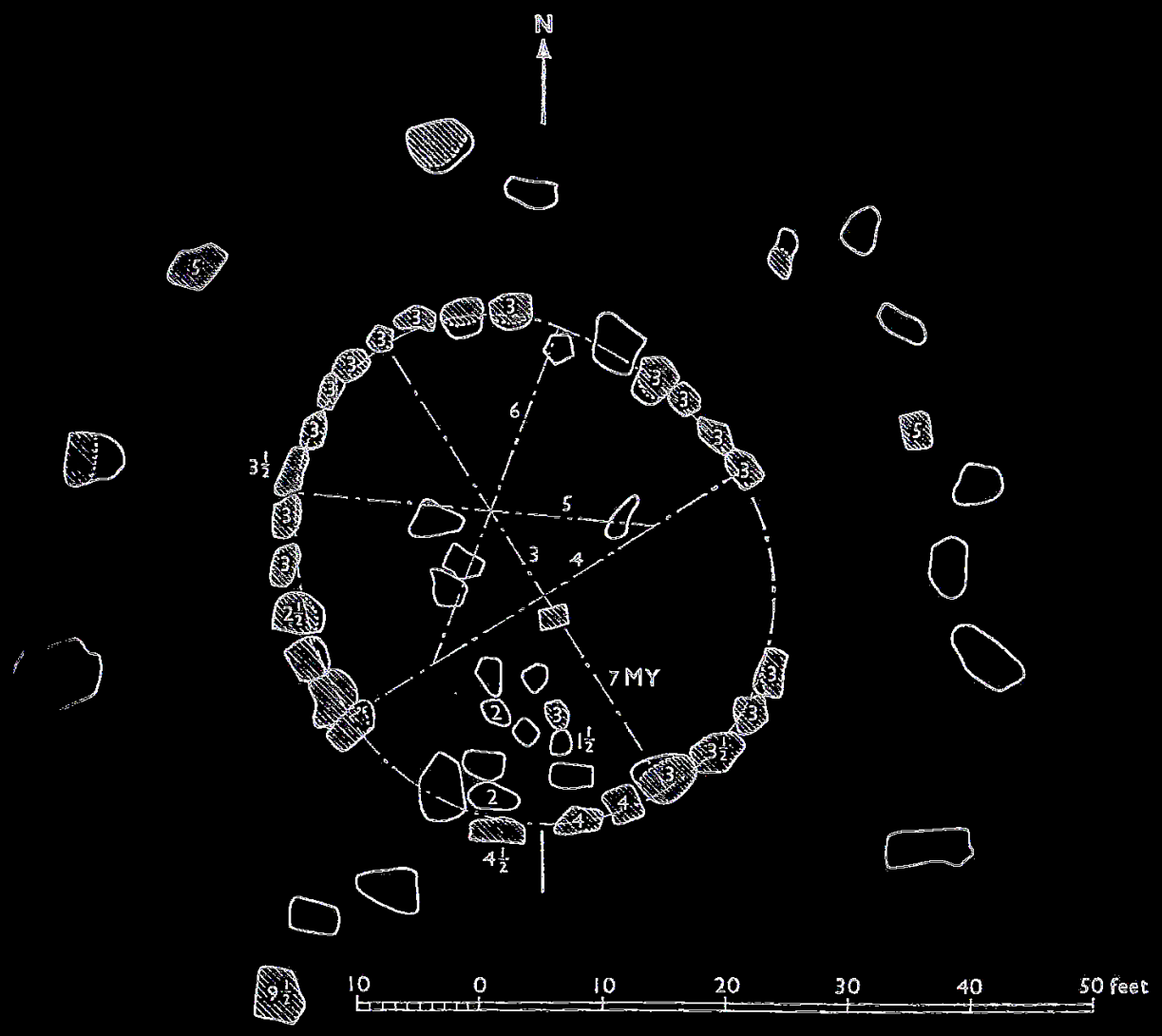


Thieves, G 4/2 (55° 01′, 4° 35′).

Druids Temple

Druids Temple

Druid Temple, B 7/18 (57° 27′, 4° 11′·4).



Druid Temple, B 7/18 (57° 27′, 4° 11′·4).

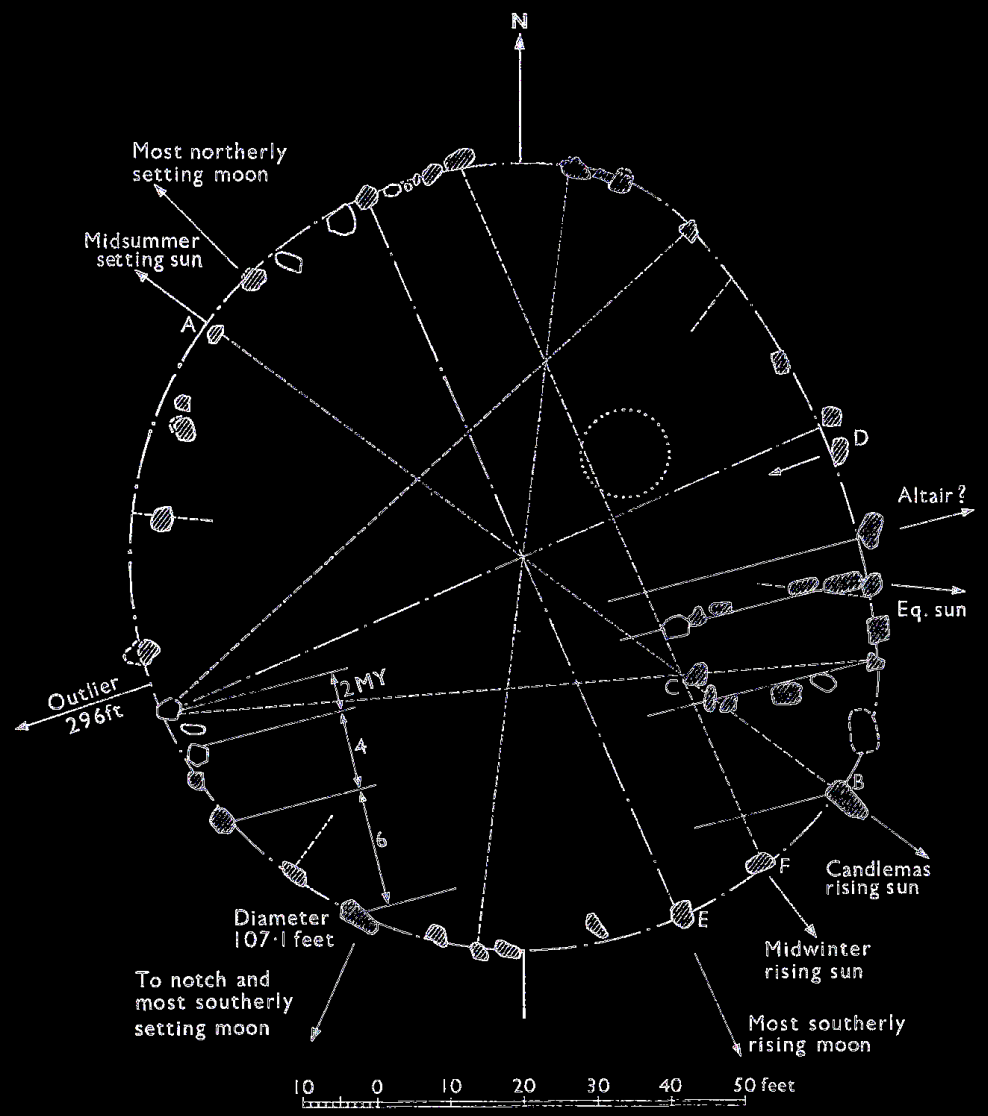
Castle Rigg


Castle Rigg

Castle Rigg


Data di acquisizione delle immagini: 6/30/2018 54°36'10.27"N 3°05'54.17"O

Castle Rigg, L 1/1 (54° 36′·1, 3° 05′·5).



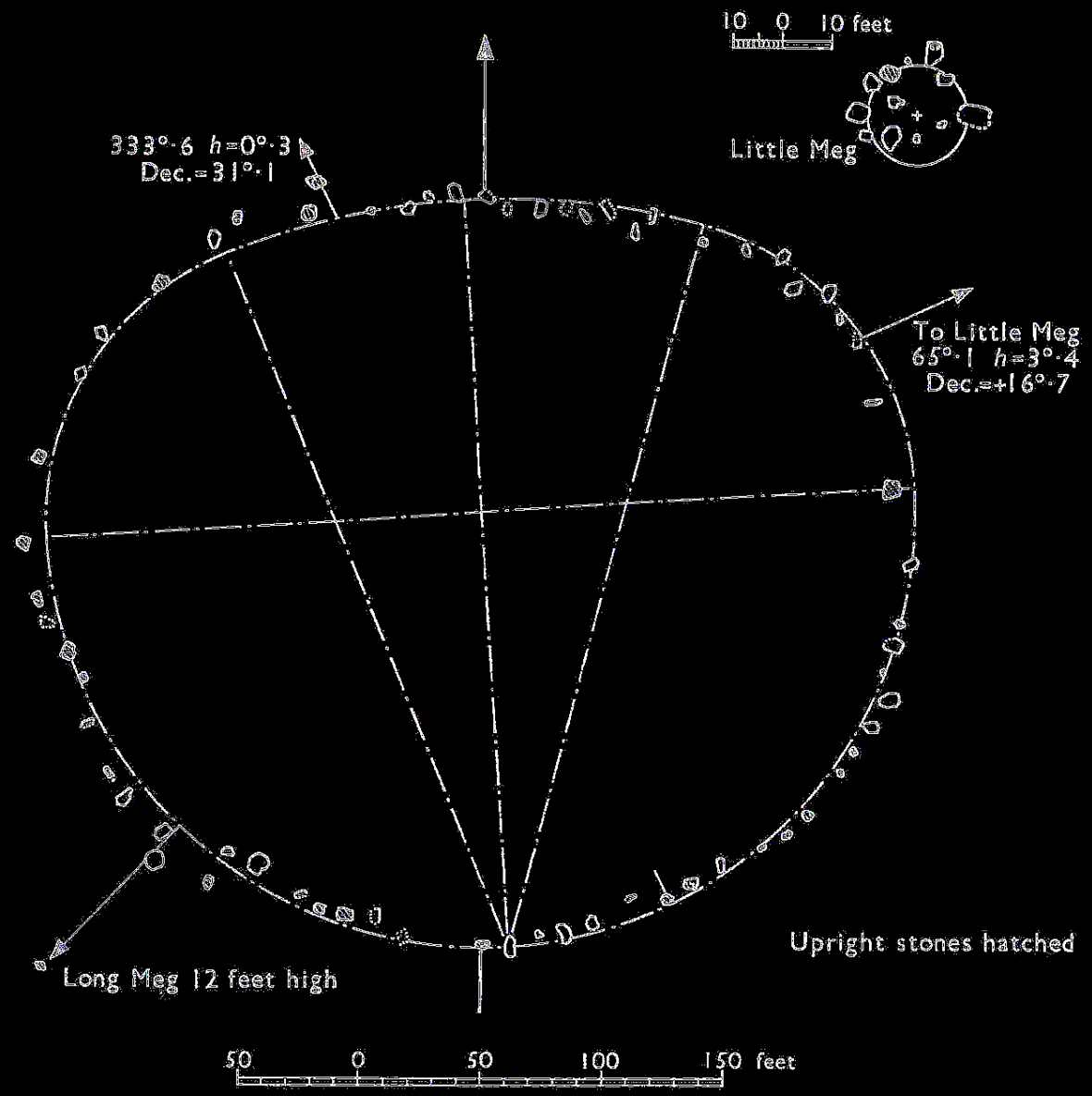
Castle Rigg, L 1/1 (54° 36′·1, 3° 05′·5).

