

## POSSIBLE ASTRONOMICAL ORIENTATIONS OF DOLMENIC TOMBS IN NORTH SARDINIA

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The existence of megalithic burial monuments in Sardinia has been known for many years. However, only in recent years has research been started on the preparation of catalogues regarding the distribution of these burial sites in the various parts of Sardinia.

This has led to the exploration and excavation of a certain number of tombs and attempts to classify them on a chronological basis. In fact, although the typology of these monuments has been defined through work performed in the past, many problems and uncertainties still remain as concerns their accurate dating with carbon-14. This is especially true of tombs dating back to the Neolithic and up through the early Bronze Age (ca. 3500-1500 B.C.). For tombs belonging to the more recent period of the Nuraghic culture (c. 1500-500 B.C.), the so-called "tombe di giganti", dating criteria based on the evolution of architectural details of a certain reliability have been used.

For several years now measurement campaigns have been conducted on the orientations of these "tombe di giganti". Such measurements have pointed out the fact that the orientations of these burial monuments are not casual, but appear to correspond to certain specific directions on the natural horizon.

Approximate dating of these tombs has also allowed the attribution of possible astronomical meanings to these orientations<sup>1</sup>.

To verify whether or not the orientations found for the "tombe di giganti", which are associated with rites and funeral cults belonging to the various phases of the Nuraghic Age, are in some way confirmed by the probable orientations of older graves going back to the Neolithic, the Copper and the early Bronze Age, the Archaeoastronomical Laboratory of the Astronomical Observatory of Cagliari has organized several measurement campaigns.

The oldest burial monuments known in Sardinia are simple dolmens and the elongated ones (corridor dolmens) which were later supplanted by the so-called gallery graves of the *allée couverte* type<sup>2</sup>. A certain number of burial monuments, known as

"dolmenic cysts", have also been attributed to the late Neolithic. The substantial difference between dolmens and "*Dolmenic cysts*" lies in the fact that the former have an aperture in one of the walls, while the latter, which are also formed by vertical slabs of stone fixed to the ground and generally rectangular, are apparently without an opening. These tombs, which usually contained only one body, once closed were covered with circular mounds of earth and gravel and bordered by stones stuck vertically into the ground, the vestiges of which are still quite evident (see Fig. 1).

Among the oldest tombs, which have been attributed to the late Neolithic, there are also some smaller ones, usually containing only one skeleton, covered with one or two shaped monoliths (see Fig. 2) known as *dolmenic graves*.

At present we know of roughly a hundred megalithic tombs, which go from the simple dolmen to dolmenic graves and up the gallery tombs of the *Allée couverte* type. These are found mostly in the central and northern areas of Sardinia.

Finally, to the pre-Nuraghic period are attributed some one thousand hypogeic graves, some natural, but most hollowed out of rock, that take the name of "rock-cut tombs" or, in the Sardinian language, "*domus de janas*" (literally "witch's house"), which are found in all parts of Sardinia.

Dating of the different burial monuments and cultures is still rather uncertain. In any case, **Table 1** gives a chronological outline of cultures present in Sardinia from the end of the Neolithic to the Nuraghic Age as proposed by Atzeni, Contu and Ferrarese Ceruti according to carbon-14 dating and based on the bristlecone-pine dendrochronological recalibration of radiocarbon dates<sup>4</sup>. An analogous chronology, but with some differences in the cultures and dates, has been supplied by Lewthwaite<sup>5</sup>.

### 2. Orientation of the tombs.

In the course of a measurement campaign, which was conducted between 13th and 16th April 1992, the orientations of 27 burial monuments, 26 of which



represented by dolmens, dolmenic graves, dolmenic cysts and some gallery graves, presumably of the *allée couverte* type, all belonging to the pre-Nuraghic period, and one nuraghic "tomba di giganti" were determined. The orientation of one "*domus de janas*" was also established.

The list of the burial monuments and their location, the township in whose territory they are located and the latitude of their sites are given in **Table 2**. This table also indicates the kind of grave and the culture to which they have been attributed in archaeological literature. Beside the grave, its condition at the time of measurement is expressed as: good (G), fairly good (FG), poor (P), very poor (VP). The classification of the type of tomb is made difficult by the amount of tampering, re-use and vandalism that they have undergone over the centuries. Furthermore, very few of these dolmens have been excavated systematically with scientific criteria by qualified archaeologists. This makes it difficult even to attribute them to the different pre-Nuraghic cultures.

