

Diachrony and the Big Picture: Chabola de la Hechicera, a Peculiar Orientation and a Sacred Landscape



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1 Introduction

Megalithic monuments abound in the northern part of the Iberian Peninsula. They appear in the local late Neolithic as the result of a complex process of crystallization of this period's social dynamics on the landscape. In general, most of the megalithic chambers appear as more or less elaborate passage graves under a conspicuous earth mound. Their location has been investigated in the last decades in search of patterns within the framework of Landscape Archaeology. This has allowed us to understand their connection with mountain passes, fords, or possible prehistoric routes (Alday Ruiz et al. *El Neolítico en la Península Ibérica y su Contexto Europeo*. Cátedra, Madrid, 2012, pp. 291–332). Archaeoastronomy has also highlighted the coherence of Megalithic monument orientation throughout large regions, perhaps pointing at the presence of common traits within larger areas than can be indicated by other material remains found at or near the burial grounds themselves (González-García and Belmonte, *J History Astronomy*, 41: 225–238, 2010).

Chabola de la Hechicera (Sorceress' Shack) forms part of a small cluster of passage graves in the vicinity of the river Ebro and the Sierra de Cantabria, in the Rioja Alavesa wine region. Michael Hoskin measured the orientation of most of these graves in the late 90s (Hoskin, *Tombs, temples and their orientations. A new perspective on mediterranean prehistory*. Ocarina Books, Bognor Regis, 2001) showing that, contrary to the general custom across most of Iberia and particularly in this area of north-central Spain, the corridors opened towards the south or south-southeast. Also, when inspecting the panoramic view and some images of the site, a particularly interesting topographic feature catches our attention. At the north-eastern extreme of the Sierra de Cantabria, the chain of mountains that constrains

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the Ebro valley to the north of this area, the Castillo de Lapoblación (1.243 m.; hereafter Lapoblación but also called León Dormido), appeared particularly prominent from the location of Hechicera.

Thus, inspired by Clive Ruggles' work on the island of Mull (Ruggles and Martlew, *Archaeoastronomy*, 17: S1–S13, 1992; see also, Ruggles, *Astronomy in pre-historic Britain and Ireland*. Yale University Press, Yale, 1999, pp. 112–124). We explore in this paper why Chabola de la Hechicera has that peculiar orientation and whether its location can be connected to the sighting of that mountain. In particular, we will explore if this prominent spot could be related to astronomical features providing a connection with a sacred landscape for the people who built this megalithic burial chamber.

2 Hechicera in Context

Chabola de la Hechicera is located near the small village of Elvillar, in the vicinity of Laguardia, the capital of the wine region of Rioja Alta, to the south of Alava province (Basque Country) and at a short distance, as the crow flies, to the Ebro river (c. 6 km).

Discovered in 1935, the corridor and part of the chamber were excavated in the following year (1936; Barandiarán, 1957), the same year when the Spanish Civil War started. A new excavation took place in 1947 and a larger excavation was carried out in the mid 70s when some major restoration work was undertaken (Apellániz & Fernández, 1978). Finally, the last intervention took place in 2010, which cleaned up the structure and delimited the tumulus (Martínez-Torres, Fernández-Eraso, Mujika-Alustiza, Rodríguez-Miranda, & Valle-Melón, 2014; Pérez Vidiella, Miranda, & Valle Melón, 2012).

Chabola is a passage grave formed by a polygonal chamber with 7–9 orthostats (Fig. 1). The uncertainty in the number of orthostats in the chamber is due to the presence of two large orthostats between the chamber and the corridor, which are larger than those inside the corridor, but slightly smaller than those in the chamber (Narvarte Sanz, 2005: 88–99). At present, a covering stone is placed on top of the rear part of the chamber, but it was probably broken at some point in the past. Three pairs of orthostats form the corridor. This is nearly 5 m long and slightly less than 1 m wide. It is apparently segmented in two parts by a closing stone. The 30s and 70s excavations recovered a number of severely damaged human remains together with stone tools, ceramics and beads from both the chamber and the corridor. In the upper layers there were also some metallic elements and decorated ceramics perhaps indicating the long use of the chamber (from 3800 BC to 1100 BC in several phases and stages, see below). In fact, several closing layers, i.e. deposits that are interpreted as being meant to seal and close the burial in several phases, have been indicated from the late Neolithic until the early Bronze Age (Narvarte Sanz, 2005: 88–99).



Fig. 1 Chabola de la Hechicera megalithic site. **(a)** General view of the monument where the upper layers of the stone crust that covers the tumulus can be appreciated together with the megalithic chamber. **(b)** Close up view of the entrance corridor and the chamber. It is also noticeable the Sierra de Cantabria mountains to the background of the monument, towards north. **(c)** Zenithal image of the passage grave and tumulus during the last restoration works. The dotted arrow indicates the orientation of the corridor. The dashed arrow indicates the direction towards the Lapoblacion Mountain. **(d)** View towards the Lapoblacion Mountain from Hechicera. This direction is nearly perpendicular to that of the corridor. Images: A. César González-García

A tumulus of nearly 26 m in diameter covered the structure but did not completely hide the chamber and the corridor. The first excavators reported that the tumulus was composed of two layers. The lower covered the larger part and, on top of it, a second layer was built with a nearly 14 m diameter and a total height of 4 m. An intricate crust of middle size stones covered the upper part. The tumulus is truncated next to the entrance of the passage grave by a paved atrium with flat slabs. It is also delimited on the east side by a stone wall which is not symmetric to the western side (Fig. 1; Martínez-Torres et al., 2014).

The excavations uncovered a Bell Beaker burial in the eastern part of the tumulus. A general attempt to destroy or to render useless the monument at some point in pre-History has also been proposed (Narvarte Sanz, 2005: 88–99).

Most of the human remains were recovered in the mid 70s excavations. These are composed of 39 individuals: 30 adults and 9 infants. They were buried together with a number of goods, including a palette bone idol, a fragmented geometric stone, an arrow flint, as well as Bell Beaker ceramics and some metal goods. According to the most recent dating, the megalithic monument was built in the early fourth millennium (3800 cal BC). The bone idol could correspond to this date. Then, a number of dates correspond mostly to the late Neolithic and Chalcolithic period

(3600–2900 cal BC), while the Bell Beaker phase could correspond to the last set of dating during the Bronze Age (1600–1100 cal BC; Arenal & de la Rúa, 1988; Fernández-Eraso & Mujika-Alustiza, 2013). These data indicate a long history of construction, and use by local communities. The history appears to be discontinuous with variable intensity in the occupation and several possible moments of closing and reuse.

