ANALYSING THE SACRED LANDSCAPE IN THE IBERIAN CULTURE: GIS, CAVES AND RITUAL PERFORMANCE

Analizando el paisaje sagrado en la cultura ibérica: SIG, cuevas y prácticas rituales

Sonia Machause López y Agustín Diez Castillo

Dpt. of Prehistory, Archaeology and Ancient History. Faculty of Geography and History. Univ. of València. Avda. Blasco Ibáñez, 28. 46010 València. E-mail: sonia.machause@uv.es; agustin.diez@uv.es. ORCID ID: https://orcid. org/0000-0003-0668-0695; https://orcid.org/0000-0001-9122-2941

Abstract: Sacred spaces, such as Iberian caves, with liminal location and character, had important ritual significance and socio-political meanings for their communities. Through the Geographical Information Systems –GIS– techniques, we can analyse these sacred spaces in context. In this paper, by using a regional study as an example, we show the main analysis undertaken with GIS, such as visibility and mobility, considering diverse variables and formulas. This will allow to develop comparative perspectives with other similar Mediterranean contexts.

A first approach to the sacred landscape of the Iberian Iron Age territory of *Edeta*, in Llíria, València, is presented, analysing two ritual caves in context: Cueva del Sapo and Cueva Merinel, located on the southern border of the territory and frequented between the fifth and the second centuries bc. By using diverse models, we propose access routes to them, with the final objective of thinking about the effort and symbolism that a ritual journey linked to these natural sacred locations would imply.

Key words: Sacred Landscape; Ritual Caves; Iberian Culture; Ritual Journeys; GIS; r.

Resumen: Ciertos lugares sagrados, como las cuevas en época ibérica, caracterizadas por su localización y carácter liminal, tuvieron un importante significado ritual y sociopolítico para sus comunidades. Gracias a los Sistemas de Información Geográfica –SIG–, podemos analizar estos espacios rituales en contexto. En este artículo mostramos, a través de un ejemplo regional aplicable a otros contextos mediterráneos similares, diversas variables analizables a través de los SIG, como la visibilidad o la movilidad ritual.

Presentamos, por tanto, una primera aproximación al territorio sacro de *Edeta*, en Llíria, València, analizando dos cuevas rituales en contexto: la Cueva del Sapo y la Cueva Merinel, localizadas en el límite sur del territorio y frecuentadas entre los ss. v-ii a. C. A través de diversos modelos, proponemos rutas de acceso a las mismas, con el objetivo final de reflexionar sobre el esfuerzo y el simbolismo que conllevaría el viaje ritual vinculado a estos espacios naturales.

Palabras clave: paisaje sagrado; cuevas rituales; cultura ibérica; viajes rituales; SIG; r.

1. Introduction[1]

The sacred landscape is one of the most important elements that shape the construction of social landscape. Its perception by the communities is a key factor to understand its meaning (Prados, 2012). However, to analyse ancient landscape we need to have in mind that it is "constructed, conceptualised and ideational" (Knapp and Ashmore, 1999): it is built through human actions, conceptualised through its use, and ideational by being imagined and ritualised when it is integrated in ritual movements (Bell, 1992). Thus, it is not only a background space for human action, but also a participant –interactive, dynamic, stratigraphic, and constantly changing (Bender, 1993; Ingold, 1993; Janowski and Ingold, 2016)–.

When analysing ritual performance in extra-urban sanctuaries we must not forget that, in many cases, those places are not located on the landscape of daily life. This type of sacred places is characterised by its location far away from the dwelling areas and the surrounding agricultural fields and pastures (Chapman, 1998: 112-113). Therefore, for their

study we should have in mind the whole movement process, considering very diverse stages, such as: getting started, walking through the known landscape, walking through the unknown landscape, arriving to the sacred destination, performing in sacred spaces, moving away from them, as well as returning home (Machause and Skeates, 2022). This ritual mobility might be called 'pilgrimage' –without the actual religious meaning of the term– or simply seen as a journey that can be ritualised, acquiring specific meanings, in certain moments –'ritual journey'–. This performative movement is understood as kinetic, interactive, and highly transformative ritual. Generally, it is performed by a group of people to a particular place of veneration associated with a powerful spiritual entity (e.g. Turner and Turner, 1978; Stoddard, 1997; Coleman and Eade, 2004; Alfayé, 2010; López-Bertran, 2011; Friese and Kistensen, 2019). In fact, the location of extra-urban sanctuaries promotes the experimentation of the landscape, creating shared experiences and strengthening community bonds (De Polignac, 1984). As Elsner (2017: 269) points out, "pilgrimage constitutes a particular relation of 'person' and 'place' constructed through mobility". This mobility is, then, "the vector that links the subjectivity of person with the objectivity of place". These shared experiences help, as well, to create spatial definitions inside and outside a community (Tuan, 1977).