Tomb 1, found in the township of Olbia, and tombs 2 to 6, in the township of Buddusò<sup>6</sup>, belong to the Bonannaro culture, which covered the north of Sardinia (Sassari and northern Logudoro) and the extreme south of the island (southern part of the Cagliari area)<sup>7</sup>. It is to be observed that tomb 3 appears to have been completely rebuilt at the time of the Roman domination.

Two gallery dolmens of the *allée couverte* type (tombs 26 and 27) found at Alà dei Sardi<sup>8</sup> belong to *facies A* of the Bonannaro culture (ca. 1800-1500 B.C.), which preceded *Facies B* (c. 1500-1200 B.C.), which in turn gave way to the Nuraghic culture. Gallery tombs 16 and 17<sup>9</sup> have been assigned to the beginning of *Facies B* of the Bonannaro culture. The first of these two tombs is composed of an original cell of the *allée couverte* type, just slightly less than four meters in length<sup>10</sup>, to which was added in nuraghic times a long cyst below ground level (tomb 15), incorporated into the pre-existing grave and having a monolithic entrance stele decorated with a horizontal rib in relief dividing it into two large frames. It also had a large exedra<sup>11</sup> (Figs. 3 and 4). We also attributed to the Bonannaro B culture the "tomba di gigante" (tomb 18) because of its being in the vicinity of two other megalithic monuments of the middle Bronze Age<sup>12</sup>.

One of the most ancient of Sardinia's cultures belonging to the late Neolithic and early Copper Age is the so-called San Michele or Ozieri culture, vestiges

of which have been found in all parts of the island. Dolmenic tombs 19 to 24, in the territory of the township of Berchidda<sup>13</sup>, have been assigned to that culture.

Giovanni Lilliu hypothesized a distinct culture characteristic of the Gallura area, in north Sardinia, as appearing towards the end of the Neolithic, together with the San Michele culture. He called this the *megalith-circle*, or Arzachena culture, from the township of the same name in the province of Sassari, in whose territory the largest number of megalithic constructions have been found. Lilliu attributed dolmens 7 to 10, situated in the township of Luras<sup>14</sup>, and the dolmenic cysts in the cemetery of Li Muri (Arzachena)<sup>15</sup>, to this culture. More recently, however, the tendency has been to consider the Li Muri tombs, and similar ones spread over the Arzachena area, as representing the Gallura facies of the San Michele (Ozieri) cultural horizon<sup>16</sup>.

The orientations of the directions of the axes and the entrance stelae of the 26 tombs listed above were determined through solar observations with a Wild T3 theodolite. Observed astronomical azimuths,  $A$ , counted starting from the north and proceeding clockwise, are given in **Table 3**. In the same table, we indicated beside the azimuths the magnetic azimuths  $a_k$  found with the use of a precision compass.

Owing to adverse weather conditions at the time of the measurements, magnetic azimuths were determined only for tombs 19, 20, 21, 26 and 27. Altitude  $h$  of the natural horizon in the observed direction of the entrance stele was associated with each observed azimuth.

From the difference ( $A - A_k$ ) found for tombs belonging to the four large areas examined here, the respective calculated mean values,  $M$ , with their standard deviations, were found:

	$M$		$E_M$
Olbia-Buddusò	-0°.9	±	0.4
Luras	-1°.5	±	0.6
Arzachena	+0°.8	±	0.7
Berchidda	-1°.6	±	1.0

The overall mean weighted value of differences ( $A - A_k$ ) = -0°.9 is largely to be explained by the magnetic declination, which in northeastern Sardinia is about -0°.8. The systematic error of the compass used for measuring magnetic azimuths is thus about -0°.1. As can be seen, this error is far below accidental errors depending both on uncertainty in measuring magnetic azimuths and on the presence of local



magnetic anomalies. These errors, given by the products of  $E_M(n)^{1/2}$ , where  $n$  represents the number of tombs belonging to each of the four large areas mentioned previously, are, in fact, on the average  $\pm 1^\circ.5$ .

In determining the orientations of tombs 7, 8, 11, 15 and 24, several independent measurements were made. This allowed us to calculate the standard deviations of the mean observed azimuths,  $A$ , which is  $\pm 1^\circ.8$ , and the root-mean-square error of each single measurement of observed azimuths, which instead amounts to about  $\pm 2^\circ.7$ .