Long Meg and Her Daughters

Long Meg and Her Daughters

Long Meg and Her Daughters

Long Meg and her Daughters, L 1/7 (54° 44′, 2° 40′).

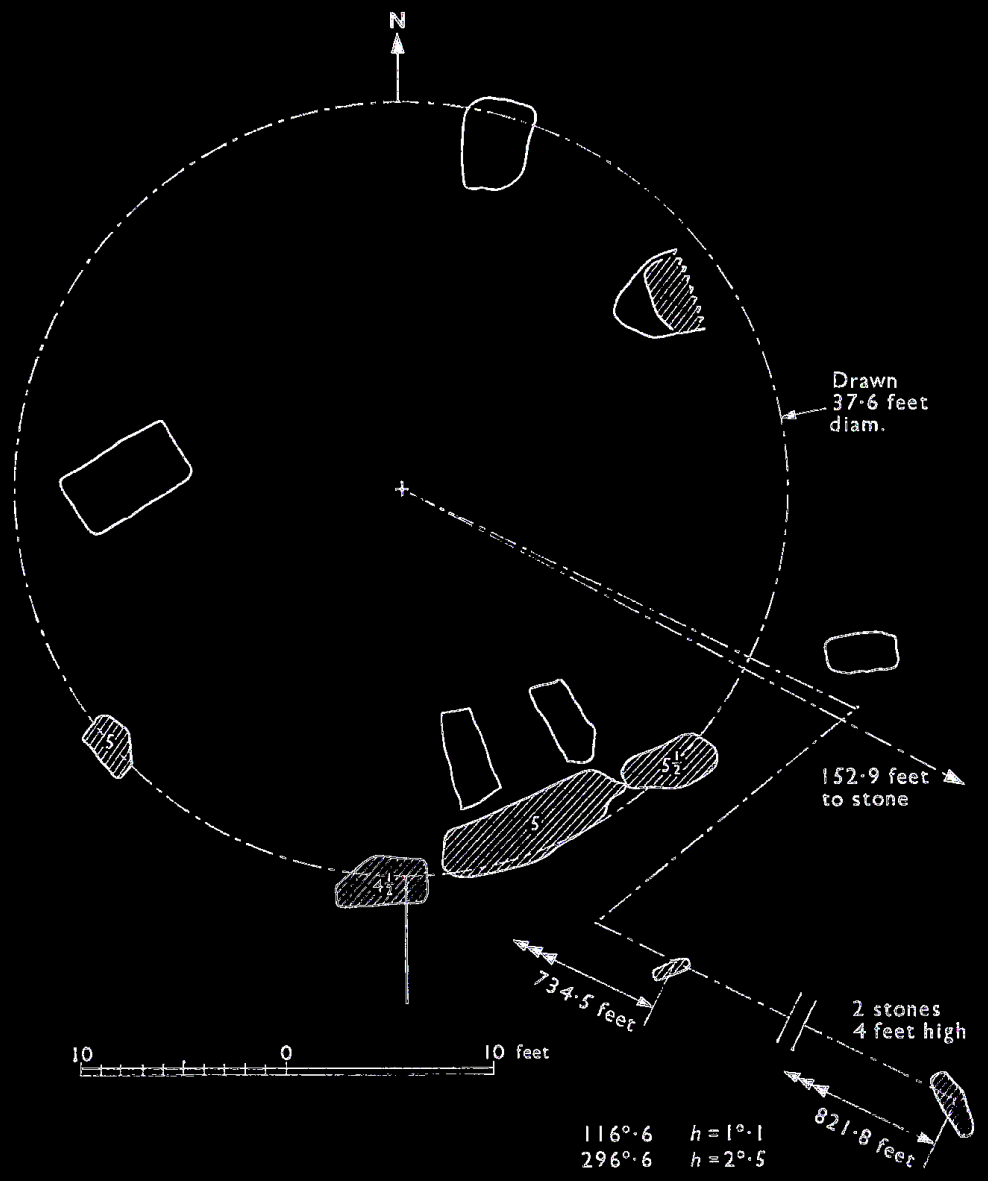


Long Meg and her Daughters, L 1/7 (54° 44′, 2° 40′).

Ardlair Stones

Ardlair Stones

Ardlair, B 1/18 (57° 20′, 2° 44′).

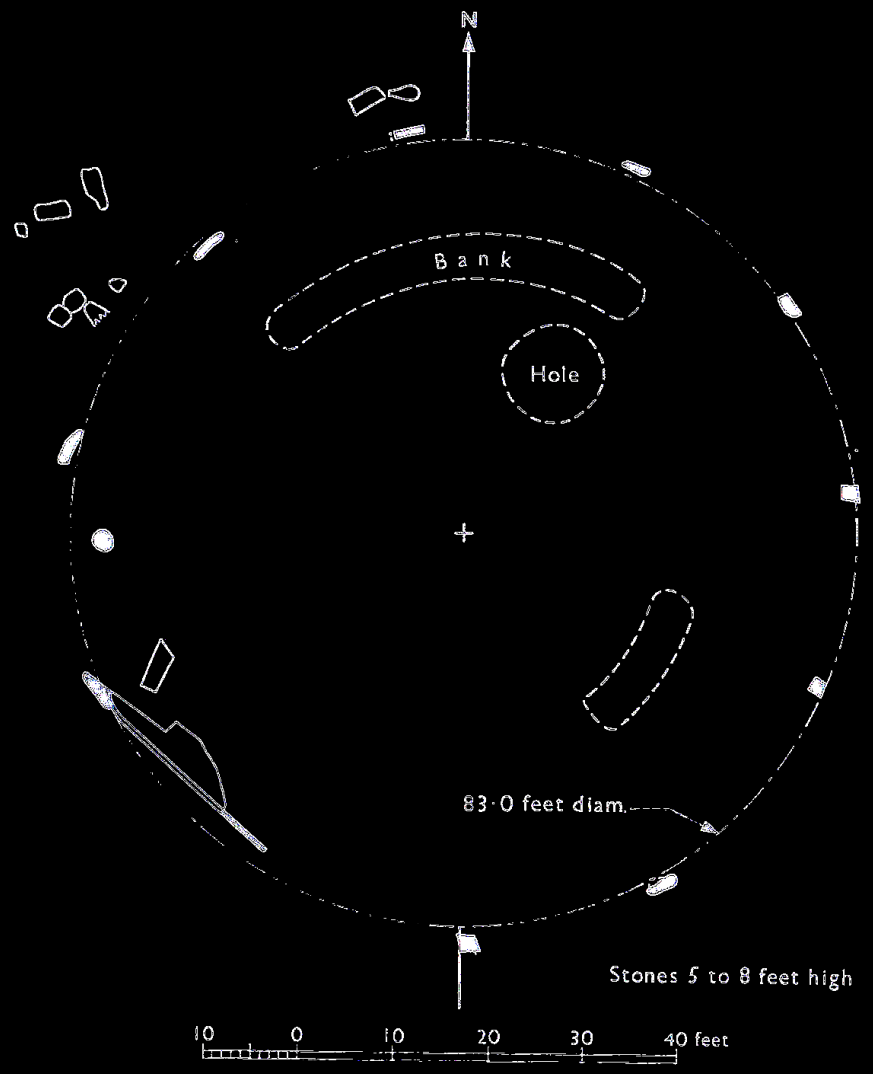


Ardlair, B 1/18 (57° 20′, 2° 44′).

Sunhoney Stone Circle

Sunhoney Stone Circle

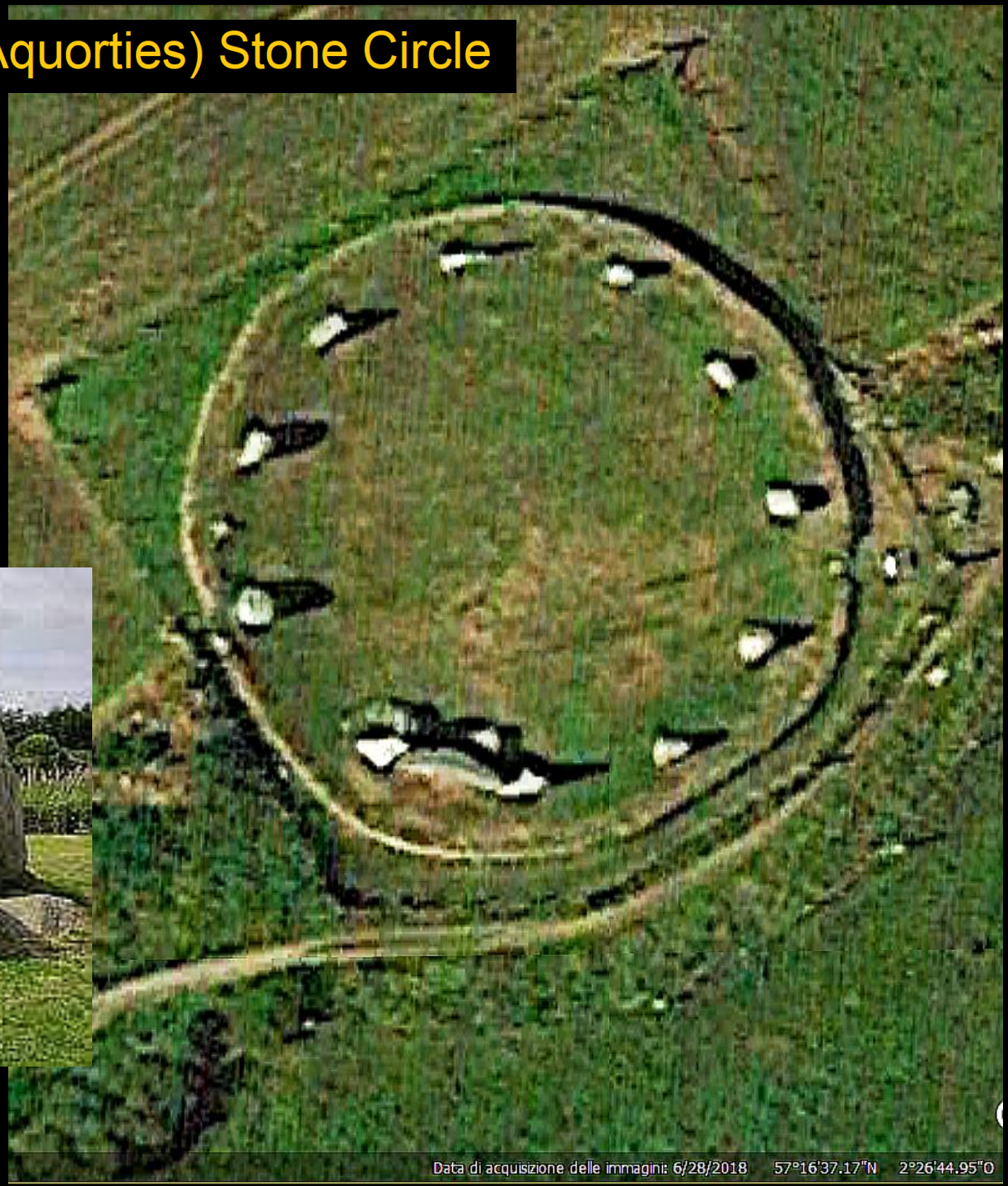
Sunhoney, B 2/2 (57° 8′·5, 2° 28′·2).