Sacred destinations can be important markers on the landscape, but also hidden and mystic locations. In fact, sometimes, the simple duality between visible/non-visible can create a natural boundary in the landscape (Rajala, 2004). The ritual activities performed in these spaces, as well as the ritual depositions made inside, can create boundaries between social groups and between people and supernatural entities. In fact, natural places linked to water, such as caves, have been seen as openings in the land to approach the underworld in many ancient societies (Fontijn, 2002: 265-267).

In this context, liminality, as a state, phase, and space (Van Gennep, 1909; Turner, 1967), plays an important role to understand the symbolic meaning

of the lived and experienced landscape. Some places, such as ritual caves, can become transitional zones. In fact, margins have been repeatedly identified as sacred locations in different areas and chronologies (e.g. De Polignac, 1984), defined in various ways, such as geographic, political, demographic, economic and cultural boundaries (Bradley, 2006; Feuer, 2016). Besides, ritual factors, despite their abstract character, can also play an important role in frontier dynamics (Ruiz and Molinos, 2012). Therefore, we need to keep in mind that boundaries as a mental construct are variable and volatile as well as the societies that create and perceive them (Young and Simmonds, 1999).

The use of Geographical Information Systems –GIS– provides a tangible discourse in the analysis of ritual spaces and helps to suggest and delve into questions related to their meaning in a broader context (Gillings, 2012; Parcero *et al.,* 1998), combined also with other methods and new trends (Cummings and Whittle, 2004), such as sensorial archaeology (Skeates and Day, 2020).

Our approach in this paper is focused on ritual caves in context (see Moyes, 2012; Bergsvick and Skeates, 2012; Dowd and Hensey, 2016; Büster *et al.,* 2019; Machause *et al.,* 2021). In the Iron Age, caves became the setting for diverse rites of passage across the Mediterranean. Specifically, in the Iberian Culture –sixth-first centuries BC–, the artefacts that confirm its ritual use are complex and present local and regional variations, mainly between the fifth and the third centuries BC. However, they always follow a specific deposition pattern, type, and treatment (Machause, 2019 and references). Considering the limitations of traditional approaches, focused on the materials of one or many study cases (e.g. González-Alcalde, 2005), our approach goes beyond the materiality of the offerings and analyses other variables related to the surrounding landscape to gain a better understanding of the 'pilgrimage' context. Similar analyses for the same chronology show that these caves were located on the boundaries of political territories, far from the main settlements and, in some cases, near to main roads (Rueda, 2011; Grau and Amorós, 2013; González

Reyero *et al.*, 2014; Rueda and Bellón, 2016; Machause and Quixal, 2018). For the first time in *Edeta* territory, a detailed GIS analysis regarding ritual caves that can be extrapolated to other similar Mediterranean contexts is published, considering different variables, formulas, scenarios, and origins.

Given the location of these caves, mobility was clearly involved in the ritual process from the beginning. In fact, the act of leaving the well-known dwelling areas to cross the boundaries of a territory is considered the first step of the rites of passage performed in these caves (Rueda, 2011: 153-160).

Using this regional study as an example we show how GIS can help us to get closer to the ritual process linked to liminal spaces and consider diverse variables when analysing sacred caves and their landscapes (Gillings, 2017). First, the contexts and the study area are presented. Second, the GIS methods, based on diverse visibility and mobility analysis are explained. And finally, we discuss the results of this first approach and suggest some key points to have in mind for future ritual journeys analysis.

1.1. Edeta's Territory

The Iberian Iron Age is a mosaic of regional and cultural groups with similar socioeconomic dynamics. They had a complex social development, led by elites that controlled both the land and the trade. The political landscapes were generally centralised by an *oppidum*, a stable settlement that provided protection to other settlements around it, inhabited by people with a certain level of social status, as their prestigious possessions show (Ruiz and Molinos, 1998; Grau, 2019 and references).