### 3. Discussion of results.

The orientations of the axes and apertures of the tombs taken into consideration are for the most part within the south-west quadrant, which is in good agreement with the orientations of the "tombe di giganti" of the Nuraghic Age as determined in the course of previous measurements campaigns<sup>17</sup>. Only four directions are in the north-east quadrant and the same number are found in the south-west quadrant. This circumstance can be considered a convincing argument for the orientations' not being wholly casual.

Should this be the case, we may attempt to discover the reasons that led communities belonging to cultures in northern Sardinia between the end of the Neolithic and the beginning of the Bronze Age to orient their burial monuments in a systematic way.

The search for these reasons is, however, extremely difficult at present. On the specific problem of the existence of burial cults and rites in Sardinia's pre-Nuraghic period to which to attribute these orientations, archaeological literature is in fact particularly scanty and inconsistent from the documentary viewpoint<sup>18</sup>. Thus, attempts to discover the existence of any other documentary elements that may exist by other means will not appear to be completely useless.

Since it does not appear to be unreasonable to suppose that one of the reasons that led to the systematic orientation of burial monuments was the presence of naturalistic rites and cults connected with the rising and setting of celestial bodies, we were tempted to see if the azimuths of the directions of the axes and entrances of the dolmenic tombs considered here correspond, either wholly or in part, to the rising or setting of the most significant celestial bodies (Sun, Moon, stars or asterisms with the brightest stars).

The element of greatest uncertainty in this

research is given, as is known, by the poor accuracy and reliability of the dating of the tombs. Taking as the probable dates of the burial monuments considered here those desumed from archaeological documents, which are given in **Table 2**, the azimuths of the rising (or setting) of Sun and Moon at their maximum elongations and those of the rising (or setting) of the brightest stars visible on the natural horizon from the burial sites were calculated<sup>19</sup>. The calculated azimuths,  $A_c$ , closest to those measured are given in **Table 3**. In the same table are indicated the possible celestial objects that rose (or set) on the natural horizon at the epochs indicated in correspondence to calculated azimuths  $A_c$ .

In the more uncertain cases, two more possible celestial targets are indicated. With a few exceptions, calculated azimuths  $A$  that do not differ by more than  $10^\circ$  from those observed,  $A$ , are underlined. **Figure 5** supplies a representative picture of the orientations of the burial monuments considered and the possible celestial targets they were oriented towards.

An examination of these orientations allows us to highlight some characteristics that we consider worth noting.

**Table 4** gives the distribution of the dolmenic graves as a function of their probable (or presumed) belonging, on the basis of archaeological dating criteria, to the Bonnannaro or San Michele pre-Nuraghic cultures. From the distribution of the tombs we can observe:

- (i) most of the tombs attributed to the Bonnannaro culture (Bronze Age) appear to be oriented in the direction of the rising of the Moon in correspondence to its minimum negative declination ( $-\epsilon+i$ );
- (ii) tombs considered as belonging to the San Michele or Arzachena cultures (late Neolithic) present, on the contrary, three possible preferential directions:
  - (a) equinoctial and meridian directions, probably corresponding to the Sun's rising at the equinoxes and (probably) to the passage of the Sun into the meridian (at the solstices?), and the direction of the Sun's rising at the summer solstice;
  - (b) the apparent directions of the rising (and setting) of the Moon at the maximum ( $-\epsilon-i$ ) and minimum ( $-\epsilon+i$ ) negative declinations;
  - (c) directions apparently corresponding to the rising of some of the brighter stars (or asterisms) of the constellations of Centaurus, the Southern Cross and Lyra.

These final considerations are, as has been said,



based upon still uncertain dating and on hypotheses that require confirmation from other sources. Contributions coming from research in the field of paleoethnography, ethnography and archeology therefore appear to assume an essential role in arriving at a correct interpretation of certain facts, such as the existence of systematic orientations

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present in prehistoric tombs belonging to different Sardinian cultures and revealed through archaeoastronomic determinations.

New measurements of orientations of tombs from the Nuraghic period also appear to be necessary to confirm, or deny, results acquired up to now.

Series, Series 244, 1985, 220-251.

<sup>6</sup> Cf. G. LILLIU, *La civiltà dei sardi*, 1983, 166-182.

<sup>7</sup> G. LILLIU, *ibid.*, 175-176.

<sup>8</sup> G. LILLIU, *ibid.*, 170. For the attribution of tombs 20 and 27 to the category of gallery dolmens, see: E. CASTALDI, "Tombe di giganti nel Sassarese", *Origini*, III, 1969, 236. Cf., also: G. MELONI, *I dolmen della Sardegna e loro correlazioni strutturali e culturali con i dolmen del mediterraneo occidentale*, Dissertation (supervisor G. Lilliu). Università di Cagliari, 1969-70, 61-65.