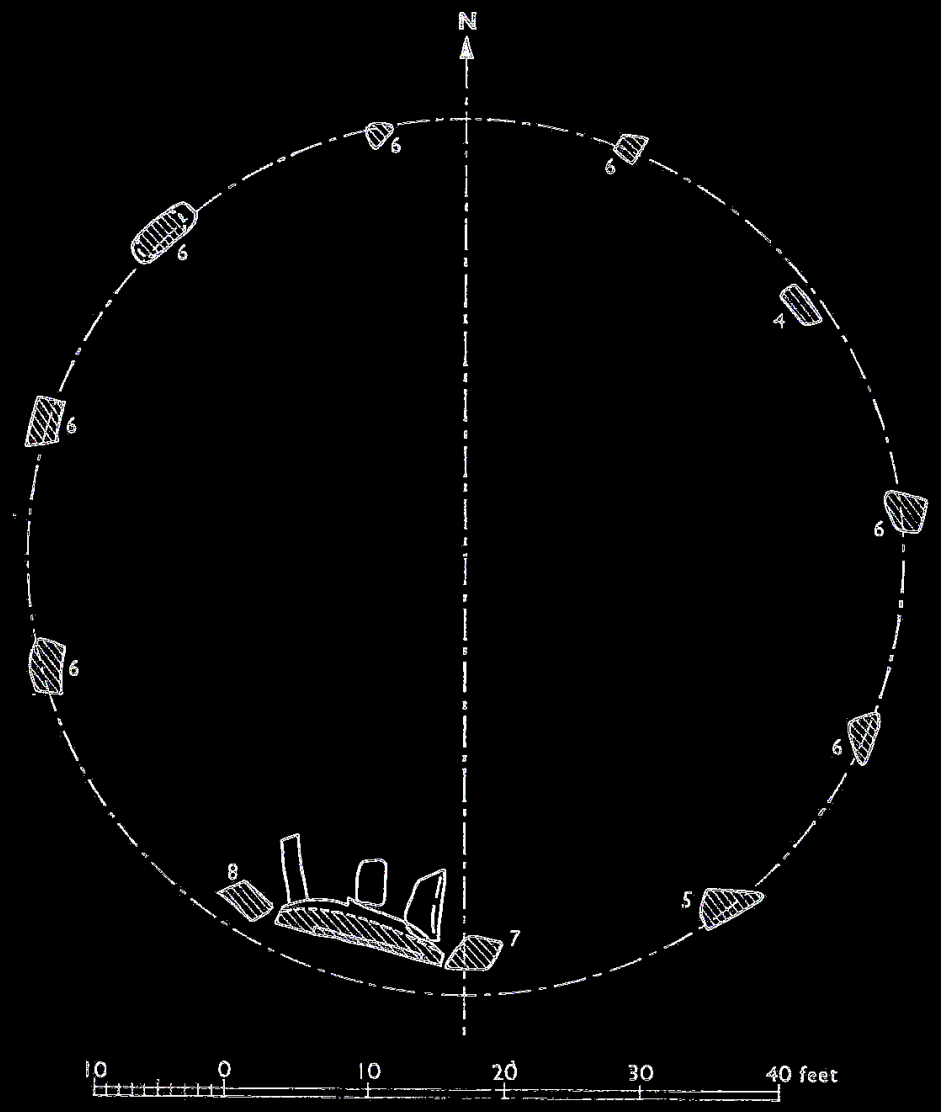
Sunhoney, B 2/2 (57° 8′·5, 2° 28′·2).

Aquorties Manar (East Aquorties) Stone Circle

Aquorties Manar (East Aquorties) Stone Circle



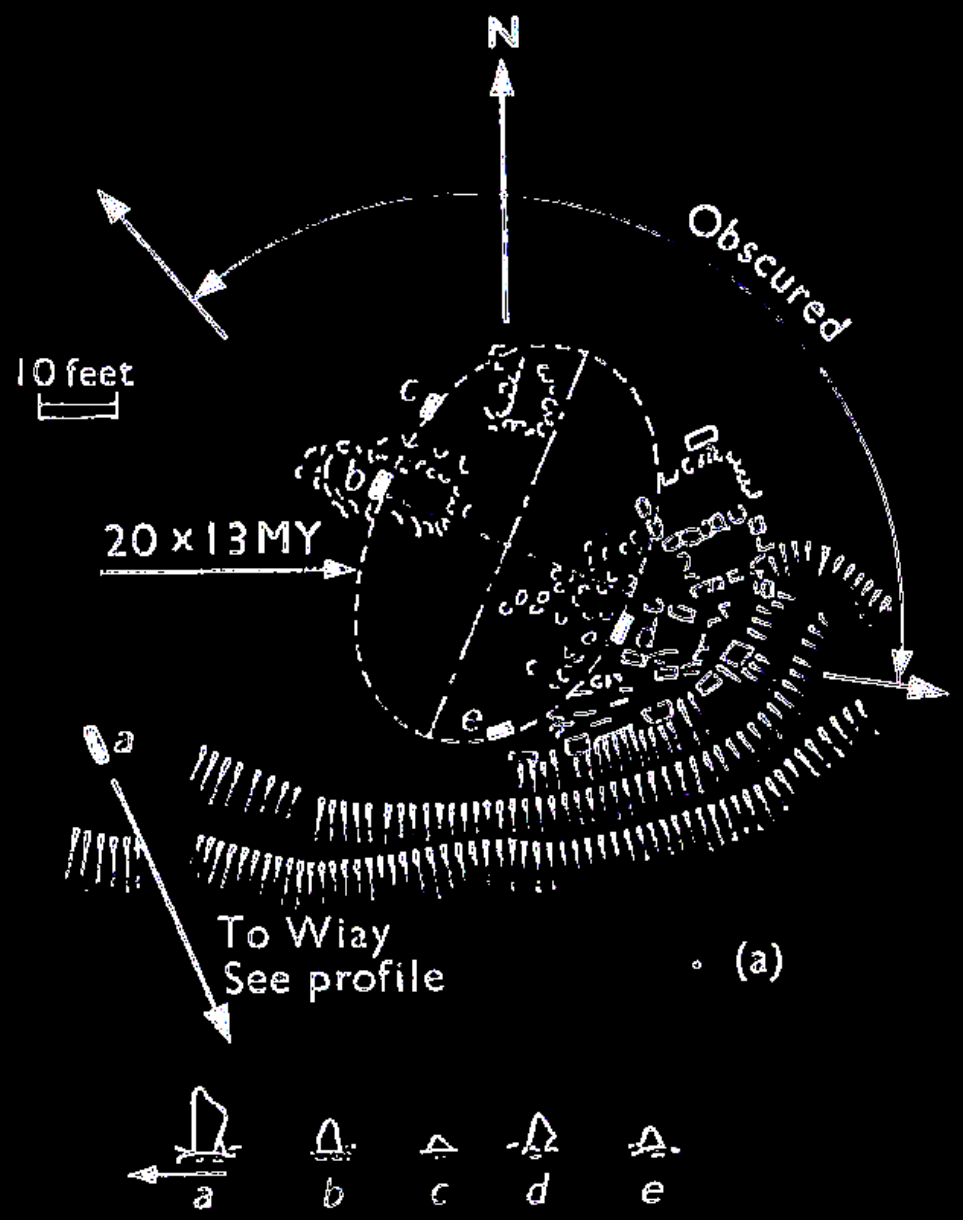
Aquorthies, Manar, B 1/6 (57° 16′·6, 2° 40′ ·7).



Aquorthies, Manar, B 1/6 (57° 16′·6, 2° 40′ ·7).

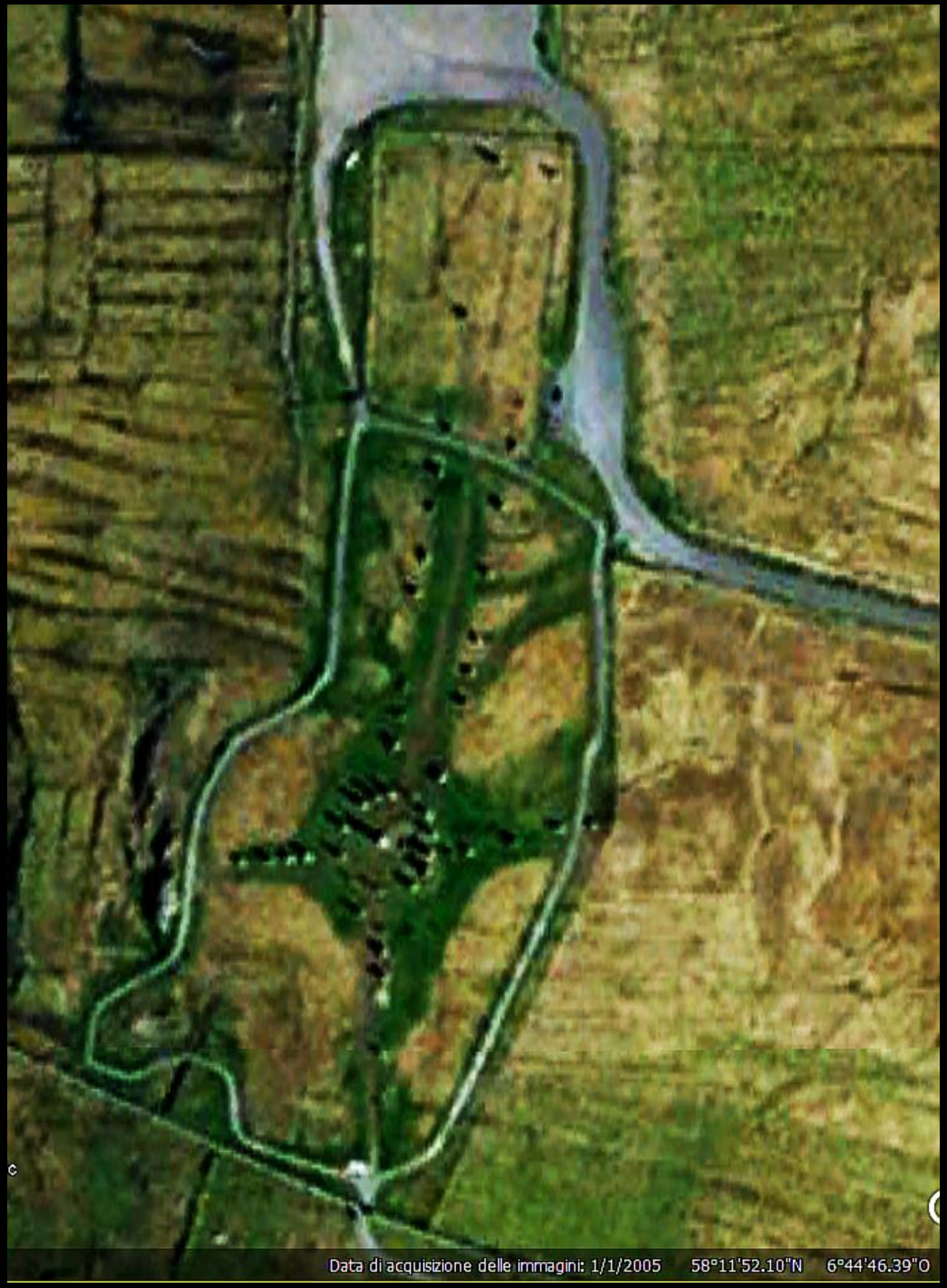
Leachac an Tigh Chloiche

Leacach an Tigh Chloiche, H 3/11 (57° 34′ 38″, 7° 21′ 17″)