In the Mediterranean coast of the Iberian Peninsula, one of the main *oppida* was the ancient city of *Edeta*, located on the site known as Tossal de San Miquel, in Llíria, València, Spain. The social organisation suggested to this area is characterised by dynamic heterarchies, where the power was constantly negotiated (Bonet *et al.*, 2015), similar to the models proposed for other Mediterranean

societies (Hamilakis, 2002). We know that this city (>10 ha) controlled an area of around 900 sq km. Its boundaries were shared with other Iberian territories such as *Arse* –northeast–, La Carència –south–, *Kelin* –west–, and Cerro Viejo –northwest– (Bonet, 1995; Bonet *et al.,* 2008) (Fig. 1).

Thanks to the prolific research focused on *Edeta*, its material culture and its territory, we have a clear idea of the sociopolitical organisation of this area (Bonet, 1995; Bonet *et al.,* 2008, 2015). In fact, it was one of the first Iberian territories in the region to be fully analysed (Bernabeu *et al.,* 1987; Bonet and Mata, 2001). Those studies divided its settlements into three hierarchical categories apart from the *oppidum.* In low altitudes or plains were located both *aldeas* –villages: 5000 sq m-2 ha– and *caseríos* –hamlets: 1000-2500 sq m–, dedicated to farming –agriculture and livestock– and mining resources. These settlements were concentrated in the most fertile lands, surrounding the city of *Edeta.* A visual control network of the territory was undertaken by *fortines* –hillforts: 400-2500 sq m–, located in higher altitudes, on the ledge of the Sierra Calderona, Chelva mountains and along the Turia river. However, they were not located in coastal areas since the visibility to those areas was optimal (see Bonet *et al.,* 2008 for a general overview).

Nevertheless, the Roman presence, that began in 218 BC, disrupted the indigenous organisation. The defensive settlements and most farmsteads and hamlets were demolished. From that moment on, the cities were located in the plains, in a more scattered way, and territorial control changed, as well as the ritual pattern. In this territory, different types of sacred spaces have been identified during the Iberian period: urban sanctuaries, both private and public; very few funerary spaces and some rural sanctuaries –caves and rock-shelters– (Bonet, 1995, 2010; Mata, 1993; Bonet and Mata, 1997).