3 Orientation

According to Michael Hoskin (Hoskin, 2001: 236; see also Table 1), the orientation of the passage grave is 143° , and the altitude of the horizon in that direction is 0.75° rendering a declination of -35.8° (see Table 1).¹ Such a declination is way far from the solar range.

The width of the corridor allows for a window of visibility ranging from azimuths of 131° – 166° . The northern extreme of this opening, with a declination of -29° , would allow the marginal visibility of the lunar southern extreme. However, any astronomical intentionality connected to the sun or the moon in the horizon of the orientation of the corridor based on this premises seems a bit far-fetched. In fact, Hoskin indicated that Hechicera faced the ‘sun long after it had risen and was climbing in the sky, and so we have here a custom that was strictly Sun Climbing’ (Hoskin, 2001: 117).

This declination, though, could coincide with the declination of the Pointers (α and β Centauri) and the Southern Cross at the moment of building and use of the passage grave.

Another interesting fact is that the corridor of Chabola is almost perpendicular to the direction where we can see the Lapoblacion Mountain, a prominent feature of the local landscape (Fig. 2a, c). The corridor seems to be facing the most distant horizon as seen from this spot, facing the Sierra de Iregua to the SE, and the slopes towards the river Ebro valley (Fig. 2d). Finally, it might also be relevant to note that the prevailing wind in this area runs from east to west, also nearly perpendicular to the entrance corridor, and the orientation could avoid those winds perhaps providing shelter to the human remains inside.

Interestingly, the ethnography of the name of this megalith might provide further relevant information. Most megalithic sites in the Basque country bear names from the area where they are located after their discovery. However, a few of them where

¹Most of the data was obtained by Michael Hoskin and his collaborators in the 90s (see e.g. Hoskin, 2001). The data was obtained with an off-shore compass (Hoskin, 2001: 12). The new data presented in this contribution was obtained with a Suunto 360 professional tandem, with a compass and clinometer with $\frac{1}{4}^\circ$ accuracy in azimuth and altitude. The new measurements in Table 1 are the mean of a set of at least five measurements, and while the state of preservation of some of the dolmens would set a stringent limit on the accuracy of the orientation, we have opted to provide the figures to the error level of the instruments employed.

Table 1 Orientation data for the several sites in the vicinity of Chabola de la Hechicera

Site	φ (°')	λ (°')	a (°)	h (°)	δ (°)	Lapoblación		Dating (cal. BC)
						a(°)	h(°)	
Layaza	42/35	2/39	147	0.7	-37.9	Not visible		2800–2000
Sotillo	42/34	2/37	180	1.6	-46.1	74	2	3000–1900(1300)
Montecillo	42/33	2/40	182	1.6	-46.1	70	2	2500–2300
Chabola de la Hechicera	42/34	2/33	143	0.75	-35.8	58	3	3500–2900(1750)
S. Martín	42/34	2/36	172	1.0	-46.1	64	2.8	3600–
Alto de la Huesera	42/34	2/34	140	0.75	-34.1	63	3	3000–2900
El Encinal	42/34	2/32	142	0.8	-35.2	54	4	-----
Los Llanos	42/36	2/32	142	0.8	-35.2	74	4.5	(4300)3700–
La Cascaja	42/35	2/44	177	1.1	-46.6	Not visible		-----
Longar	42/35	2/24	179	1	-46.9	300	3.7	3100–2900

The columns provide the name of the megalithic site, location (latitude and longitude) the orientation of the corridor, altitude of the horizon and declination. Then we include the alignment towards the Lapoblación mountain. Finally, we provide the dating for the several sites as given by Fernández-Eraso and Mujika-Alustiza (2013)

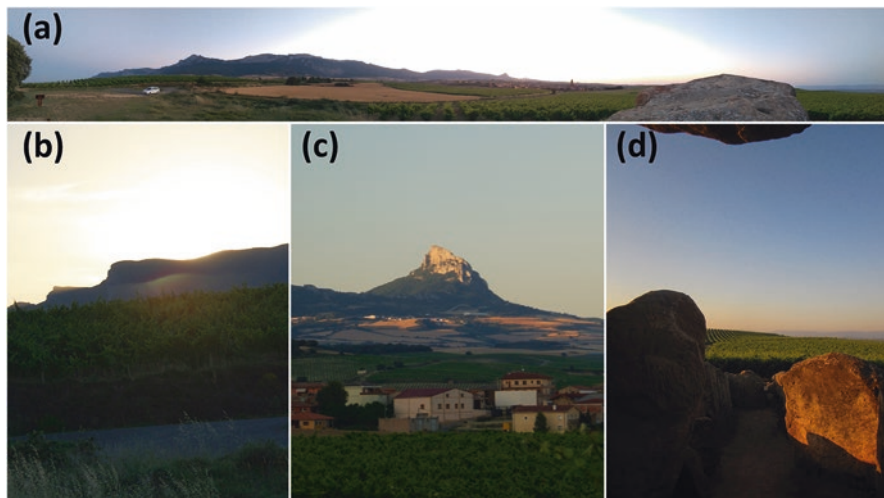


Fig. 2 The landscape surrounding Chabola de la Hechicera. (a) General panorama centred in the northern horizon. The northern part of the horizon is dominated by the imposing view of Sierra de Cantabria mountain range. The picture was taken from a position close to the megalithic chamber. The capstone can be observed in the lower right. (b) The summer solstice sunset as seen from Hechicera's location happens on the NW extreme of the Sierra (at a position close to that of the car in the upper image). At this moment, the last part of the surrounding landscape to be still lit by sunlight is the peak of the Lapoblación mountain (c), seen on the NE extreme of the Sierra. (d) The chamber and corridor open towards SE, facing the gentle slopes going towards the Ebro valley. The river is not directly observable from this site. Images: A. César González-García

known since long ago, and had their own proper name usually connected with Basque mythological figures. The name of the site, Chabola de la Hechicera (Sorginaren Txabola in Basque) or Sorceress' Shack, connects this site to a commonplace in Basque folklore, the Sorceress (Gordón Peral, 2008; Vegas Aramburu, 1991). In particular, the legend of Hechicera, which could be traced back at least to the beginning of the nineteenth century (Vegas Aramburu, 1991), says that this was the shack of a Sorceress who at night on Saint John's day (June 24th) turned into stone anybody that came along her way.