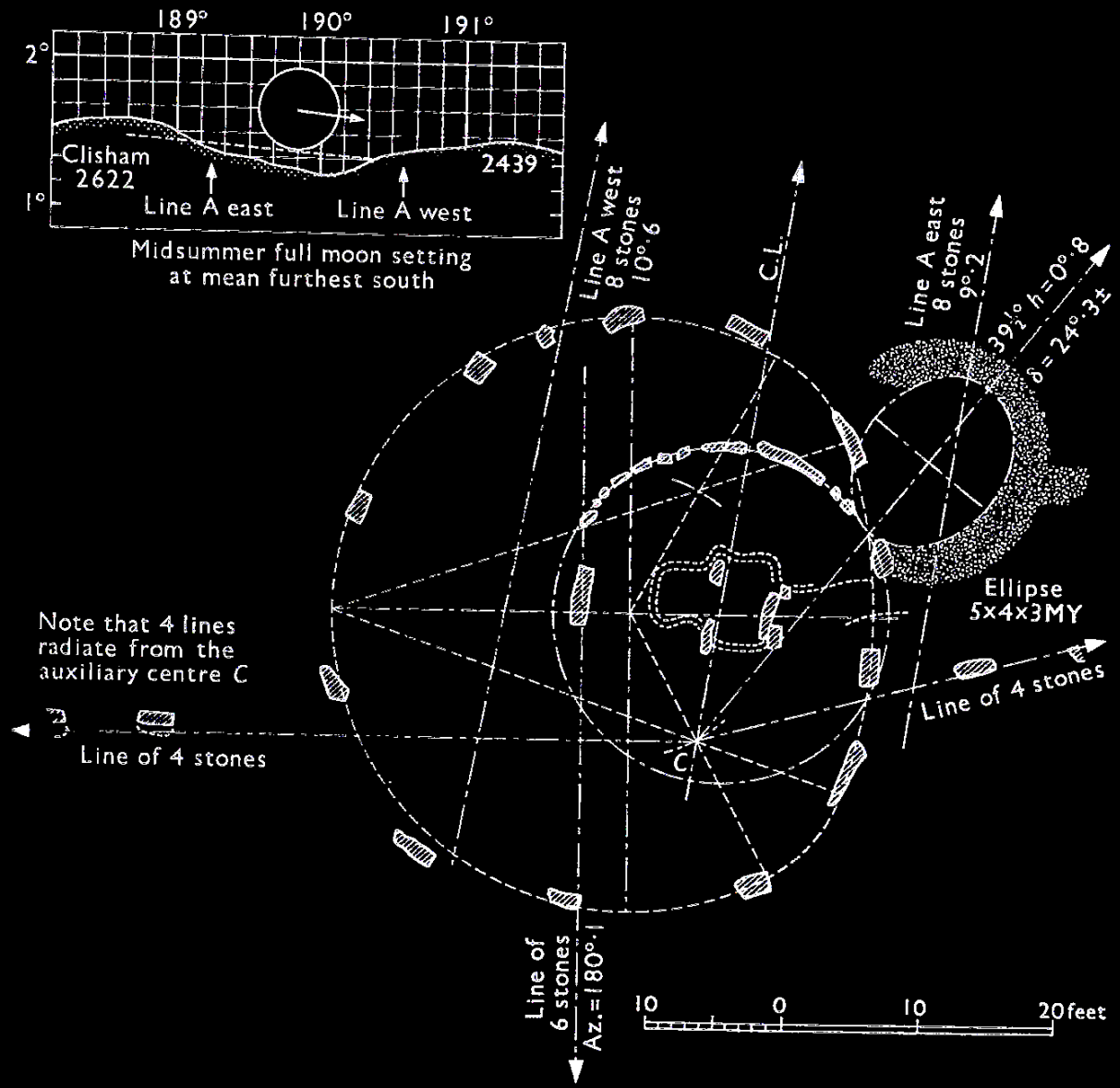


Callanish

Callanish

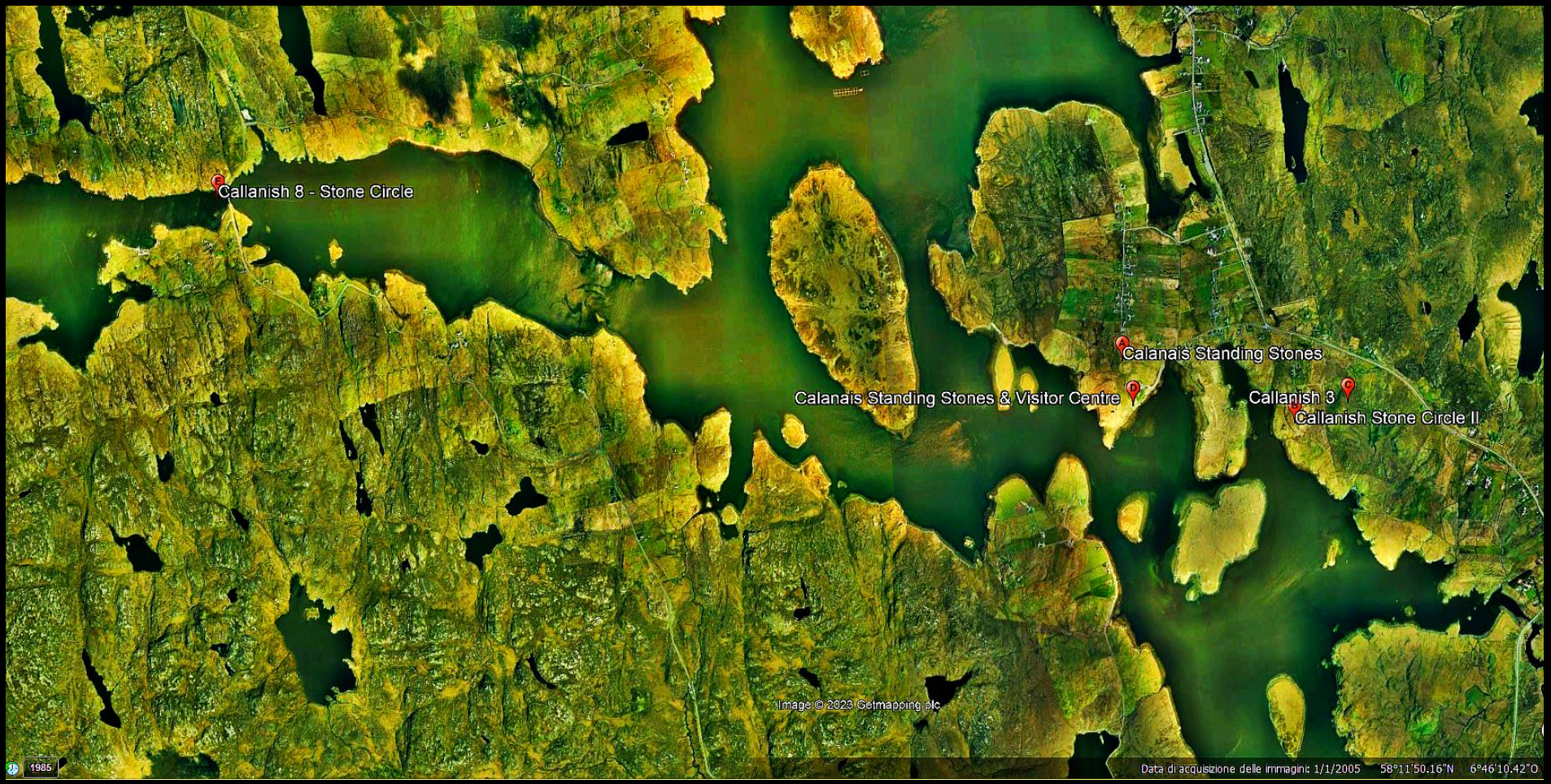

Data di acquisizione delle immagini: 1/1/2005 58°11'52.10"N 6°44'46.39"O

Tursachan Callanish, H 1/1.



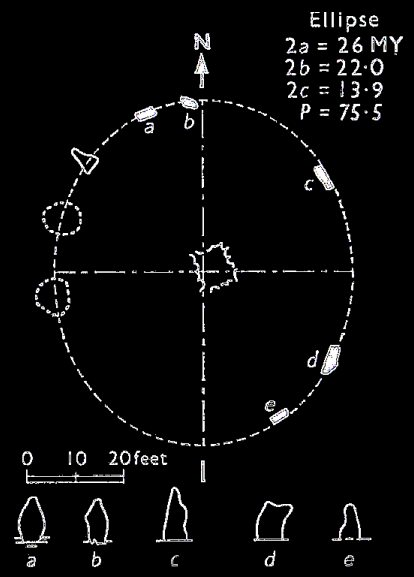
Tursachan Callanish, H 1/1.

Callanish

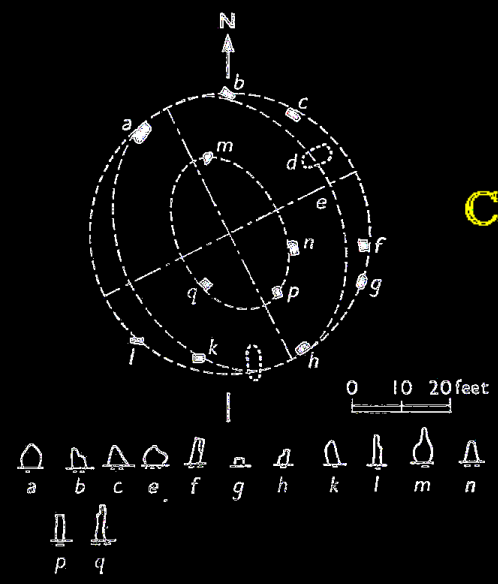

Callanish 8 - Stone Circle
Calanais Standing Stones
Calanais Standing Stones & Visitor Centre
Callanish 3
Callanish Stone Circle II
Image © 2023 Getmapping plc
1985
Data di acquisizione delle immagini: 1/1/2005 58°11'50.16"N 6°46'10.42"O

Callanish II, H 1/2; Callanish III, H 1/3; Callanish IV, H 1/4; Great Berneray, H 1/8.