1.2. *Ritual Caves in* Edeta

In this study we focus on caves found on what is generally accepted to be the southern boundary of the Edetan territory –as previously defined by Bonet and colleagues–. To date, three caves and one rock-shelter with evidence of Iberian frequentation are known in this area. Only two of them, however, have been clearly identified as ritual spaces: Cueva
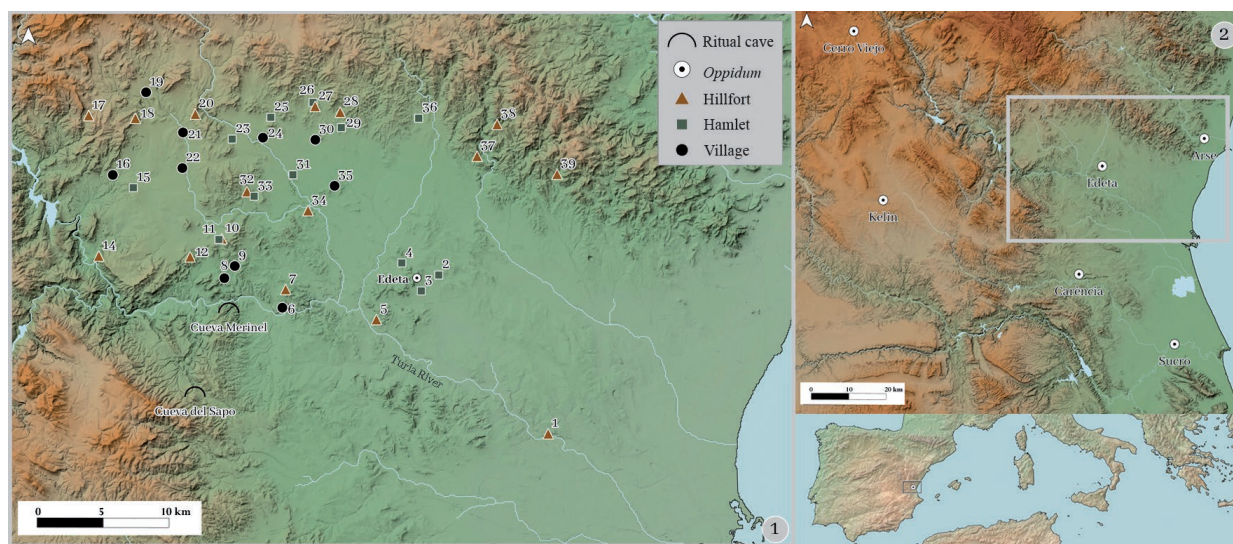
FIG. 1.   *1)* Edeta's *territory at its peak, between the fifth and the third centuries* BC; *for the name of the settlements,* cf. *Fig. 7; 2) Study area in relation with the Iberian* oppida.
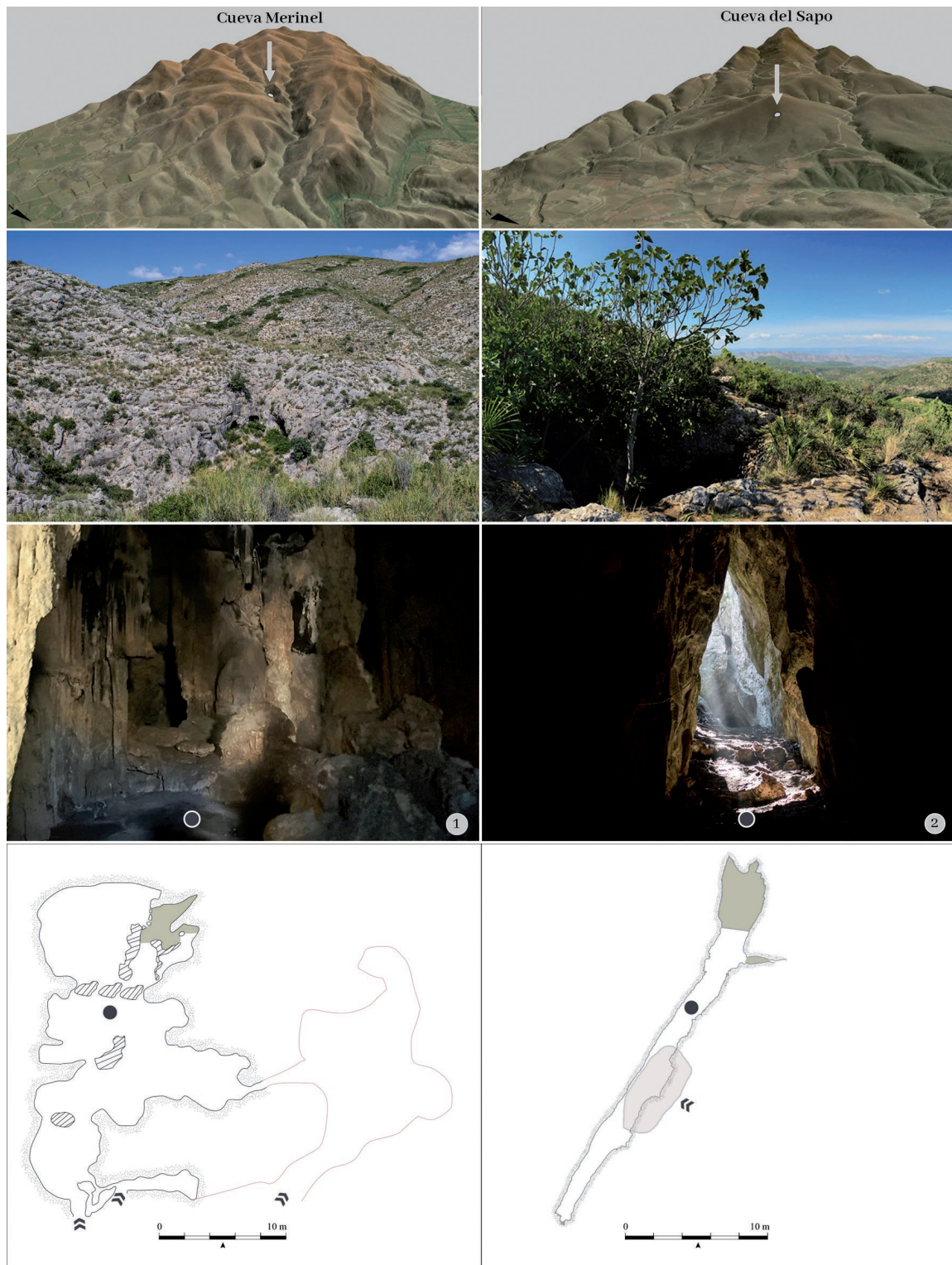
FIG. 2. *Ritual caves in* Edeta *(3D view, entrances and interior): 1) Cueva Merinel; 2) Cueva del Sapo.*

Merinel, in Bugarra, València, and Cueva del Sapo, in Chiva, València (Fig. 2). These caves and its ritual deposits had diverse characteristics, but both seem to have been visited in different moments between the fifth and the third centuries BC (Machause, 2019).