As indicated above, the orientation of the main axis of Hechicera is far from any solar orientation looking out from the interior of the structure. The reverse orientation, looking from the outer extreme of the corridor towards the chamber, faces the high parts of the Sierra de Cantabria to the north (see Fig. 2a) and is thus also far from the summer solstice sunset.

However, the northern horizon is extremely interesting, as in the northeast appears the shape of the Lapoblación Mountain with a prominent figure. The peak of this mountain has an azimuth of 58° and declination near $+25^\circ$ and thus is nearly perpendicular to the corridor entrance, as mentioned above. Interestingly, the summer solstice sunrise would be visible on the slopes of this prominent peak as seen from Hechicera.



Fig. 3 Summer solstice sunrise as seen today from Chabola de la Hechicera on June 19, 2017. The sun rises from the slope of the Pico del León Mountain. At the time of use of the megalith, the sun rose further up in the slope. This is indicated by the empty circles in the image. Image, A. César González-García

Interestingly, at summer solstice, the sun sets on the western most slopes of the Sierra and the last rays illuminate Lapoblación (Fig. 2b, c), while the rest of the landscape is already in shadows. The next morning the sun rises from the slopes of such peak in a stunning way (Fig. 3).

This observation could render support to the importance of Saint John's day in the story and perhaps to the summer solstice: the actual orientation of the corridor is not directly connected with this astronomical event, but the location of Hechicera could be, so that it is on the spot where the sunrise and set of such day happen with a peculiar phenomenology in the local landscape. However, we do not know if the builders and users of Hechicera also noticed this fact in prehistoric times. In spite of this, and as it was mentioned earlier, Hechicera forms part of a small cluster of megalithic monuments. A set of 8 further monuments can be identified in the close vicinity, which share several characteristics.

4 A Regional Pattern?

These eight monuments include seven passage graves and a simple dolmen, although this last monument might be a further passage grave whose passage is missing today (Fernández-Eraso & Mujika-Alustiza, 2013; Narvarte Sanz, 2005). In general, the eight monuments present similar characteristics to those of Chabola. They are megalithic chambers with six (Huesera) to ten (San Martín) orthostats and polygo-

nal shapes. The archaeological findings include human remains plus the material record composed of lithic material, ceramics and beads (Narvarte Sanz, 2005). It is interesting that in several cases there are some figurines in bone, identified as idols (notably in San Martín; Fernández-Eraso, Mujika-Alustiza, & Fernández-Crespo, 2015) by the archaeologists who excavated the different sites.

The dating of the human remains from sites indicate that the construction of these megaliths started at the end of the local Middle Neolithic or early late Neolithic (i.e. end of the V and mid IV millennium cal BC; Fernández-Eraso & Mujika-Alustiza, 2013). They seem to be contemporaneous to other megalithic monuments in nearby regions such as the north of Burgos or the Basque Country to the north (Fernández-Eraso, 2007–2008). It must be noted that, in general, two phases of use have been identified. The first one would be from mid-fourth millennium cal BC, during the late Neolithic and Chalcolithic, and the second at the end of the third millennium BC, during the first Bronze Age. It is interesting that some of the megalithic sepulchres continued to be used until the end of the second millennium BC (e.g. El Sotillo; Fernández-Eraso & Mujika-Alustiza, 2013).

The orientation of all these monuments is towards the southern part of the horizon, with clearly two main directions (see Table 1; Fig. 4). One seems to be quite similar to that of Hechicera, with declination -36° , while the second is very close to due south, and declination -47° (see Fig. 4). The consistency of the orientation

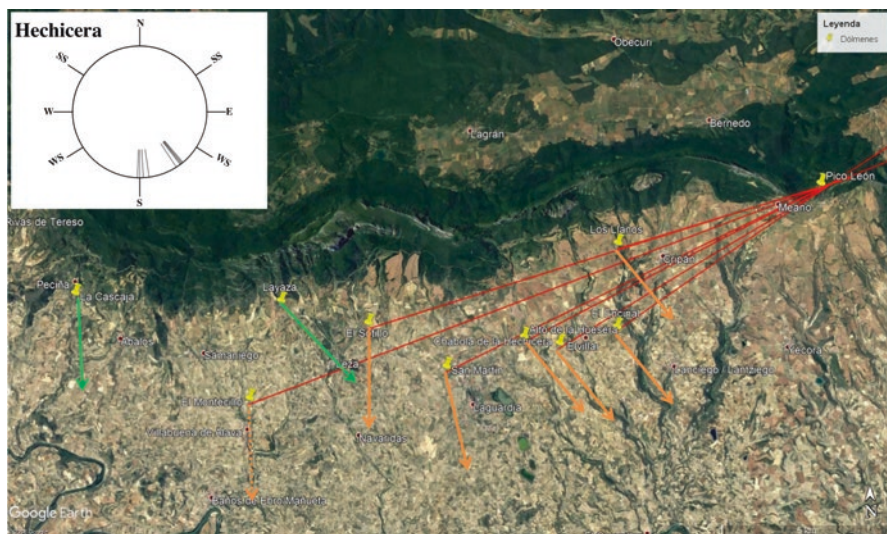


Fig. 4 The nine megalithic chambers in the vicinity of Chobola de la Hechicera. A yellow pin marks the locations of the passage graves. The arrows indicate the orientation of each chamber and corridor, the orange color indicates that Lapoblación Mountain (Pico León in the figure) is visible from the site of the megalithic chamber. If this mountain is not visible it is indicated in Green. The red line connects each site with the mountain. Top left inset: orientation diagram for the megalithic chambers in the Rioja Alavesa. They all appear to cluster in two narrow directions. The first is similar to the orientation of Hechicera. The second scatters slightly from due south. Image by the author from a photograph courtesy of GoogleEarth

indicates that the coherence of the group is not only present at the typological architectural features, meaning the shape of the structure, but also at a more formal one that includes how the monument is placed and located in the local environment.