<sup>9</sup> Concerning tomb 17, consult: E. CASTALDI, *cit.* in the previous note, 136. See also: E. CASTALDI: "La tomba di gigante di Coddù Vecchiù", in: *Monumenti archeologici: Arzachena*, Sassari, 1984, 44-48.

<sup>10</sup> Cf., E. CASTALDI, "La tomba di gigante di Li Longhi", in: *Monumenti archeologici: Arzachena*, *cit.*, 42.

<sup>11</sup> Cf., *ibid.*, 37-41.

<sup>12</sup> Cf., G. LILLIU, *cit.* in Note 6, 327-28. M. LUISA FERRARESE CERUTI, "Il tempietto di Machittu", in: *Monumenti archeologici: Arzachena*, *cit.*, 64-71.

<sup>13</sup> For the attribution of the tombs situated at Abealzos, consult G. LILLIU, *cit.* in Note 6, 62. For tombs 22, 23 and 24, cf. *ibid.*, 62, 103-104 and 104-105 respectively.

<sup>14</sup> Cf., G. LILLIU, *ibid.*, 36 and 102.

<sup>15</sup> Cf., G. LILLIU, *ibid.*, 30-35.

<sup>16</sup> Cf., E. CASTALDI, "La necropoli di Li Muri", in: *Monumenti archeologici: Arzachena*, *cit.* in Note 9, 36. See also: A. ATZENI, E. CONTU, M. LUISA FERRARESE CERUTI, *cit.* in Note 4, 450.

<sup>17</sup> See bibliography given in Note 1.

<sup>18</sup> One of the few contributions to the study of burial cults in pre-Nuraghic Sardinia was that of Giovanni Lilliu (cf., G. LILLIU, "Religione della Sardegna pre-nuragica", *Boll. di Paletnologia Italiana*, XI, Vol. 66, 1957, 7-96). In this work, Lilliu, although he recognized the existence of a pre-Nuraghic religious-funerary ritual on the basis of few documentary elements, furnished only conjectural elements of a general nature. In this ritual, however, manifestations connected with the concepts of "regeneration" and "resurrection" appear to prevail within the framework of animistic-naturalistic burial cults (cf., *ibid.*, 16-59).

<sup>19</sup> In calculating azimuths, the tables compiled by Anthony Aveni were used, starting from the Ephemerides of the azimuths of the Sun's and Moon's rising and setting at the maximum elongations, and of the brightest stars (about twenty).

<sup>1</sup> Cf. E. PROVERBIO, G. ROMANO, A. AVENI, "Astronomical orientation of five megalithic tombs at Madau, near Fonni, in Sardinia", *Archeoastr. Suppl. to JHA*, vol. 11, 1987, S55-S65; E. PROVERBIO, G. ROMANO, A. AVENI, "Astronomical orientation of 'Tombe di Giganti' in Barbagia (Sardinia)", *Coll. Inter. Archeologia e Astronomia*, in: *Rivista di Archeologia, Supplem.* 9, 1989, 52-59; E. PROVERBIO, "New evidence concerning possible astronomical orientations of 'Tombe di Giganti' in Sardinia", *Proceed. Archaeoastronomy in the 1990s* (CLIVE L.N. Ruggles, Ed.) in: Longhborough, 1993, 324-331; E. PROVERBIO, "New observations of possible astronomical orientations of burial monuments in Sardinia", *Proceed. Conference on Archaeoastronomy: Current problems and future of archaeoastronomy* (in press).

<sup>2</sup> The first dolmen discovered in Sardinia was reported by Taramelli only in 1906 (cf., A. TARAMELLI, "Dolmen Sa perda e s'altare nel Comune di Birari in provincia di Cagliari", *Boll. Paletnologia Italiana*, 1906, 268, and ff).

<sup>3</sup> Cf. V. SANTONI, "Note preliminari sulle grotticelle artificiali funerarie in Sardegna", *Archivio Storico Sardo*, Vol. XXX, 1976, 3-49.

<sup>4</sup> E. ATZENI, E. CONTU, M. LUISA FERRARESE CERUTI, "L'età del rame nell'Italia insulare: la Sardegna", *Rassegna di Archeologia*, 7, 1988, 441-467.