• *Cueva Merinel* is located 290 m above the sea level on the left edge of the Hoces or Merinel ravine, on a steep slope of the hill of Loma de la Pinada. It is just one km away from the Turia talweg. The three entrances give access to various interconnected spaces full of speleothems. However, the sacred deposit rediscovered and excavated in the 1980s was found in the innermost and darkest area of the cave. The ritual practice carried out in this cave revolved around the repeated offering of animals –cranial parts of young pigs, goats, and sheep, less than one and two years old respectively–, most of which were deposited inside pottery vessels: plates and vases. This practice may have been related to a diversity of rites of passage and performers (Martínez Perona, 1992; Blay, 1992) (Fig. 2, n. 1). Besides, the recent study of the deposit, has allowed to identify some inhumated human remains (Machause, 2019). The radiocarbon results for a left femur diaphysis are related with the Iberian frequentation of the cave –340-52 cal BC 2σ–, maybe showing an interesting change on its ritual use after the third century BC[2].

• *Cueva del Sapo* is located 565 m above sea level on the hill known as Montico Redondo or Atalaya hill; it lies 7 km from the Turia river. The current access to the cave is a vertical drop of 16 x 2.50 m width and 5.50 m depth. The cave is formed by a simple, narrow gallery, with a total length of 30 m and a width that varies between 1 and 1.5 m. Earlier excavations in 1983, as well as recent excavations –as well as on going excavations that started in 2018– have shown two main deposit areas. Based on the materials found, the ritual practice undertaken in Cueva del Sapo seems to be organised around a hunting and also involved an offering of red deer and ovicaprids, with ceramic vessels and special ornaments, represented by personal adornments. The hunt and the subsequent offering of animals, which might share the space and time with an atypical inhumation –390-200 cal BC 2σ–[3], symbolise, amongst others, a key initiation ritual for the Iberian aristocratic societies, which is represented in the pottery images of various territories (Machause *et al.*, 2014; Machause and Sanchis, 2015) (Fig. 2, n. 2). Other ceramic offerings can be related to a diversity of rites of passage and performers.

Analyses regarding other Iberian ritual landscapes show that the selection of some caves as ritual spaces is not random but influenced by territorial control interests (Grau and Amorós, 2013; González Reyero *et al.*, 2014; Rueda and Bellón, 2016; Machause and Quixal, 2018). To assess this main hypothesis about the territory of *Edeta* and provide a first approach to the ritual analysis of this landscape, we apply a model-contrast sequence based on the most recent research.

2. Methodology

Visibility and mobility analyses are the foundation of this study. This first approach to the Iberian ritual landscape of *Edeta* is focused on two main questions: 1) Can these two caves be considered landmarks on the landscape?; 2) How long could be the journey from the settlements to these ritual caves? Focusing on those two questions, we create diverse visibility and mobility models.

Visibility has been one of the most important elements to consider when analysing the archaeological landscape, even before the development of GIS (Moseley, 1975; Renfrew, 1979). Visual control is seen as a key to understand social and political domination (Diez Castillo, 1997; Wheatley and Gillings, 2000; Lake and Woodman, 2003)[4]. In the

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[2]   Instead of incineration, which was the most common funerary practice in the Iberian period. Cueva Merinel: 2123 ± 24 BP: SUERC-96578.

[3]   Cueva del Sapo: 2130 +/- 30 BP: Beta-327999.

[4]   Also Van Leusen, A. M. (2002): *Pattern to process: methodological investigations into the formation and interpretation of spatial patterns in archaeological landscapes.* PhD diss. presented in 2002 at the Univ. of Groningen

Iberian landscape it has been valued as a strategic and defensive element (Ruiz and Molinos, 1984).