Although the monuments appear in close vicinity, the mean distance to the nearest neighbour grave is 2.5 km (De Carlos Izquierdo, 1988) and, although some of them present intervisibility relations, not all are visible to each other. Spatial studies of this megalithic group indicate that the monuments seem to be in general on the middle ground between the river Ebro and the Sierra and that the monuments were built on a potentially important economic route running east to west (Alday Ruiz et al., 2012; De Carlos Izquierdo, 1988).

It is important to note that the river Ebro is not directly visible from any of the nine megaliths (including here Hechicera; see Fig. 2d). However, it is clear that the corridors open to the south, facing the furthest horizon seen from their location. In particular, Sierra de Iregua (c. 35 km away) can be seen in that direction on clear days. The orientation of the corridors is not facing towards the closest neighbouring grave. The horizon towards north is high and at close proximity due to the Sierra de Cantabria Mountains just a few km away. In fact, we have checked also the direction looking from the outside in, instead of the customary inside out. Taking into account the height of the horizon we can notice two main facts. The first is that the monuments point always to the Sierra, but each points to different parts. The second is that if we consider the declination, i.e. the part of the sky that such directions might be pointing at, the spread of the data is larger than in the opposite direction. While to the south the declinations for the eight monuments cluster on just two values, towards north they spread at several different values. An astronomical intention towards north then seems more speculative than to the southern skies.

The wind could be a driving factor in the orientation of the corridors, as indicated above. The prevailing winds in the area today are running east west due to the configuration of the local orography, and one might argue that the same winds could have been important in the past. The orientation towards the south could thus avoid those winds, but this still does not answer why all structures seem to be directed so narrowly towards two particular spots and not spread around the perpendicular of the wind direction, as one might expect if this were the only explanation.

Given the interesting visibility relation between Hechicera and Lapoblación Mountain, we took the chance to verify if the peak was visible from all monuments and then measure the direction towards its summit (see Table 1 and Fig. 4). We must remember that the corridors are not facing this mountain, but it appears as a prominent spot on the local horizon. The peak is visible from seven megalithic chambers (including Hechicera). In all cases, it appears to the northeast, ranging from declinations $+13^\circ$ to $+28.5^\circ$. We could speculate that the visibility of this mountain could have been related to the sighting of a 'summer' sunrise from the end of April to mid August. It might be noticeable that in most cases this peak appears to be roughly perpendicular to the direction of the corridor.

In the close vicinity of this megalithic cluster there is a number of burials in rock shelters in the Sierra de Cantabria (Fernández-Eraso & Mujika-Alustiza, 2013). Recent results suggest that there was a cultural difference between the people buried

in these shelters and those placed inside the megaliths (Fernández-Crespo et al., 2020). Also to the south there is a contemporaneous collective burial site (called San Juan ante Portam Latinam; Vegas et al., 1999), where 289 individuals of both sexes and including infants and adults were buried. A large fraction of the individuals presented evidence of violence. This shelter opens to the southwest, similarly to the ones in the Sierra and also in broad similarity with the orientation of the corridors of the megalithic monuments.

A singular megalithic monument some 13 km to the west of Hechicera is Longar (Narvarte Sanz, 2005: 272–277; Armendáriz & Irigaray, 1995; Table 1). This is a collective burial site on a horseshoe shaped chamber excavated in the bedrock, filled with dry stone masonry and covered by two sandstone boulders. The chamber is elongated and opens in a perforated stone, and towards a *dromos* or open corridor. Inside the tomb the archaeologists discovered the remains of at least 114 individuals of both sexes. Some of the bodies showed evidence of the cause of death being due to warfare, such as arrow flints attached on bones. Interestingly, the chamber included a few ceramics deposited as grave goods. The dating of the site is 2500–2400 cal BC according to the ^{14}C of the bones (Alday et al., 2016). This is contemporaneous to Hechicera, during the transition to the Chalcolithic.

The orientation of Longar is due south. Longar is in full view of Lapoblación, and interestingly this mountain displays a completely different profile from here, but the direction towards this mountain would coincide with summer solstice sunset as seen from Longar (Table 1).

The dating of the several megalithic monuments in the Hechicera station could perhaps help us interpret all the results exposed above (Fernández-Eraso & Mujika-Alustiza, 2013); Table 1). Most are deduced from the human remains recovered during the successive excavations. In the following lines, we will consider that the earliest dates are mostly contemporaneous with the first use and thus erection of the megalithic structure. We are aware of the strong assumption this entails, and to this, we must add the scarcity of the data.

Figure 5 left compares the declination of each corridor with that earliest date. We do not see any systematic trend. However, it is interesting to note that all monuments with declinations close to -36° seem to be built prior to 3100 cal BC, while most of the monuments with declinations closer to -46° (due south) appear systematically later than those of the first group. The exception to this is San Martín dolmen where there is a dating from a very early stage.

Figure 5 right compares the declination of the Lapoblación Mountain as seen from each of the sites where we have a dating. There seems to be a general trend of declinations from values close or above 24° at the earliest stages towards declination c. 14° later on. Now the exception is the Los Llanos dolmen, which is the closest dolmen to this mountain peak and has a very early dating with a declination towards the peak of 14° .

These figures suggest that the earliest dolmens tend to have an orientation of c. -36° , and are located in a spot where Lapoblación Mountain is seen at a declination c. 22° .

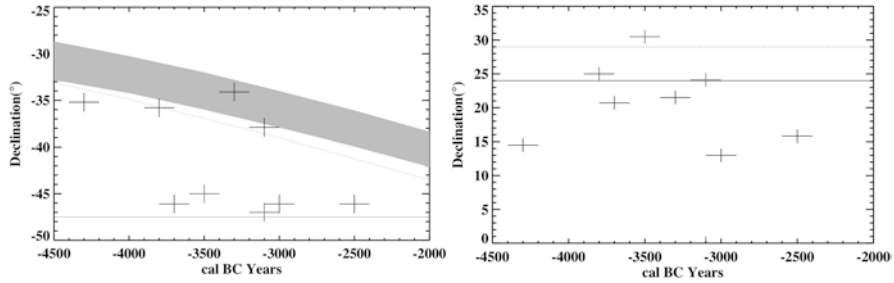


Fig. 5 (a) Comparison of the declinations of the corridors (left) and that of the Lapoblación Mountain (right) with the earliest dating obtained from the Hechicera cluster. The Longar and San Juan burial sites are also included as red crosses. The grey band in the left panel indicates the declination range covered by the Southern Cross during the period indicated in the x-axis. The dotted line indicates the declination of α Cen. The solid line indicates the declination south and a flat horizon at the latitude of Hechicera. The Solid line in (b) indicates the declination of summer solstice while the dotted line stands for the northern lunar extreme

To summarize, the megaliths in this area south of Sierra de Cantabria, a boundary region between the Ebro valley, the Basque Country and the Duero plateau to the west, appear as a coherent group with the orientation of most burial sites towards south. The prevailing winds and the local orography do not seem to fully explain the coherence of these orientations. We could perhaps suspect that the local topography together with some astronomical features could provide clues to interpret the area as a particularly sacred region for the local population. But, how does this compare to other neighbouring and contemporary areas?