<sup>5</sup> J. LEWTHWAITE, "Colonialism and Nuraghisism", *BAR Inter.*

**TABLE 1**

Chronolgy of Sardinian Culture.

<b>Radiocarbon</b>	<b>B.C. Cal.</b>	<b>Age</b>	<b>Culture</b>
3000-2400	3500-2800	Late Neolithic	Ozieri (San Michele)
2400-1700	2800-1900	Copper Age	Monte Claro (Filogosa, Abealzos), Campaniforme (Beaker)
1700-1500	1900-1600	Bronze Age	Bonnannaro
1500-500	1500-500	Late Bronze and Iron Ages	Nuraghic

TABLE 2

Localities, typology, cultures and chronology of pre-nuraghic tombs.

N°	Township	Locality	Lat. (N)	Type of tomb	Tomb condition	Presumed culture	Presumed Date (B.C.)
1	OLBIA	Casteddu o Pedres (Su Monte 'e s'Ape)	40°.9	"tomba di gigante", gallery type	G	Bonnannaro A	1800
2	BUDDUSÒ	Santu Miali	40°.8	dolmen	FG	Bonnannaro (A?)	1800-1500
[3]	BUDDUSÒ	Santu Miali	40°.8	(rebuilt tomb)	P	Roman epoc	1800-1500
4	BUDDUSÒ	Santu Miali	40°.8	dolmen	FG	Bonnannaro A?	1800-1500
5	BUDDUSÒ	Santu Miali	40°.8	dolmen	VP	Bonnannaro A?	1800-1500
6	BUDDUSÒ	Santu Miali	40°.8	dolmen	VP	Bonnannaro A?	1800-1500
7	LURAS	Ladas	40°.9	dolmen	P	Arzachena	2000?
8	LURAS	Ciuledda	40°.9	dolmen	FG	Arzachena	2500-2300
9	LURAS	Alzaledda	40°.9	dolmen	P	Arzachena	2500-2300
10	LURAS	Billella	40°.9	dolmen	FG	Arzachena	2500-2300
11	ARZACHENA	Li Muri A5	41°.1	dolmenic cyst	FG	San Michele (Arzachena)	2500?
12	ARZACHENA	Li Muri B1	41°.1	dolmenic cyst	G	San Michele (Arzachena)	2500?
13	ARZACHENA	Li Muri C2	41°.1	dolmenic cyst	P	San Michele (Arzachena)	2500?
14	ARZACHENA	Li Muri D3	41°.1	dolmenic cyst	VP	San Michele (Arzachena)	2500?
15	ARZACHENA	Li Longhi 1	41°.1	tomba gigante w/ underground cyst	FG	Nuraghic	1200?
16	ARZACHENA	Li Longhi 2	41°.1	tomba gigante gallery type	FG	Bonnannaro B?	1500?
17	ARZACHENA	Coddu Vecchiu	41°.0	tomba gigante gallery type	G	Bonnannaro B	1500?
18	ARZACHENA	Malchittu	41°.1	tomba gigante	P	Nuraghic	1200?
19	BERCHIDDA	Abealzos A	40°.8	dolmenic tomb	P	San Michele?	2500?
20	BERCHIDDA	Abealzos B	40°.8	dolmenic tomb	VP	San Michele?	2500?
21	BERCHIDDA	Abealzos C	40°.8	corridor dolmen?	P	San Michele?	2500?
22	BERCHIDDA	Sant'Andrea	40°.8	dolmenic tomb	P	San Michele?	2500?
23	BERCHIDDA	Mesu Serra	40°.8	dolmen?	P	San Michele?	2500?
24	BERCHIDDA	San Salvatore di Nulvara A	40°.8	dolmenic tomb?	P	San Michele?	2500?
[25]	BERCHIDDA	San Salvatore di Nulvara B	40°.8	domus de janass	P	?	1800?
26	ALÀ DEI SARDI	Dolifichima I	40°.7	gallery dolmen	VP	Bonnannaro A?	2000?
27	ALÀ DEI SARDI	Dolifichima II	40°.7	gallery dolmen	VP	Bonnannaro A?	2000?



TABLE 3

Observed astronomical (A) and magnetic ( $A_k$ ) azimuths of the tombs compared with the calculated astronomical azimuths of possible celestial targets ( $A_c$ ).