Like visibility, the study of the mobility of social groups in their environment is one of the fundamental aspects treated in landscape archaeology (Jarman *et al.*, 1972; Gilman and Thornes, 1985; Vicent, 1991). Thanks to GIS, we can perform motion simulations and calculate energy and time costs based on physical and cultural factors (Grau, 2011; Moreno, 2011). Those simulations allow us to draw optimal routes between two points, depending on the minimum cost of friction surface travel (Van Leusen, 1999, 2002). However, there are limitations very difficult to represent, since the conditions of physical landscapes have changed over time, as well as the influence of cultural variables (Llobera, 2000).

Before addressing the main results of our case study, it is important to specify the software and data used in our research. The software used for this analysis was QGIS 3.4-Madeira-LTR and R –the programming language for statistical analysis; R Core Team 2022–[5]. The data used to create vector layers[6] come from both direct and indirect sources. The location of the caves was registered with a GPS 60 Garmin™, at the entrances. The other coordinates, however, came from archaeological surveys (Bonet *et al.*, 2008), but very precise, official up-to-date databases[7], and cave catalogues (Donat, 1966; Fernández *et al.*, 1982). Regarding Iberian Iron Age habitat evidence, we focus on the

settlements from the fifth to the third centuries BC. We dismiss indeterminate settlements –isolated evidence of scattered artefacts–. We focus, then, on plausible information originated from reliable sources. Geographical information –DTMs, DEMs and hydrography–, came from regional and national Spatial Data Infrastructures –SDI–[8]. Depending on the accuracy required, different kinds of resolution have been used: a 25 x 25 m model for general maps and mobility analysis, and a 5 x 5 m model[9] for visibility analysis, as well as for the 3D scenes.

2.1. Visibility Analysis

Regarding visibility analysis, we paid attention to two elements: visibility and intervisibility (Llobera, 2003). When creating the viewshed points in QGIS to calculate the viewshed and the intervisibility networks, we considered the variable of the observer's height –1.60 m–. We generally preferred to calculate a radius analysis of 50 km, highlighting later an area of 15 km radius of major visibility (Malm, 2016). Our objective is to show that some areas outside this radius, such as the coast or some hills that stand out on the landscape, can be seen, although not perceived (Higuchi, 1983; Ogburn, 2006).

2.2. Mobility Analysis

Regarding mobility, we carried out Cost Surface Analysis –CSA–, as well as Cost Path Analysis –CPA– from the settlements to the caves and vice versa. This allows us to evaluate whether accessibility can be considered as a positive or negative factor when choosing a ritual cave, as has been indicated in other areas (Grau, 2010).

(https://pure.rug.nl/ws/portalfiles/portal/7002343/thesis.pdf).

[5]   http://www.qgis.org; https://www.R-project.org/

[6]   *Cf.* Machause, S. and Diez Castillo, A. (2022): *Archaeological sites in the area of the Iron Age city of* Edeta-*Valencia, Spain* (Version 1) [Data set], elaborated in 2022. Zenodo. https://doi.org/10.5281/zenodo.7365243

[7]   See list of references and links of the main databases and SDI used in this research at the end of the paper. The data provided by Bonet and colleagues' team are very precise and have been roughly checked by the authors, as well as the data coming from the DGPV. The data from the cave catalogs is not updated. However, we have only used them to know the number of caves located in the territory of *Edeta* and their approximate location. This information was not used to calculate any of the GIS analysis presented here.

[8]   *Cf.* n. 7.

[9]   *Cf.* Diez Castillo, A. and Machause, S.: *Digital Terrain Model of Edeta's land* (Version 1) [Data set] elaborated in 2022. Zenodo. https://doi.org/10.5281/zenodo.7365195

To carry out the CSA and Least Coast Path Analysis –LCPs–, we considered not only the distance but also the level of ease or difficulty to move across the landscape. The main factor to keep in mind when analysing the human effort in moving across the landscape is the slope (Gilman and Thornes, 1985; Vicent, 1991; Verhagen *et al.*, 2019). Other variables such as the direction of the movement are not considered, although the return trip could obviously change. To calculate the CSA and the LCP, one of our preferences is to use a modification of the options proposed by Uriarte (2005: 613-614) $-1/ (0.0277 *(abs(x[adj]* 100) + 0.6115)$ where $x[adj]$ represents the cell slope, as expressed by the tangle angle, calculated by the high difference of the adjacent cells–. We have compared results of Uriarte's formula –originally calculated in seconds– with results of Tobler's most popular formula (Herzog, 2014) as implemented by the package 'R movecost' (Alberti, 2019) and the more recently variation of Tobler considering an off-path movement (Irmischer and Clarke, 2018: 181-182). All the above are measured in time, considering the human speed. Yet we also made some calculations about the energy needed to move across the landscape using watts (Pandolf *et al.*, 1997)[10] that we represent as megawatts, KJ/m (Llobera and Sluckin, 2017) or J/(kg*m) (Herzog, 2016) –see Supplementary Materials 1 and 2: tables–[11].