5 In Context of the Other Megaliths in the Area

If we compare the orientation of the megalithic monuments in this group with others in the neighbourhood, we can verify that the norm in most areas next to the Rioja Alavesa is to be facing towards the east or southeast, and certainly, in most cases they can be related to Hoskin’s sunrise customs.

The closest group to Hechicera would be the few passage graves to the other side of the Ebro valley, on the slopes of Sierra de Cameros that serves as a natural communication route between the Ebro and Duero valleys. Their date is almost contemporaneous to the Hechicera group with possible re-occupations during the Bell Beaker phase (Pérez Arrondo, 1983; see Fig. 6).

Other groups include those to the other side of the Sierra de Cantabria to the north, in the province of Alava; those to the north of the Burgos province, in the Sedano area, also in the Ebro valley. To the east, we could mention those in the southern parts of the pre-mountains of Navarra and Huesca, which are closer to the Ebro valley than other megalithic monuments of those provinces in the Pyrenees (Fig. 6; most data was obtained from Hoskin, 2001. A few new measurements are included in Table 2).

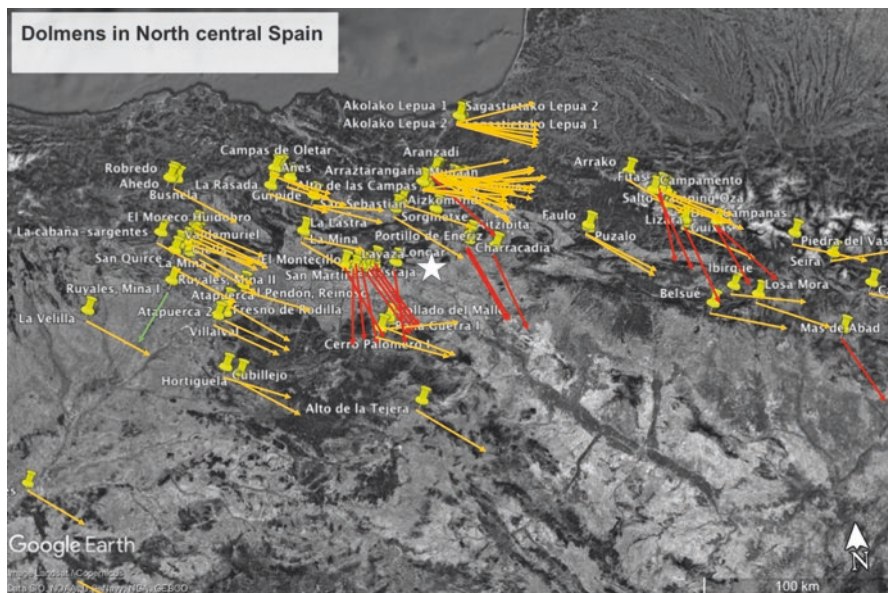


Fig. 6 Map of the megalithic chambers in north-central Spain. A yellow pin indicates each site. The arrows indicate the orientation—azimuth—of the megalith. In dark yellow are those whose orientation is compatible with sunrise. In red are those with orientations far from the solar range. Ruyales I and II (green arrow) are included here for comparison. They were measured by Hoskin (2001: 214) but they are not considered today as megaliths. Image by the autor from a photograph courtesy of GoogleEarth

The Rioja group presents orientations towards the east and southeast, in contrast to those found in the Hechicera group. A similar situation appears in the Alava province, and mostly in the Sedano area, where the orientations are predominantly towards southeast. None of these groups presents a similarity with the Hechicera group.

The closest parallel to the Hechicera station appears in the dolmens located on the hills closer to the Ebro valley, in Navarra and Huesca. Especially in Navarra, we find those of Artajona and Chacarradía, Faulo and Puzalo and in Huesca we have those in the Pyrene valleys and Mas de Abad.

There are two passage graves in Artajona, and both contain a chamber with nine orthostats and a corridor that ends at a perforated stone (Narvarte Sanz, 2005: 269–271, 277–280). This entrance is in close resemblance to the Longar hypogeum. Typologically, and due to the presence of the perforated entrance, they are normally thought to be a late representative of the megalithic buildings in the area. Chacarradía (Narvarte Sanz, 2005: 266–269) is a passage grave with a chamber composed of eight orthostats. Several human remains were recovered from the chamber. The archaeological reports indicate that the orientation of the corridor is towards the east (see, e.g. Narvarte Sanz, 2005: 266), but we could measure an orientation of 164° , which closely resembles those of the Hechicera group.

Table 2 Orientation data for the new measurements in several regions

#	Site	φ (°/')	λ (°/')	a (°)	h (°)	δ (°)
La Rioja						
1	Collado del Mallo	42/18	2/27	85	-0.5	2.9
2	Cerro Palomero I	42/16	2/31	110	2.5	-13.1
3	Peña Guerra I	42/19	2/28	116	9	-12.5
Álava						
5	Campas de Oletar	43/3	3/7	122.5	1.75	-22.1
6	Añes	43/3	3/9	113	10	-9.4
7	Alto de las Campas	43/0	3/3	118	1.5	-19.2
8	La Lastra	42/44	2/58	103	4.7	-6.4
Navarra						
10	Faulo	42/41	1/9	135	2.4	-29.6
11	Puzalo	42/41	1/9	132	6.5	-24.4
12	Aranzadi	42/56	1/57	125	0	-25.2
13	Arzábal	42/56	1/58	95	0.2	-3.9
14	Aitzibita	42/41	1/54	127	0.5	-26.2
15	Artekosaro	42/49	2/7	96	3	-2.5
16	Charracadia	42/40	1/55	164.75	1.25	-44.3
Huesca						
17	Losa Mora	42/18	0/5	110	4.8	-11.4
18	Belsué	42/17	0/23	98	7.9	-0.6

The columns provide the name of the megalithic site, location (latitude and longitude) the orientation of the corridor, altitude of the horizon and declination

Faulo and Puzalo are two chambers near the village of Bigüezal. The first has a tumulus of 12 m in diameter composed of dry stone, with a small chamber formed by five orthostats in a rectangular plan (Narvarte Sanz, 2005: 228–230). Puzalo is very similar to Faulo, with a tumulus of dry stone of 14 m in diameter with a rectangular chamber comprised of four stones (Narvarte Sanz, 2005: 231–232). These two have an orientation towards the southeast, slightly outside the solar range, although they could be facing the lunar extremes (see Table 2).