N°	A (degrees)	$A_k$ (degrees)	h (degrees)	$A_c$ (degrees)					possible celestial targets	Declin.
				2500	2000	1800	1500	1200		
1	133.2	133.3	1°.2			132.2			Moon	-ε-i
2	115.2	116.5	7.5			124.1	124.1		Moon	-ε+i
[3]		260.	0.?				245?		(set) Moon?	(-ε +i)?
4	116.8	118.5	4.9			120.8	120.8		Moon	-ε+i
5	109.7	111.	6.7			123.0	123.0		Moon?	-ε+i
6	118.1	118.	2.0			117.5	117.5		Moon	-ε+i
						124.8	124.8		Sun?	
7	173.0±1.8	175.5	4.2		180.0				(Sun) Meridian orientation	
8	128.9±2.3	131.5	2.8	134.5					Moon	-ε-i
9	150.4	151.	3.6	135.6					Moon?	-ε-i
10	24.3	24.5	6.3	57.1 37.4 32.4					Moon? α Lyr (Vega)? α Boo (Arturo)?	+ε+i
11	95.3±0.4	96.5	6.5	90.0					(Sun) Equinoctial orientation	
12	181.1	180.	0.0	180.0					(Sun) Meridian orientation	
13	166.0	167.0	0.0	130.5 156.0 162.5					Moon? α Cen α Cru	(-ε-i)?
14	202.8	200.	0.5	226.5 204.0 197.5					(set) Moon? (set) α Cen (set) α Cru	(-ε-i)?
15	108.5±2.2	106.5	0.0					115.3	Moon	-ε+i
16	112.2	112.	0.0				115.3		Moon	-ε+i
17	94.6	90.	2.1				90.0		(Sun) Equinoctial orientation	
18	67.2	67.5	1.8					67.1	Moon	+ε-i
19		90.	-3?	90.0					(Sun) Equinoctial orientation	
20		115.	-2?	113.4					Moon	-ε+i
21		55.	-2?	47.6 55.2					Moon Sun	+ε+i +ε
22	242.5	242.	-1.	245.5					(set) Moon	-ε+i
23	227.5	230.	-0.5	230.3					(set) Moon	-ε-i
24	152.2±2.4	155.	0.0	130.5 152.0 157.0					Moon? α Cen α Cru	-ε-i
[25]		33.5	3.?			50.4 35.2			Moon? α Lyr (Vega)	+ε+i
26		118.5±1.9	0.?		115.4				Moon	-ε+i
27		117.5	0.?		115.4				Moon	-ε+i

**TABLE 4**

Distribution of the orientations of the dolmenic graves and their possible astronomical targets depending on their (probable) dating or appurtenance to pre-Nuraghic cultures.

Culture	Tombs	Possible target
San Michele (Arzachena)	(11), 19	Equinoctial
	7, (12)	Meridian
	(8), (9), 23	- $\epsilon$ -i
	20, 22	- $\epsilon$ +i
	21	+ $\epsilon$
	10	$\alpha$ Lyr?
	13, (14), 24	$\alpha$ Cen, $\alpha$ Cru
Bonnannaro	2, 4, 5, 6, 16, 26, 27	- $\epsilon$ +i
	1	- $\epsilon$ -i
	17	Equinoctial
Nuraghic	15	- $\epsilon$ +i
	18	+ $\epsilon$ -i
Recent nuraghic	3	(- $\epsilon$ +i)?