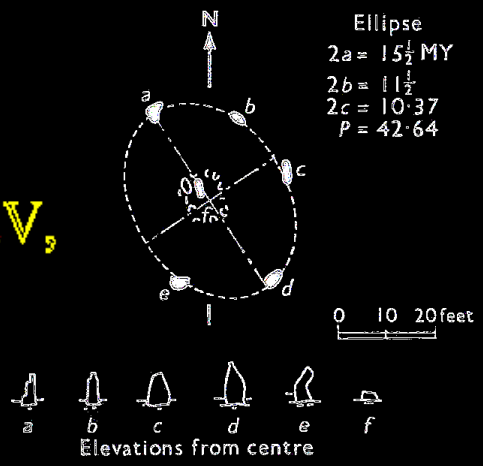
Callanish II,

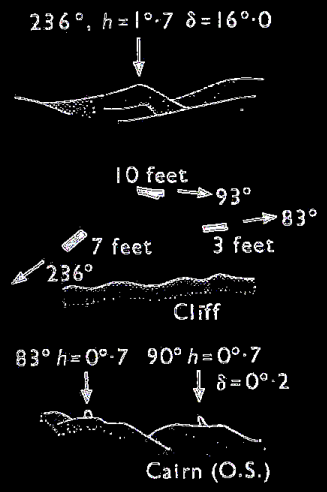


Callanish III,



Callanish IV,





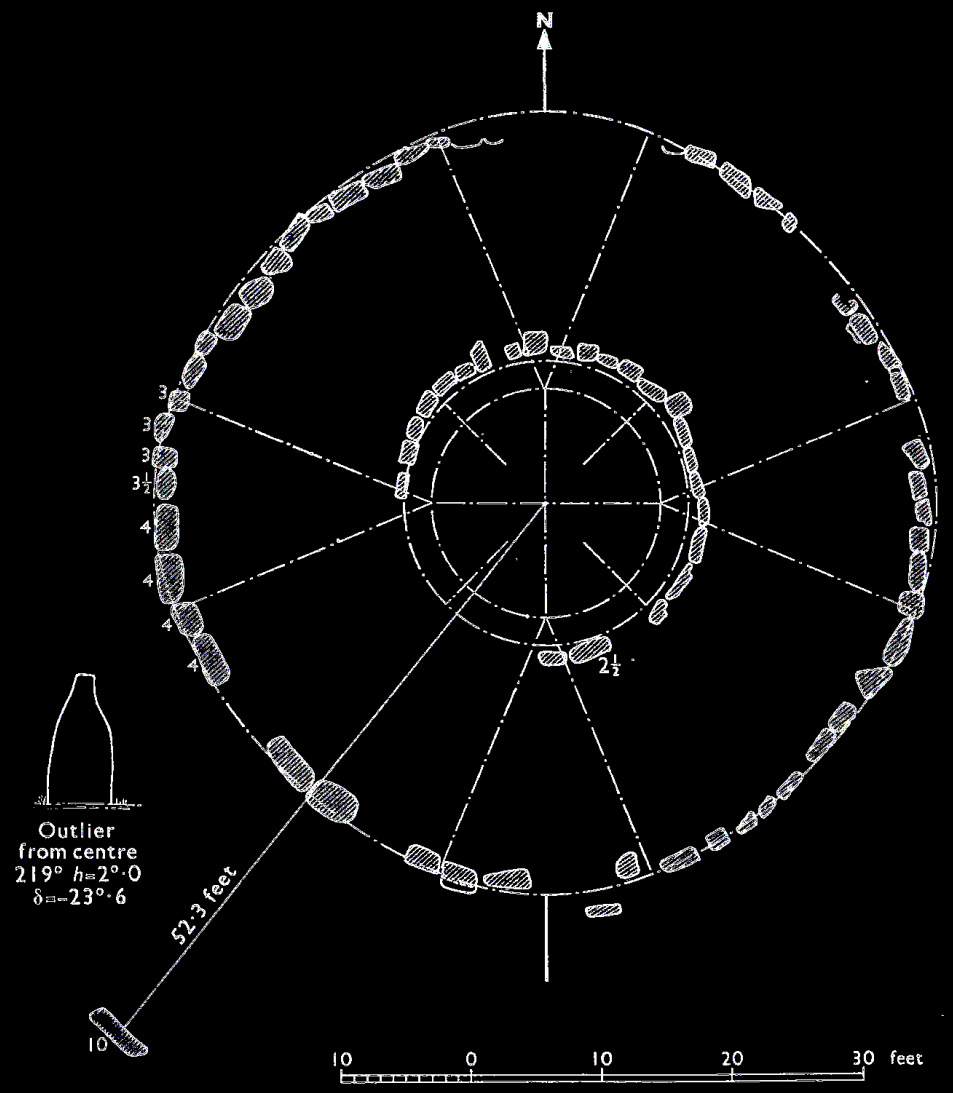
Callanish II, H 1/2; Callanish III, H 1/3; Callanish IV, H 1/4; Great Berneray, H 1/8.

Easter Delfour

Easter Delfour

Easter Delfour

Easter Delfour, B 7/10 (57° 09′, 3° 54′).

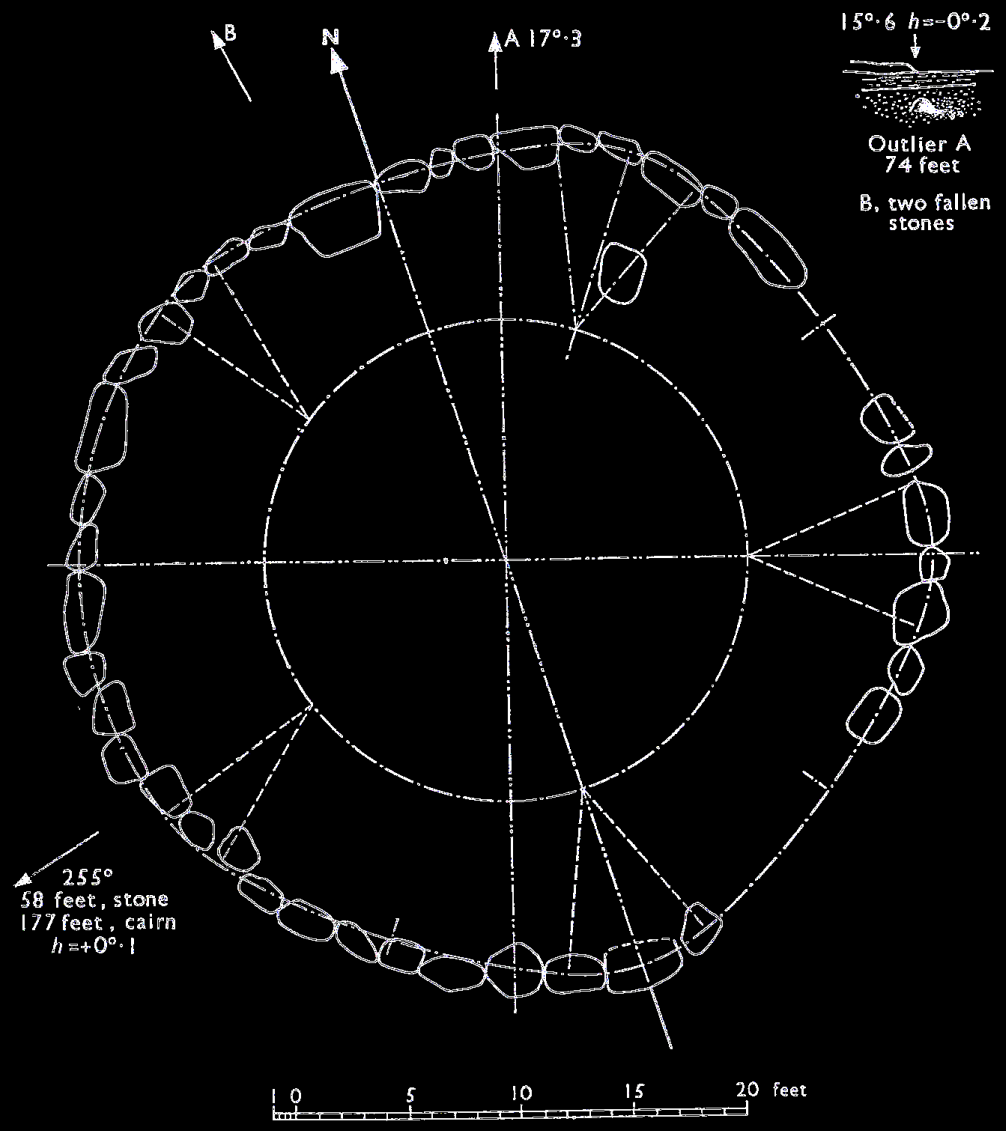


Easter Delfour, B 7/10 (57° 09′, 3° 54′). Taking maximum outer diameter = 22 MY and diameter of small circle = 6½ MY, calculation shows minimum outside diameter = 21·01 and P = 67·56

Moel Ty Uchaf

Moel Ty Uchaf

Moel ty Ucha, W 5/1 (52° 55′·4, 3° 24′·2).



Moel ty Ucha, W 5/1 (52° 55′·4, 3° 24′·2).

Postbridge

Soussons Stone Circle

Postbridge

Soussons Stone Circle

Postbridge, S 2/8.

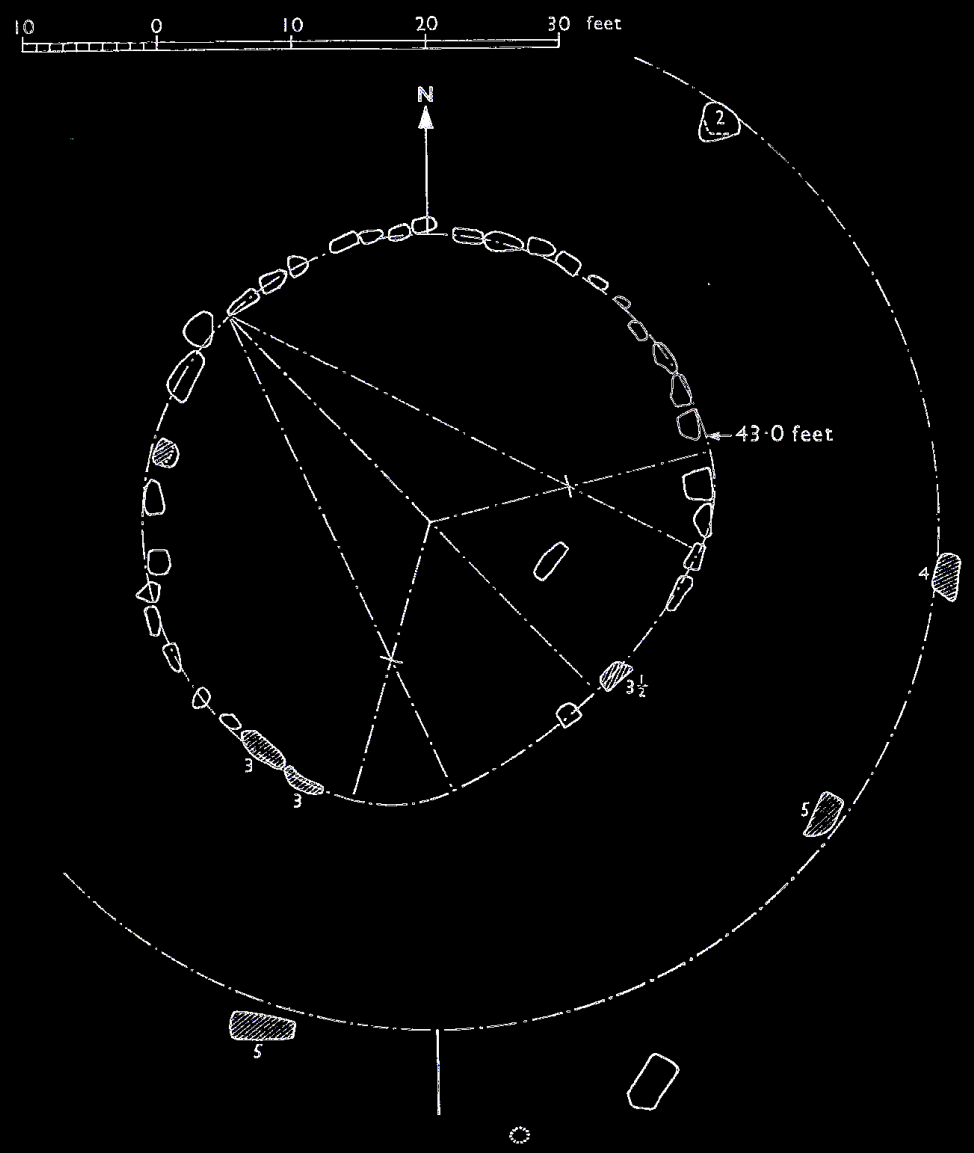
Soussons Stone Circle

Postbridge, S 2/8.