Interestingly, all of these structures present orientations towards the southeast, in close resemblance to those of Hechicera group. Finally, we should mention the Mas de Abad dolmen, which is very close to Catalonia and offers another example of a dolmen with a southern orientation. Thus, the similarity appears throughout the Ebro valley.

If we open the scope of our inspection to regions further to the north, east and west (there is a clear megalithic void to the south), we find a similar trend again when we move towards east.

To the west, most dolmens in the Duero plateau, including those closer to the Portuguese border in Salamanca, appear to present mostly orientations between nearly due east and winter solstice sunrise. The ones in the northern parts of the

Basque Country or Navarra also tend to systematically present orientations towards the east (see Fig. 6).

Finally, the dolmens in the Pyrenees are a cumbersome group. Those in Huesca (Spanish Central Pyrenees) present mostly orientations within the solar range, although there are a number of examples that have orientations to azimuths far to the south, given their locations within the Pyrenees' valleys, the altitude of the horizon renders the declinations perfectly compatible with the luni-solar range (Belmonte & González-García, 2012). A similar situation is present in the Cerdagna valleys, of the Catalonian Pyrenees (Hoskin, 2001). We have to move to the Catalonian coast to find several groups with orientations similar to those found in Hechicera or the Ebro valley, well outside the solar range.

In order to ascertain this general impression, we have performed a cluster analysis of these several groups, similar to that in González-García and Belmonte (2010). In that paper, the Hechicera group was included together with several others in a group called north central Spain. The results indicated that, according to their orientation trends, these groups could be somehow related to the Catalonian coastal groups, although they were then considered as interlopers.

We have performed a new and refined analysis with the new orientations. The number of groups considered is 13, and are given in Table 3. For each group we consider the mean azimuth, the median, the standard deviation, the maximum and minimum azimuths, and the two largest concentrations obtained from a curvigram representation of the azimuths in each group with a bandpass of twice the uncertainty in the azimuth determination. We have thus performed a cluster analysis based on our IDL algorithms to calculate the distances among groups by a nearest

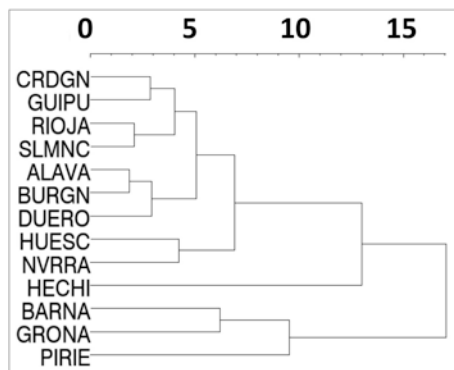


Fig. 7 Dendrogram of the groups in Table 3. The figure plots the distance between the several groups of megaliths considered. Such distance is measured in the space that considers the orientation distribution for each group. For each group, such distribution is characterized by the mean, median and standard deviation, the minimum and maximum azimuth and by the two largest concentrations. These values are given in Table 3. The dendrogram then provides a visual tool to grasp the distance between groups. Hechicera group (HECHI) is located between the Eastern clusters of megalithic monuments, with orientations mostly towards sunrise, and those in the Catalonian coast (BARNA Barcelona; GRONA Girona and PIRIE, East Pyrenees)

Table 3 Input data for the cluster analysis

Cluster	Acronym	Mean(a)	Med(a)	$\sigma(a)$	Max(a)	Min(a)	$a_{\max 1}$	$a_{\max 2}$
Alava	ALAVA	113.1	113	12.8	131	94	104.3	128.0
Barcelona	BARNA	154.8	140	54.9	270	91	120.8	221.0
Burgos North	BURGN	118.5	118	8.6	137	105	115.3	128.0
Cerdagna	CRDGN	118.0	121	25.3	161	73	119.3	85.0
Duero plateau	DUERO	119.0	120	9.7	135	102	118.4	102.0
Girona	GRNA	144.0	148	48.5	244	55	140.4	185.0
Guipuzcoa	GUIPU	104.7	102	20.9	157	77	104.9	80.0
Hechicera	HECHI	160.3	172	18.9	182	140	144.8	178.0
Huesca	HUESC	122.1	116.5	28.2	173	71	109.8	159.0
		124.0	116.5	28.6	173	71	110.6	162.0
Navarra	NVRRA	115.2	101	30.6	169	80	93.1	85.0
		96.6	95	15.1	125	80	94.7	85.0
East Pynenees	PIRIE	175.6	168	47.2	304	48	165.3	149.0
Rioja	RIOJA	103.7	110	16.4	116	85	107.7	80.0
Salamanca	SLMNC	111.0	112	12.2	133	84	112.9	87.0
Ebro valley	EBRO	149.2	147	26.0	182	93	165.2	135.0

The table presents the cluster name, the acronym, the corresponding statistical data for every group. For the first analysis we considered provincial groups so, there was no Ebro valley group. In the second analysis we did include such group by detaching those passage graves closer to the valley from the ones in Navarra and Huesca. The second file in these entries provides such data. For details, see text

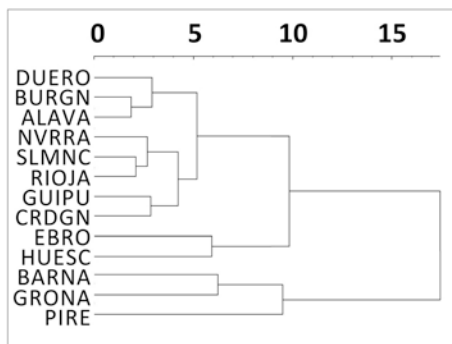
neighbour procedure (González-García & Belmonte, 2010). The results appear in Fig. 7. The groups considered are numbers 1–13 in Table 3.