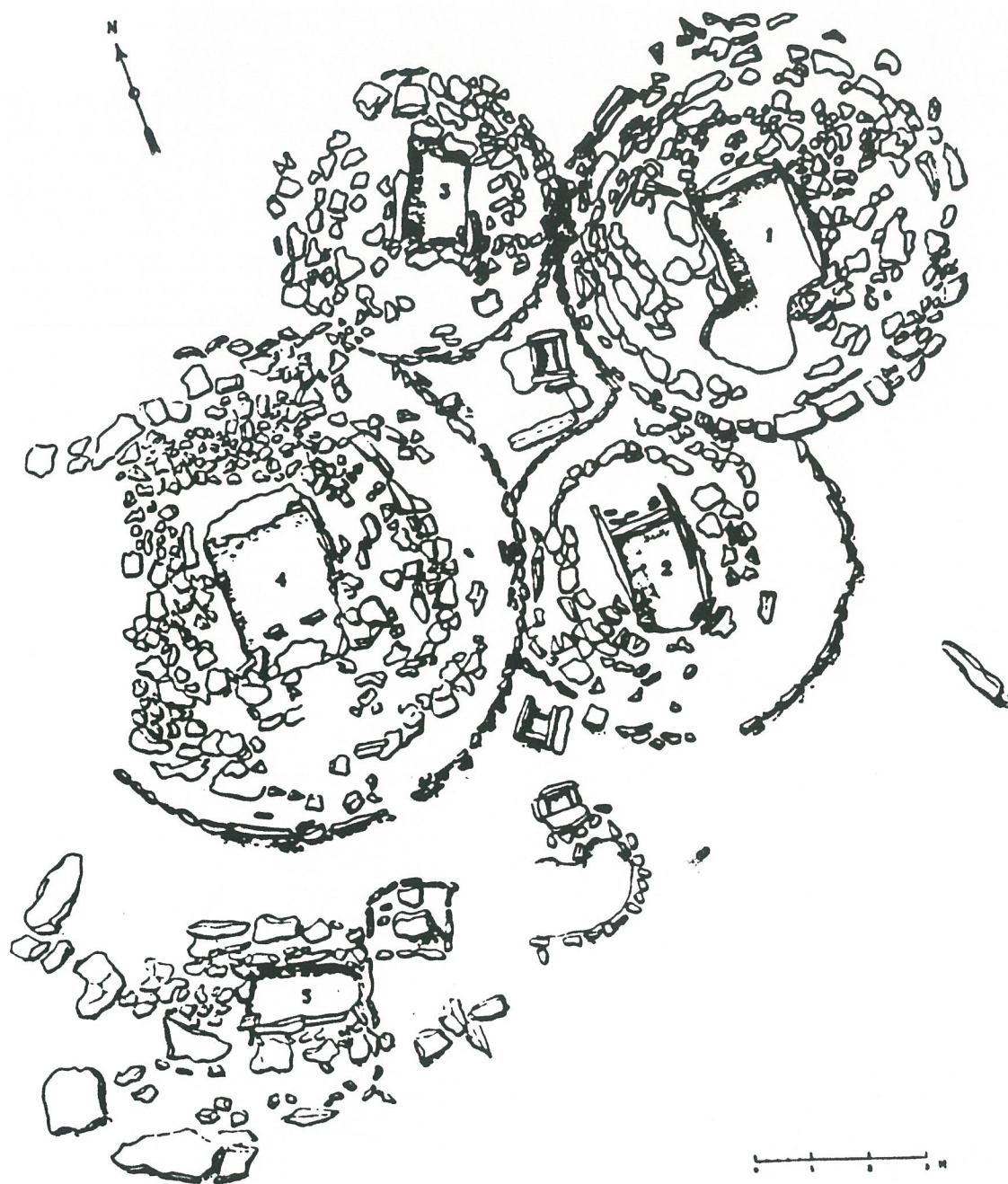


Fig. 1 - The Li Muri necropolis (Arzachena) with the vestiges of the characteristic "dolmenic cysts". In the centre at the top and the bottom and to the right tombs 14, 13 and 12 respectively of Table 2 are visible. Of the completely destroyed tomb on the left it was impossible to determine the orientation. Tomb 11, with an equinoctial orientation, is at the bottom and outside the figure.



Fig. 2 - Dolmenic grave with its characteristic shaped roof (about 100 x 70 cm in size) attributed to the late Neolithic (Ozieri culture) with an equinoctial orientation. The tomb contained only one skeleton with the head turned towards the east.

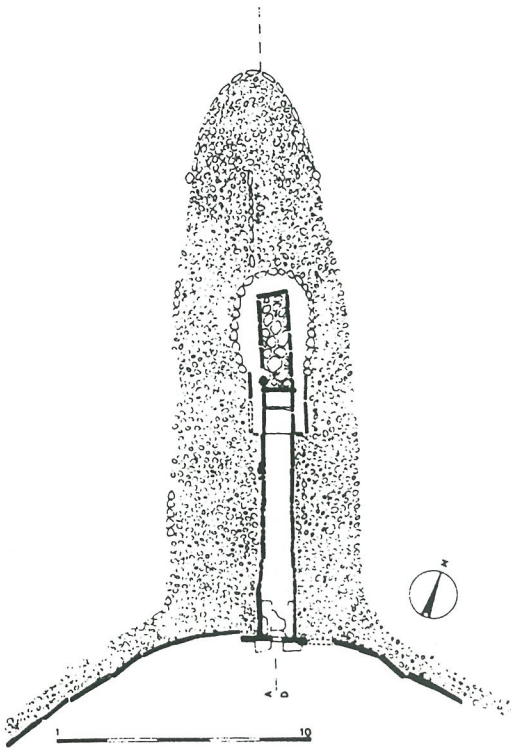


Fig. 3 - Plan of the Li Longhi "tomba di gigante" (tomb 15) and the preexisting paved gallery grave (tomb 16), which still conserves its original ellipsoid stone border delimiting the mound that must have covered it.