Aviemore Stone Circle

Aviemore Stone Circle

Aviemore, B 7/12 (57° 12′, 3° 50′).

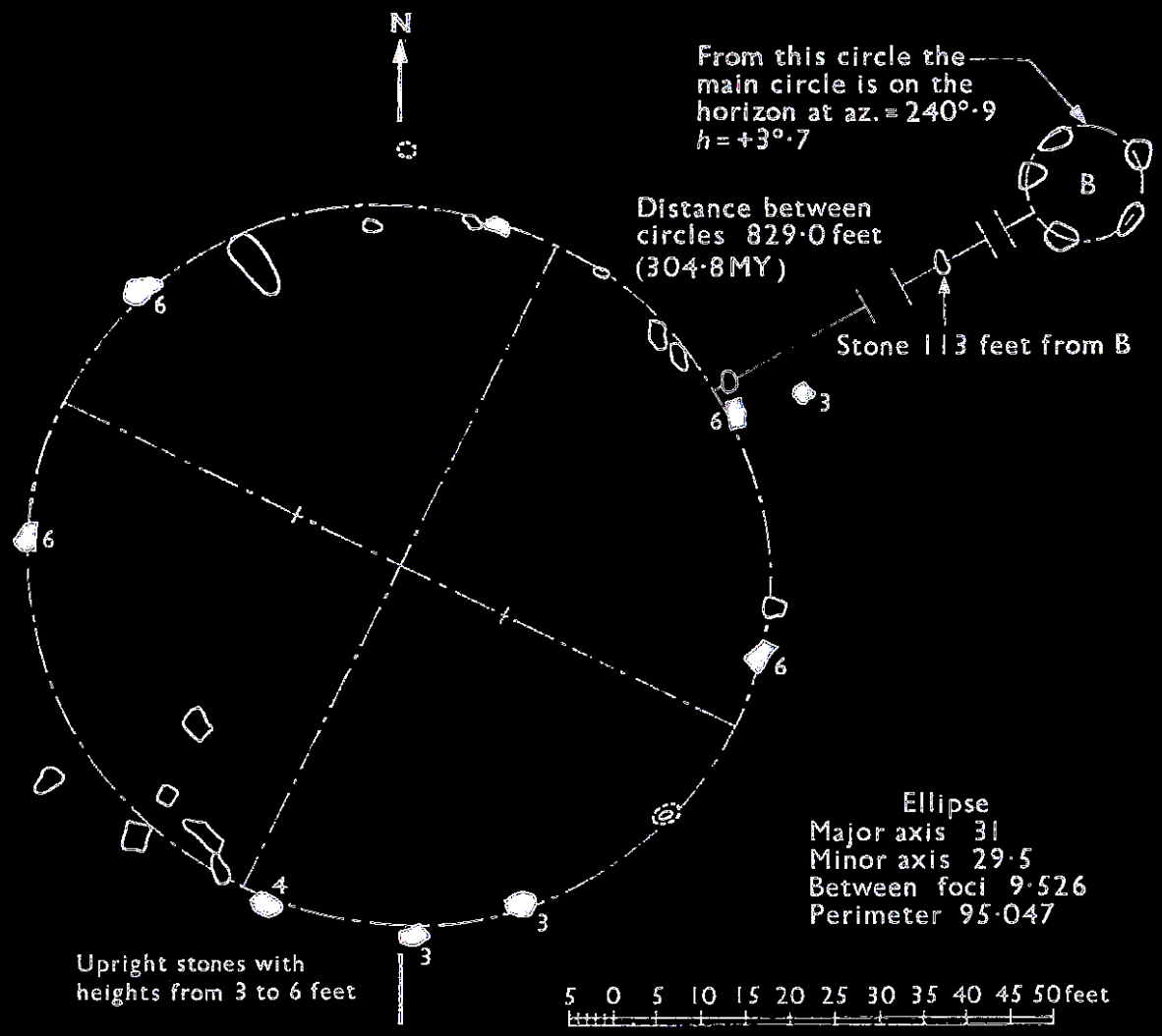


Aviemore, B 7/12 (57° 12′, 3° 50′).

Penmaen-Mawr (Cefn Coch) stone circle

Penmaen-Mawr (Cefn Coch) stone circle

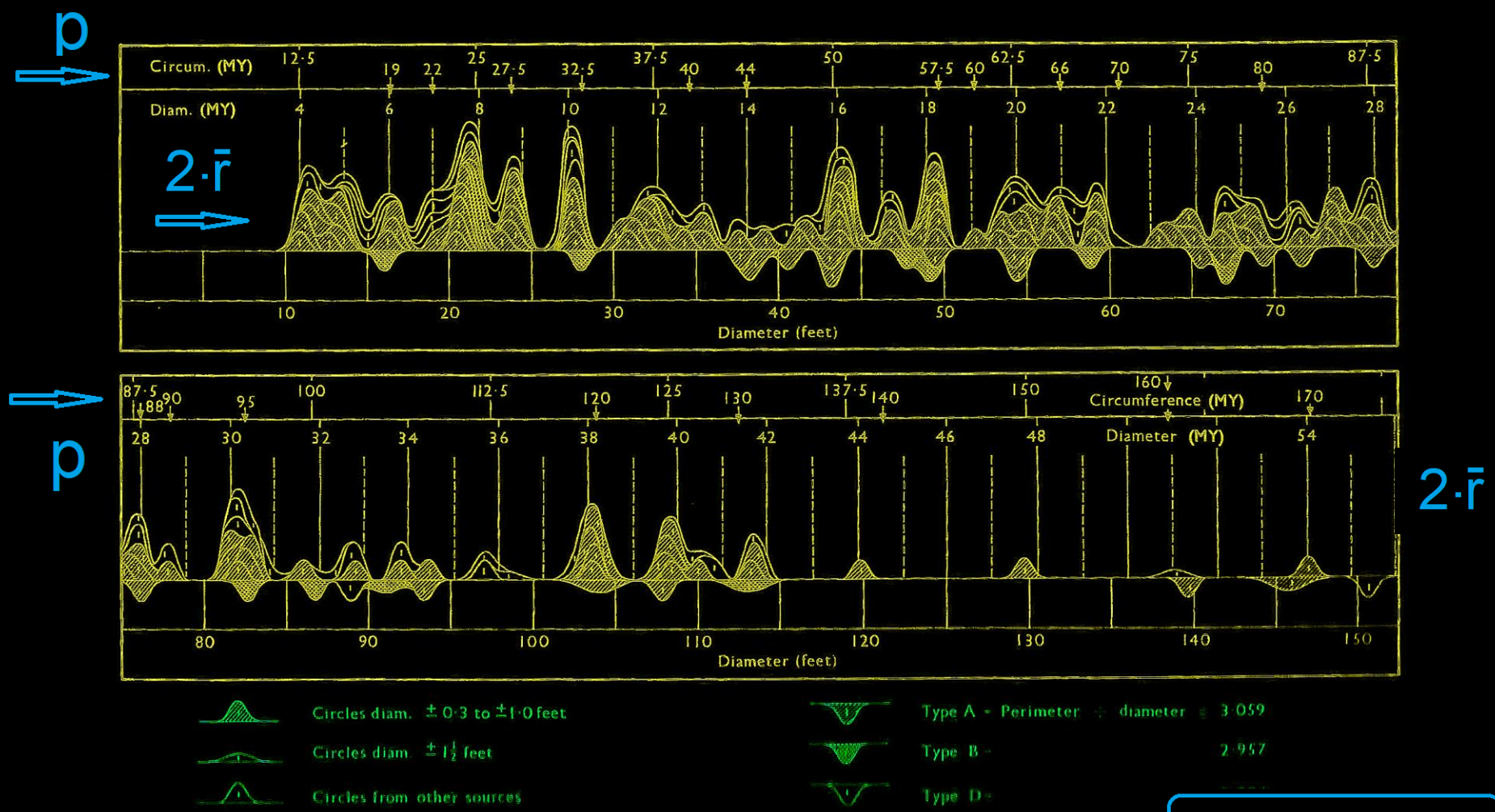
Penmaen-Mawr, W 2/1 (53° 15′, 3° 55′).



Penmaen-Mawr, W 2/1 (53° 15′, 3° 55′).

Circoli di Pietre megalitici britannici

Istogramma dei diametri



$$S = K \cdot 2 \cdot \pi \cdot \bar{r}$$

1 foot = 30.48 cm

$$I = e^{K \cdot 2 \cdot \pi \cdot \bar{r}}$$

Orientazioni Astronomiche

Site		Class	Type	Az	h	h_E	Decl.	Star	Date	Remarks
A 10/6	Stillaig	A	OSIF	325·5	0·8		+27·9	Moon		
A 11/2	Blanefield	A	A4	56·7	+7·2		+24·0±	Sun		
B 1/8	Sheldon of Bourtie	A	CO	119·7	−0·2		−16·0	Sun		
,,	,, ,,	A	CO	55·9	0·0		+17·1±	Sun		
B 1/18	Ardlair	A	CSSS	116·0	+1·1		−13·4	—		
B 1/26	Loanhead	B	CC	41·6	+0·7		+24·0	Sun		
,,	,,	A	CSS	144·0	0		−26·4	—		
,,	,,	A	CSS	139·0	0·2		−24·3	Sun		
B 2/4	Esslie (S)	A	CC	43·1	1·1		+24·1	Sun		To B 2/5
,,	,,	A	CS	306·2	0·2		+18·4±	Moon		
B 2/5	Esslie (N)	A	CC	223·1	2·7		−21·2	Sun		To B 2/4
B 3/3	Raedykes	B	CS	259·2	0·8	1·7	− 4·4	Bellatrix	1670	
,,	,,	B	CC	314·2	2·1		+23·9	Sun		
B 3/5	Kempston Hill	B	SS	231·4	0·6		−19·8	Moon		
B 7/1	Clava	A	PP	216·5	1·7		−24·3	Sun		
B 7/3	Dulnanbridge	A	AS	230·9	0·9		−19·5	Moon		
B 7/10	Easter Delfour	A	CO	219	2·0		−23·6	Sun		
D 1/7	Barbrook	A	CO	284·8	2·3		+10·5	Spica	2000	
,,	,,	B	CO	118·6	2·2		−15·1			Below grass hor.
G 1/4	Ballantrae	A	SSS	11·8	+2·7		+36·5	Deneb		
G 3/3	Laggangarn	B	CS	296	2·1		+16·2			
,,	,,	B	CS	106·2	0·7		− 9·0	Sun		Long stone
,,	,,	B	CS	105·4	0·7		− 8·5	Sun		
,,	,,	B	CS	150·3	0		−30·4	Moon		
,,	,,	B	CS	124·8	0		−19·6	Moon		
,,	,,	B	CC	133·8	0·2		−23·7	Sun		
G 3/12	Drumtroddan	A	A3	43·3	+0·4		+24·8	Sun		Re-erected (?)
G 3/13	Wren's Egg	B	—	227·5	−0·2		−23·6	Sun		To Big Scare
G 3/17	Whithorn	B	SS	254·3	+0·9		− 8·5	Sun		
G 4/1	Carsphairn	B	CO	100·4	+3·2		− 3·5			
G 4/2	The Thieves	C	SS	228	−0·4		−23·4	Sun		Axis of ring
,,	,,	C	SS	48	+6·7		+28·5	Moon		,, ,,