3. Results

The location of the caves would clearly influence its visibility and accessibility. Both caves are separated by barely 6 km. Their immediate landscapes, however, are quite different. As mentioned before, Cueva Merinel is situated in a

[10]   Also Van Leusen, *op. cit.*, n. 4.
[11]   All the supplementary material for this paper is available in: https://doi.org/10.5281/zenodo.7398014
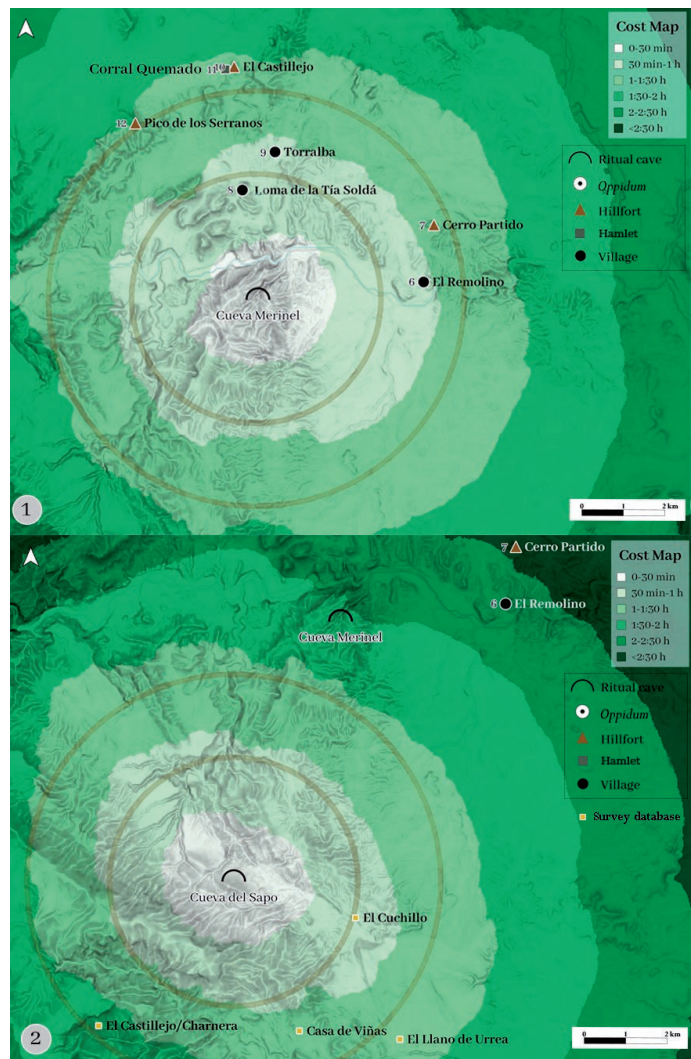
FIG. 3. *Buffers of 3 and 5 km: 1) Cueva Merinel; 2) Cueva del Sapo; the darker the color, the longer the distance (Cost Maps based on Uriarte, 2005); the orange squares in 3.2 represent preliminary evidence collected from recent archaeological surveys, that would not be considered in our visibility and mobility analyses.*

concavity of the rocky hillside, difficult to reach, either descending the cliff from the north side or crossing the ravine from the south (Figure 2.1). Cueva del Sapo is set in an open area, with very good visibility during clear days. The ascent here is not as demanding, although the vertical drop complicates the access (Fig. 2, n. 2).

As Fig. 1 shows, the Turia river is one of the natural boundaries of the territory. It crosses *Edeta*'s land from west to east, collecting water from a large channel network of ravines and watercourses, which nowadays only carry water in moments of torrential rain. The southern limit of *Edeta*'s territory, where both caves are located, shares its border with the territory of La Carència, in Turis, Valencia (see Fig. 1, n. 2 and Supplementary Material 3: map). Although the area closer to this *oppidum* has been studied extensively (Albiach *et al.*, 2012; Albiach, 2013), broader analysis needs to be undertaken to gain a better understanding of its territory. Based on the available data, none of the caves have evidence of habitation in their immediate area. Nevertheless, there is some evidence in a broader area –3-5 km buffer–, especially if we show the data collected from the archaeological survey undertaken in those areas (Fig. 3). However, as we cannot confirm their use or exact chronology, we disregard these settlements in the visibility and mobility analyses which follow, but they could be regarded in future work (Fig. 3, n. 2).