Fig. 4 - Li Longhi "tomba di gigante": detail of the entrance stele divided into two frames by a horizontal rib at the centre.



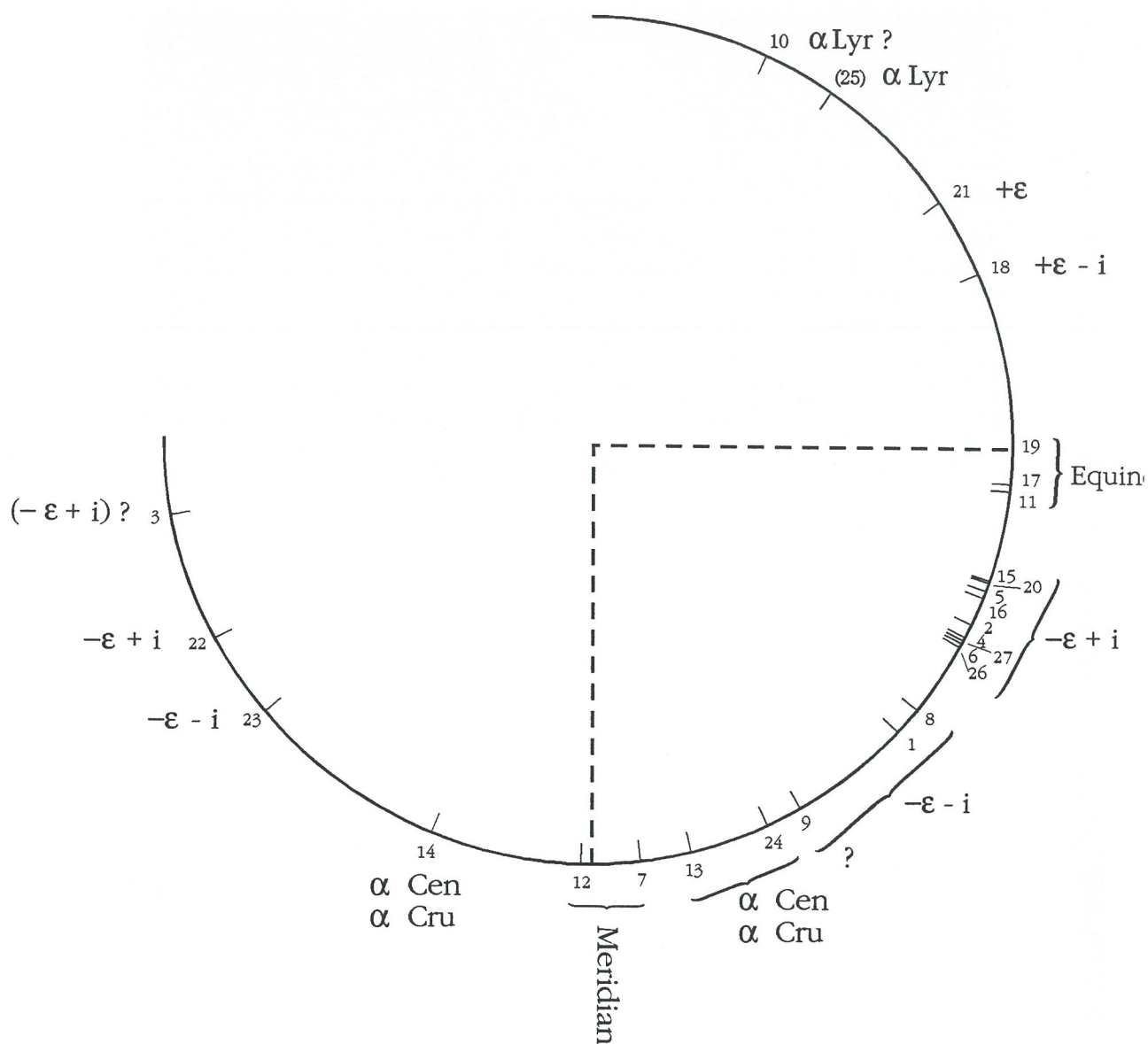


Fig. 5 - The orientations in azimuth of the 26 dolmenic tombs and of one "domus de janus" (25) and their possible astronomical targets.