We can see that there are two main groups based on this analysis. The largest one includes most of the monuments to the west and north of Hechicera. These have orientations mostly towards east and within the solar range. The second group includes those in the Catalanian coast.

We have rearranged slightly the groupings to have all monuments close to the Ebro valley in one group, including Hechicera, plus all the passage graves in Huesca and Navarra close to the Ebro (see Table 3, the entries here change for these three groups, while for the others are the same as before). We find that the regional grouping still appears (see Fig. 8). There is one cluster with the monuments of the Duero plateau, those of Alava and the north of Burgos and very close to it there is a second cluster which includes the monuments in La Rioja, Salamanca and Navarra. Then we have a third group with the monuments of Guipuzcoa and Cerdagna. According to this classification scheme, all these three clusters form a big family of orientations. At the other extreme there are the Catalanian coast groups. The dolmens in Huesca and those in the Ebro valley appear as a group between these other two broad regional groups.

This seems to indicate that Hechicera is in a transitional position between two large families. The two large families appear to indicate two orientation traditions that apparently were maintained over large regions and epochs. The first one is the

Fig. 8 Dendrogram of the groups in Table 3 now including a group for the Ebro valley that includes Hechicera group



one that would correspond to Hoskin's 'sunrise custom'. This appears mostly in the western part of the region of our study, in the Duero plateau, the mountains to the north, the Basque Country and the Pyrenees valleys. The second family presents orientations mostly to the south, from southeast to southwest, and appears mostly in the Catalanian coast, but also in the interior along the Ebro basin. The two traditions meet very close to the Hechicera group that would appear then as the last example of this family as we move from east to west.

At this point, it might be interesting to have a look at the burial places of the previous epoch both on the Catalanian coast and in the Ebro valley.

6 Previous Epochs

The first evidence of Neolithic activity in the northeast of the Iberian Peninsula appeared in the Mediterranean coasts in the mid-sixth millennium BC (Zapata, Peña-Chocarro, Pérez-Jordá, & Stika, 2004). These areas were previously occupied by Mesolithic communities. However, little evidence of funerary practices has been recovered prior to the fifth millennium BC. The middle Neolithic (end of fifth millennium cal BC) is characterised in Catalonia by the appearance and development of the 'pit burial culture'. This includes individual, occasionally double, burials in pits or stone boxes. Similar depositions have been documented in other parts of Europe, notably in Switzerland ("Cortaillod"), and France ("Chasséen"). It has been argued that this funerary custom may have spread through the trade networks existing at the time serving the exchange of honey flint from the Alps, variscite from the Gavà mine (Barcelona), obsidian from Sardinia and ceramics and other goods to the Mediterranean shores. Morell Rovira et al. (2018) suggest that the burials in France and Switzerland appeared before those in Catalonia. According to these authors, this cultural stage lasted in Catalonia until the start of the fourth millennium (Morell Rovira et al., 2018) and has been traditionally considered the phase before the collective inhumations in megalithic monuments (Balaguer, García, Tenza, &

Antequera, 2013; Tarrús, 2002). Apparently, this stage ended when the trade networks collapsed (Morell Rovira et al., 2018).

Interestingly for our purpose, although most of the necropoles tend to be rather small (4–5 graves), large numbers of remains (>650 bodies) have been recovered from a number of sites in the Catalanian coast, for the orientation of which we have qualitative information (Morell Rovira et al., 2018). The largest of these sites is Bòbila-Madurell (Plasencia Figueroa, 2016). This is the largest necropolis of this period in Catalonia to date. In several areas the excavators have recovered the remains of more than 150 individuals, always buried in a flexed lateral position. The remains have been dated from 4100 to 3660 cal BC, and therefore immediately pre-date the appearance of the megalithic chambers.

The communities in the Pyrenees valleys, according to their material culture, seem to be of the same cultural phase. The burials in this area consist of stone boxes, instead of pits, formed by slabs defining a rectangular space often buried under a tenuous tumulus (see e.g. Morell Rovira et al., 2018; Remolins et al., 2018). These stone boxes started to be built slightly after the start of the pits culture, but lasted for almost the same period, and they contained similar types and kinds of deposited artefacts, suggesting that this period formed the first phase of occupation in these areas by a Neolithic culture.

The bodies normally lay on their left side; the head is always placed towards the NE with their feet towards the SW (Plasencia Figueroa, 2016). However, in the few reports found for the stone boxes we can deduce that the situation was much more varied, with orientations towards the N-S or SE-NW (Remolins et al., 2018). We do not have direct and precise measurements based on Archaeoastronomical survey standards, but these general indications may suffice for our current purposes.

Closer to the Hechicera area (c. 35 km to the east), we find the Los Cascajos funerary area (indicated with a white star in Fig. 6). This is located near the Los Arcos community in Navarra. It is one of the first places where the Neolithic is clearly identified in this area (phase I, 4435–3700 cal BC) lasting possibly until the mid-fourth millennium BC (García Gazólaz et al., 2011).

The archaeologists recovered traces of a settlement plus a number of burials in nearly circular pits. Possibly an expansion of the pit burial culture to the Ebro valley, it presents 32 individuals, together with several grave goods and material remains (e.g. sickle flint, decorated ceramics, a small bottle and a necklace; García Gazólaz & Sesma-Sesma 2007). The recovered bodies appeared mostly flexed over their left side with the head towards the SE or SW (García Gazólaz & Sesma-Sesma 2007; García Gazólaz et al., 2011; see also Rojo Guerra et al., 2016). Interestingly, the general orientation (broadly N-S) is the same as in the coast, but here the head is placed opposite to the Catalanian pits.

We could therefore argue that together with the material custom, the burial practice included not only the pits and grave goods, but also the general way the bodies were laid down and this also pertained on how they were oriented. Such orientation, curiously enough is qualitatively the same in the orientations of the megalithic chambers of the posterior phase, and the bodies found inside, are also deposited

with the head towards the inner parts of the chamber and the feet towards the entrance, acquiring therefore a general N-S orientation.

7 Discussion

The peculiar orientation of Hechicera and other members of its group does not seem to be easily explained by an orientation to avoid the prevailing winds. Neither a general orientation towards the further part of the horizon, with the Sierra on its back, seems to account for the pattern explained above. Also the local topology does not seem to be so systematically oriented towards the two narrow directions indicated above. In the following section, we discuss then their possible astronomical orientation.