G 4/13	Kirkmabreck		B	SSS	5·9	3·1		+37·7			Meridian (?)
G 4/12	Cambret		A	CCC	296·7	0·2		+14·7			
,,	,,		A	CCC	116·7	5·7		−10·3	Antares	1860	
,,	,,		B	CS	254·3	4·3		− 5·4	Bellatrix	1870	Stone on skyline
G 4/14	Cauldside		A	CSSC	156·8	8·7		−23·9			
,,	,,		A	IF	59·5	0·3		+16·8	Sun		Peak
,,	,,		B	IF	78·2	+0·3		+ 6·6			
,,	,,		,,	,,	,,	,,	0·9	+ 7·2	Altair	1900	
G 6/2	Auldgirth		B	COIF	281·2	+3·3		+ 8·9	Sun		Reported fake
G 7/4	Loupin Stanes		A	CC	306·5±	5·1		+24·1	Sun		
,,	,, ,,		B	CSS	201·2	1·5		−31·0			
G 8/8	Dere Street IV		B	SSC	276·7	2·3		+ 5·4			To Dere St. II
G 8/9	Eleven Shearers		A	A18	94·7	4·1		+ 0·5	Sun		
,,	,, ,,		A	A	109·2	3·1±		− 8·3	Sun		Estimated *h*
G 9/10	Borrowston Rig		A	CSS	333·3	2·0		+31·8	Capella	1930	
G 9/13	Kell Burn		A	A	129·8	1·8		−19·7	Moon		
,,	,,		A	A	309·8	2·9		+23·5	Sun		
H 1/1	Callanish I		A	CA	9·2	1·5		+32·5	Capella	1790	
,,	,,		A	CA	10·6	1·6		+32·5	,,	,,	
,,	,,		A	AC	190·6	1·3		−30·2	Moon		
,,	,,		A	AC	189·2	1·5		−30·2	,,		
,,	,,		A	CA	270·9	0·5		+ 0·3	Sun		
,,	,,		A	CA	77·8	0·9		+ 6·9	Altair	1760	
,,	,,		B	CC	142	+0·5		−24·5	Sun?		To V
H 1/2	,,	II	B	CC	129·5	+0·3		−19·7	Moon		To VI
H 1/3	,,	III	B	CC	280	0·6		+ 5·4	Sun		To I
,,	,,	III	B	CC	249	+1·7		−10·2	Antares?	1880	To II
H 1/4	,,	IV	B	CC	89	+1·0		+ 1·0	Sun		To VI
,,	,,	IV	B	CC	135	+1·4		−22·8	Sun		To V
H 1/5	,,	V	B	CC	64	+0·7		+13·6	Sun		To VI
,,	,,	V	B	CC	332·8	+0·3		+27·8	Moon		To II
,,	,,	V	B	CC	322	−0·2		+23·8	Sun		To I
H 1/6	,,	VI	B	CC	304·9	−0·2		+16·9	Sun		To I
,,	,,	VI	B	CC	269·0	+1·0		0·0	Sun		To IV
,,	,,	VI	B	CC	244	+0·9		−12·9	Sun		To V

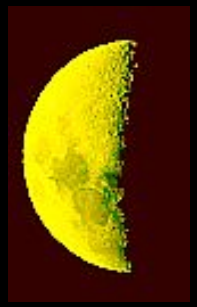
Site		Class	Type	Az	h	h_E	Decl.	Star	Date	Remarks
H 1/7	Gt. Bernera	B	IF	236	1·7		−16	Sun		Dip
,,	,,	B	IF	83			+6±			Cairn
,,	,,	B	IF	90	0·7		0·3	Sun		Cairn
H 1/10	Steinacleit	B	CO	89·1	0·7±		+0·7±	Sun		Too close
H 1/12	Clach an Trushel	B	AC	77·9	0·9		+6·8	Altair	1700	To H 1/10
H 1/14	Clach Stein	A	CC	24·8	0·4		+28·5	Moon		To H 1/15
,,	,,	A	IF	98·3	0·4		− 4·5	Sun		To Suilven
H 1/15	Dursainean	A	SC	227·9	2·0		−19·3	Moon		H 1/15 on hor.
H 2/1	Clach an Teampuill	B	CC	138	1·9		−21·8	Sun		To Hill
H 2/2	Clach Mhic Leoid	A	IF	271·0	−0·1		0·0	Sun		To Boreray
H 2/3	Borvemore	B	IF	317·2	−0·1		+22·3	Sun		To Gasgier
H 3/1	Cladh Maolrithe	A	IF	296·6	−0·2		+13·2			To Spuir Islet
H 3/2	Clach ant Sagairt	A	IF	287·6	−0·0		+ 8·8	Sun		To Boreray
H 3/3	Clettraval	C	SC	126·5	−0·1		−19·2	Moon		To H 3/11
H 3/5	Fir Bhreige	B		121·8	0±		−16·0	Sun		To H 3/9
H 3/6	Barpa nan Feannag	C	—	160·7±	0·7		−29·8±	Moon		Az. doubtful; stone on hor.
,,	,, ,,	C	CC	220·0±	0·6		−24·2±	Sun		To Tigh Chloiche
H 3/8	Na Fir Bhreige	B	SSS	288·9	2·3		+11·7	—		Perhaps reverse
,,	,, ,,	A	IF	271·8±	0·4		+ 0·8±	Sun		To H 3/6 and hill
,,	,, ,,	C	IF	253·2	1·3		− 8·2	Sun		To Marrival
H 3/9	Ben a Charra	B	IF	255·7	−0·3		− 8·1	Sun		To Deasgeir
H 3/11	Leacach an Tigh Chloiche	C	IF	304·1	−0·2		+17·0	Sun		To Haskeir
,,	Leacach an Tigh Chloiche	A	CCC	131·8	−0·3		−21·7	Sun		To H 3/20
H 3/12	Clach Mhor à Ché	A	IF	281·9	+0·4	0·9	+ 6·8	Altair	1700	To Craig Hasten
,,	,, ,,	A	IF	281·9	+0·4	0·5	+ 6·4	Procyon	1750	,, ,,
H 3/15	Claddach illeray	C	—	288·3	0·0		+ 9·3	Sun		,, ,,
H 3/18	Sornach Coir Fhinn	A	IF	303·2	+0·6		+21·6	Sun		To Cringraval
,,	,, ,,	A	IF	318·5	+0·8		+24·0	,,		To H 3/11
H 3/20	Craonaval	A	CCC	311·8	+0·6		+20·9	—		To H 3/11
H 4/2	Gramisdale (S)	C	CC	120·7	+0·3		−16·2	Sun		To Hacklet
H 4/4	Rueval Stone	A	IF	303·8	−0·1		+16·9	Sun		To Boreray
H 5/1	An Carra	C	—	315·4	−0·1		+21·9	Sun		,,
H 5/9	Pollachar Inn	C	—	227·6	−0·1		−22·1	Sun		Not visited
H 6/3	Brevig, Barra	A	A	135·0	−0·3		−23·6	Sun		
H 6/5	Berneray	C	CS	342	4·8		+35·9	Deneb		To Hecla
L 1/1	Castle Rigg	A	CO	251·5	3·2		− 8·1	Sun		Good outlier
,,	,,	A	SS	127·0	5·2		−16·0	Sun		Diameter
,,	,,	A	SS	307·0	4·6		+24·3	,,		,,
,,	,,	A	SS	157·1	2·8		−29·8	Moon		Cross axis