The direct orientation of the corridors does not seem to be related neither to the sun or the moon. We could investigate if the orientation was perhaps related to the Pointers (α and β Cen) and the Southern Cross, and the location, was perhaps related to summer solstice sunrise. This could explain the orientations of the entire dataset. In other words, are there any significant stellar-solar events for this period of time?

If the sun is the element related to the mountain, then it is possible that a summer time occurrence was important. In this case the stars of the Southern Cross and the Pointers would be seen rising in the direction of the corridor after sunset (acronychal rising) around the time of the Spring Equinox. However, when the sun has declination $+14^\circ$ (i.e., starts to be seen rising from the Mountain from any of the megalithic sites in Hechicera group), the stars are already in their southern culmination at sunset (i.e. their rising would not be visible anymore at this time of the year). In addition, by the summer solstice, we would see the last visibility of the stars (i.e. they would be seen setting, not rising) a few minutes after sunset.

The answer to the question posed above is then, apparently not. Neither the heliacal rising nor the acronychal rising of these stars occur at moments when both (stellar and solar) orientations could be coordinated. Indeed, this result seems to weaken the possibility of a synchronic effect that may give us a hint for a particular time, but does not rule out the possibility of a stellar orientation having been adopted for the corridor, while the topographical alignment towards the conspicuous mountain could explain the actual location of the sites.

If we take the moon as the element to be linked to the mountain, the situation is somewhat reversed. The first visibility of the stars in relation to the general orientation of the corridor would coincide with the autumn equinox, while for the winter months, when we could see the full moon rising close or on top of the mountain, the stars would rise above the horizon by midnight. This line of reasoning then could perhaps favour a lunar-stellar alignment.

From the comparison with the contemporary monuments in central and NE Iberia, we could then argue that the orientation of Hechicera and the other monuments in the Ebro basin seem to share a number of interesting characteristics, notably the interest and importance of the south or SE horizon, in contrast to other

orientations (like due east and Winter Solstice) more prominent in the regions found to the north and west of the Hechicera group.

In González-García and Belmonte (2010) and Belmonte and González-García (2012) we proposed and argued that there were different orientation families within Iberia. These seemed to suggest that the orientation customs appeared in certain areas that were later adopted by neighbouring ones. The above result indicates that the S-SE family observed in Hechicera, the Ebro valley and the Catalanian Coast do form such a family.

It is interesting that the megalithic monuments in the Catalanian NE have provided some of the earliest dates in north Iberia. In addition, we have observed how the general trend of human remain deposition with a broad N-S orientation appeared in the Iberian Peninsula for the first time in this Catalanian NE, and moved subsequently towards the Pyrenees valleys and the Ebro basin, reaching as far as Los Cascajos, 35 km east of the Hechicera group.

We could therefore investigate if the orientation we found in Hechicera is a relic of the previous epoch when the general N-S orientation of the bodies was introduced from central Europe. Indeed, further studies, perhaps focused on a detailed analysis of the orientation of the bodies or the pits of this period is needed. If the interpretation suggested here was indeed the case, it is intriguing that such an orientation was maintained in the area of the Ebro valley for such long period of time. It would be interesting to further investigate if this orientation custom was maintained in later periods and in newly discovered sites. One such study could be carried out at Tres Montes (Andrés Rupérez, García, & Sesma, 2001), where a burial area with the remains of nearly 100 bodies has been dated to the Bronze Age.

Finally, it should be noted that this general orientation was maintained in the central Mediterranean for a long time. We have argued elsewhere that this is a characteristic of megalithic monuments in the central Mediterranean (González-García & Belmonte, 2014; González-García, Zedda, & Belmonte, 2014).

8 Conclusion

La Chabola de la Hechicera is a passage grave in northern Spain where an in depth study of the landscape helps shedding new light towards its understanding. The study demonstrates a connection with the monument in a way that was first proposed by Clive Ruggles in his study of the standing stones of the Island of Mull (Ruggles & Martlew, 1992; Ruggles, 1999: 112–124).

Hechicera and the monuments in its vicinity share coherent orientation patterns, which are not connected to sunrise or sunset. Their orientation could be related to the Southern Cross and the Pointers. However, it is intriguing that from these locations the remarkable peak of Lapoblación is prominently visible towards NE. We could argue that the orientation of the corridor was dictated by the orientation of the bodies deposited in the interior of the structure, but the location fulfilled a number of criteria. One could be being close to trade routes, or at a mid distance from the

river and the mountains. At the same time, they had to be at points where the conspicuous peak of Lapoblación was seen in such a way that it possibly marked important times within the community. In this sense, we could perhaps borrow Clive's terminology for the Mull study and propose that this area, with the visibility towards this mountain was, or formed, a sacred landscape for that community.

Interestingly, it has been argued that this is a transitional area between herders, moving their flocks towards the nearby mountains, and between agricultural communities that tended to occupy the lowlands closer to the river Ebro. The times indicated by sunrise on the peak, from the end of April to mid-August are the busiest times in the year for both groups, as they delimit the seasons of harvest for most crops, particularly wheat and barley. But this time could also mark the season of moving to the summer grounds for pastoral communities. Therefore, the sighting of sunrise behind Lapoblación Mountain could have served as a relevant time marker for such communities. We do not find any relevant time in the heliacal or the acronychal risings the Southern Cross that can be linked with these activities. Another possibility is a lunar-stellar association. This would point towards the importance of 'winter' months. Finally, we could consider that the southern orientation, and thus its possible association with the Southern Cross, had a ritual function connected only with the visibility of such stars rising on the horizon.

The folklore connects Chabola de la Hechicera with summer solstice. Interestingly, the sun rises and sets at particularly interesting spots of the horizon at this time of the year as seen from the megalith. In view of this, the association of the passage grave with sorceress and their meetings the night of Saint John, the shortest night of the year, a moment commonly associated in this land with fire and magic could be natural given the astronomical phenomena. However, any link of such folklore with the builders of these sites is clearly farfetched. The association is most probably occurring at historic times possibly then appearing as a second time in history when Hechicera was linked to astronomical events.

In conclusion, the peculiar orientation of this group could be the relic of previous orientation customs maintained through time. At the same time, the positioning of these monuments in the landscape help us understand the social time of the communities that built and used them several millennia ago.

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