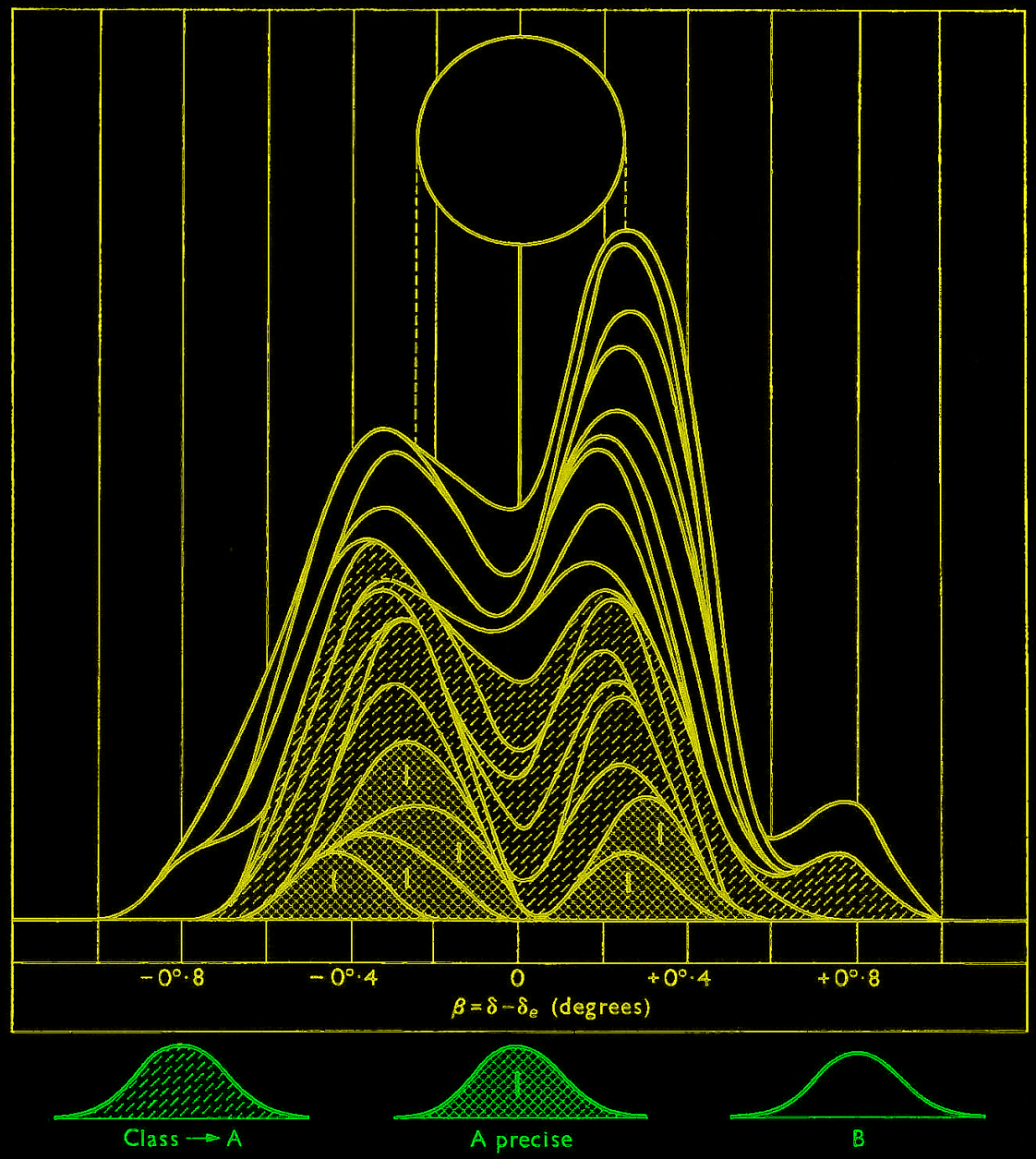
L 1/3	Sunkenkirk	B	—	128·8	+0·5		−21·5	Sun		'Entrance'
L 1/6	Burnmoor	A	CC	348·0	+7·5		+42·1	Arcturus	1900	E to A
,,	,,	A	CC	343·5	7·7		+41·5	,,	1800	E to B
,,	,,	B	CC	292·3	6·2		+17·9	Moon		
,,	,,	B	CC	311·9	+5·5		+27·6	Pollux (?)	1600	E to D
,,	,,	B	CC	243·6	−0·5		−16·0	Sun		D to C
,,	,,	B	CC	131·9	+1·6		−21·6	Sun		D to E
,,	,,	B	CC	63·6	4·3		+18·5	Moon		C to D
,,	,,	B	CC	112·3	2·6		−10·8	Antares	1700	C to E
,,	,,		CC	358·7			Meridian			C to B
L 1/7	Long Meg, etc.	A	CO	223·4	1·1		−24·2	Sun		To Long Meg
,,	,, ,,	A	CC	65·1	3·4		+16·7	Sun		To Little Meg
,,	,, ,,	B	SS	86·0	3·7		+ 5·2			Cross axis
L 1/10	Seascale	A	CO	354·0	1·0	1·3	+36·3	Deneb		Good outlier
L 1/11	Giants' Graves	A	SSS	30·8	2·1		+31·8	Capella	1920	
,,	,, ,,	B	SSS	210·8	0·5		−30·2	Moon (?)		*h* guessed
L 3/3	Five Kings	B	A4	252	4·5±		− 6·5	—		Uncertain
,,	,, ,,	A	IF	312·6	21·3		+41·1	Vega	1820	Stone on hor.
L 6/1	Devil's Arrows	B	A3	331·2±	0·7		+31·2	Capella?		Re-erected (?)
,,	,, ,,	B	A3	151·2±	0·4		−30·7	Moon?		Trees?
M 1/4	Dervaig (A)	A	A4	342·0	0·0	0·5	+31·7	Capella	1930	One fallen
M 1/5	Dervaig (B)	B	A7	334·0	0·7±		+29·9	Castor	1700	Poor *h*
,,	,,	B	A7	154·0	1·6±		−28·4	—		,,
M 1/9	Ardnacross	B	A	339±	2·0		+32·7	Capella	1750	Fallen alignment
M 2/6	Ross of Mull	A	IF	59·9	1·5		+17·1	Sun		Peak

Site		Class	Type	Az	h	h_E	Decl.	Star	Date	Remarks
M 2/8	Bunessan	B	IF	330·7	0·2		+28·6	Moon		St. on hor.
M 2/9	Ardlanish	B	CS	282·4	2·6		+ 9·0	Sun		From ring
M 2/10	Uisken	B	IF	229·6	0·3		−21·3	Sun		
M 2/14	Loch Buie	A	CO	123·4	6·8		−12·0			
,,	,, ,,	A	CO	223·6	0·4		−23·7	Sun		
,,	,, ,,	A	CO	237·0	2·1		−16·0	Sun		
,,	,, ,,	B	CO	330·8	14·1		+42·1	Arcturus	1740	
,,	,, ,,	B	CC	297·9	9·0±		+23·2±	Sun (?)		To small circle
,,	,, ,,	A	SSIF	348·5	10·3		+42·9	Arcturus	1980	Stone on hor.
,,	,, ,,	C	SS	65·7	+6·2		+18·2	Moon		
,,	,, ,,	A	OS	245·1	3·5		−10·4	Antares	1850	
,,	,, ,,	B	SCIF	324·7	16·8		+42·4	Arcturus	1900	Peak
,,	,, ,,	C	SC	150·8	5·1		−24·2	Sun		
M 4/2	Tiree S	B	IF	190·2	2·8		−30·4	Moon		Flat hill top
M 8/2	Barcaldine	A	IF	319·5	2·3		+26·6	Pollux	1930	Double stone
N 1/8	Loch of Yarrows	B	SS	343·0	0·0		+29·6	Castor	1800	Reverse?
N 1/13	Latheron Wheel	A	CO	196·1	1·0±		−29·7	Moon		
N 2/1	Learable Hill	A	A	92·8	2·4		+ 0·3	Sun		Multiple rows
,,	,, ,,	A	A	61·6	2·4		+16·6	,,		,, ,,
,,	,, ,,	A	AIF	75·0	2·2		+ 9·5	,,		Single row
P 1/1	Muthill	A	A3	57·3	1·8		+18·7	Moon (?)		
,,	,,	A	A3	237·3	5·6		−12·7	Sun		
P 1/2	Doune	A	A3	13·5±	0·5		+32·7	Capella	1760	
P 1/8	Comrie	A	SS	296·8	5·3		+18·2	Moon		
,,	,,	B	SS	116·8	2·3		−12·3	Sun		
P 1/10	Fowlis Wester	B	CS	30·9	0·6		+29·4			
P 1/13	Monzie	B	CS	305·5	4·8		+22·8			
P 1/14	Tullybeagles	B	CC	264±	3·7		− 0·5±	Sun		
P 1/19	Croftmoraig	B	CO	101·7	8·9±		+ 0·8±	Sun		Close outlier
P 2/8	Shianbank	A	CC	137·5	2·6		−21·9	Sun		
,,	,,	A	CC	317·5	0·6		+24·2	Sun		
P 2/12	Dunkeld	B	A2	310±	3·7		+24±	Sun		
P 2/17	Dowally	B	SS	106·4	6·2		− 3·9	Sun		
P 3/1	Glen Prosen	A	A4	198·1	1·9		−29·9	Moon		
P 7/2	Galabraes	B	SO	86·8	5·6		+ 6·2	Procyon	1840	

S 1/1	The Hurlers	B	A4	76·3	0·8		+ 9·0	Sun		Far uprights
,,	,, ,,	B	A4	256·3	0·5		− 8·6	Sun		,, ,,
,,	,, ,,	B	SCC	16·5	3·4		+40·7	Vega		& Arcturus
,,	,, ,,	B	CC	12·4	3·3		+41·5	Arcturus	1800	Trees (?)
,,	,, ,,	B	CC	10·1	2·4		+41·9	,,	1860	,,
S 1/2	Nine Stones	A	CA	63·5	1·5		+17·5	Moon		
S 1/5	Treswigger	B	CS	317·2	1·9		+29·3	Castor	1840	Poor
S 1/6	Leaze	A	CS	59·1	1·7		+16·3	Sun		
S 1/7	Rough Tor	B	CS	351·5	5·1		+43·7			
S 1/9	Nine Maidens	A	A9	26·1	2·0		+36·5	Deneb		Good line
S 1/11	Nine Maidens	B	CSS	332·7	0·5		+34·4			
S 2/2	Merrivale	A	CO	70·4	3·5		+14·9			
S 3/1	Stanton Drew	B	CC	232·7	1·6±		−21·2±	Sun		Trees
,,	,, ,,	B	CC	52·7	1·3±		+22·9±			,,
,,	,, ,,	B	CC	211·4	1·7±		−30·9±	Moon (?)		*h* unknown
S 5/2	The Sanctuary	A	IF	320·0	0·3		+28·4	Moon		
S 5/3	Avebury	A	CC	339·2	0·5	1·3	+36·5	Deneb		
S 5/4	Woodhenge	A	CS	31·0	0·4	0·5	+32·5	Capella	1790	
S 6/1	Rollright	A	CO	29·0	0·0	0·5	+32·7	Capella	1750	
,,	,,	A	CC	95·0	−0·2		− 3·8	Sun		The Whispering Knights
W 2/1	Penmaen-Mawr	A	CC	60·9	−0·2		+16·4	Sun		Large to small
,,	,, ,,	A	CC	240·9	+3·7		−14·1			Small to large
,,	,, ,,	B	A3	18·6		1·3	+35·5	Deneb		? reverse
W 5/1	Moel ty Ucha	B	IF	256·7	0·1		− 7·6			
,,	,, ,,	A	CS	17·3	−0·2	1·3	+36·1	Deneb		
,,	,, ,,	B	CC	298·6	0·6		+16·9	Sun		To W 5/2
W 5/2	Twyfos	A	CC	118·6	5·0		−12·7	Sun		To W 5/1
W 6/2	Rhos y Beddau	A	CA	79·1	5·0		+10·5	Spica	2000	
,,	,, ,,	B	AC	259·1	3·8±		− 3·7	Sun		
,,	,, ,,	B	CA	72·7	5·5±		+15·0			
W 8/1	Rhosygelynnen	A	A	82·1	0·6		+ 4·9	Sun		
,,	,,	A	A	262·1	2·2		− 3·3			

Site		Class	Type	Az	h	h_E	Decl.	Star	Date	Remarks
W 9/2	Gors Fawr	A	A4	49·6	1·3		+24·3	Sun		
,,	,, ,,	A	A4	229·6	−0·2		−24·2	Sun		
W 9/4	Castell-Garw	A	CCSS	214·3	0·0±		−31·2±	Moon (?)		Trees
W 9/5	St. Nicholas	A	CSS	71·0	0·3		+11·4	—		
W 9/7	Parc-y-meirw	A	A4	301·4	−0·4		+17·8	Moon		
W 11/1	Saeth-maen	B	A8	83·5	3·6		+ 6·6	Procyon	1660	
W 11/2	Y Pigwn	B	CC	53·3	0·4		+21·5	Sun		Stone on horizon
,,	,,	B	CC	233·3	1·0±		−21·0±	,,		
,,	,,	B	CS	131·0	0·9		−23·5	,,		
W 11/3	Maen Mawr	A	CO	335·2	4·3		+38·0			
,,	,, ,,	B	CS	4·5	4·6		+42·4	Arcturus	1950	
W 11/4	Usk River	B	CO	285·0	1·5		+10·1	Spica	1900	
,,	,, ,,	B	A3	78±	3·3		+ 9·7±	Sun		
,,	,, ,,	A	CC	295·3	1·2		+16·0	Sun		
,,	,, ,,	A	CC	115·3	2·9		−13·1	Sun		
W 11/5	Ynys Hir	B	IF	126·5	0·2		+21·7	Sun		Vis. unchecked
W 8/3	Four Stones	B	COO	67·5	0·9		+13·9			Distant outliers





Distribution of suspected lunar lines plotted as observed declination minus expected declination.