3.1. Visibility

Focusing first on the *oppidum*, visibility is clearly higher to the east, considering several viewpoints located inside the potential area of *Edeta* –around 600 km² and little less than 1 million pixels–, based on the data from the archaeological surveys around the hill (see Bonet, 1995: fig. 168). What is interesting here, is that the location of Cueva del Sapo is visible, as well as the summits above Cueva Merinel (Fig. 4).
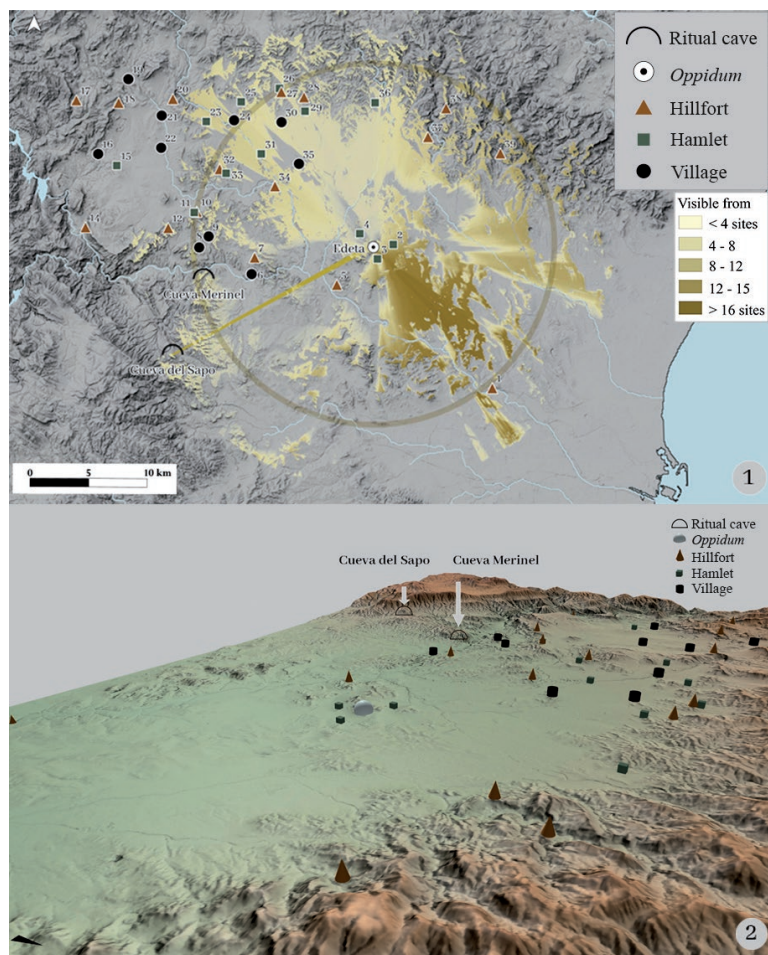
FIG. 4. *Area of* Edeta: *1) Cumulative viewshed from the oppidum of* Edeta *(buffer of 15 km) with intervisibility line with Cueva del Sapo; 2) 3D view of the landscape between* Edeta *and the caves.*

To determine if the caves could have been visible from the other settlements –a total of 39 sites–, we calculated a cumulative viewshed and an intervisibility network. As Fig. 5 shows, the location of Cueva Merinel is not visible. However, the most *prominent areas,* 100 m around the cave, are visible from at least four settlements. Regarding the location of Cueva del Sapo, we can verify that it is visible from only one settlement inside a 15 km area: the hillfort of Pico de los Serranos (Fig. 5, n. 1, 12). Yet there are intervisibility connexions with seven more settlements outside this radius (Fig. 5, n. 1).

Fig. 5. *Territory of* Edeta*: 1) Cumulative viewshed from the settlements, with intervisibility connexions to the caves; 2) General visibility connexions; buffer of 15 km around Cueva del Sapo.*

landscape, however, we were interested in the visibility of *Edeta*'s territory from the closest areas to the cave.

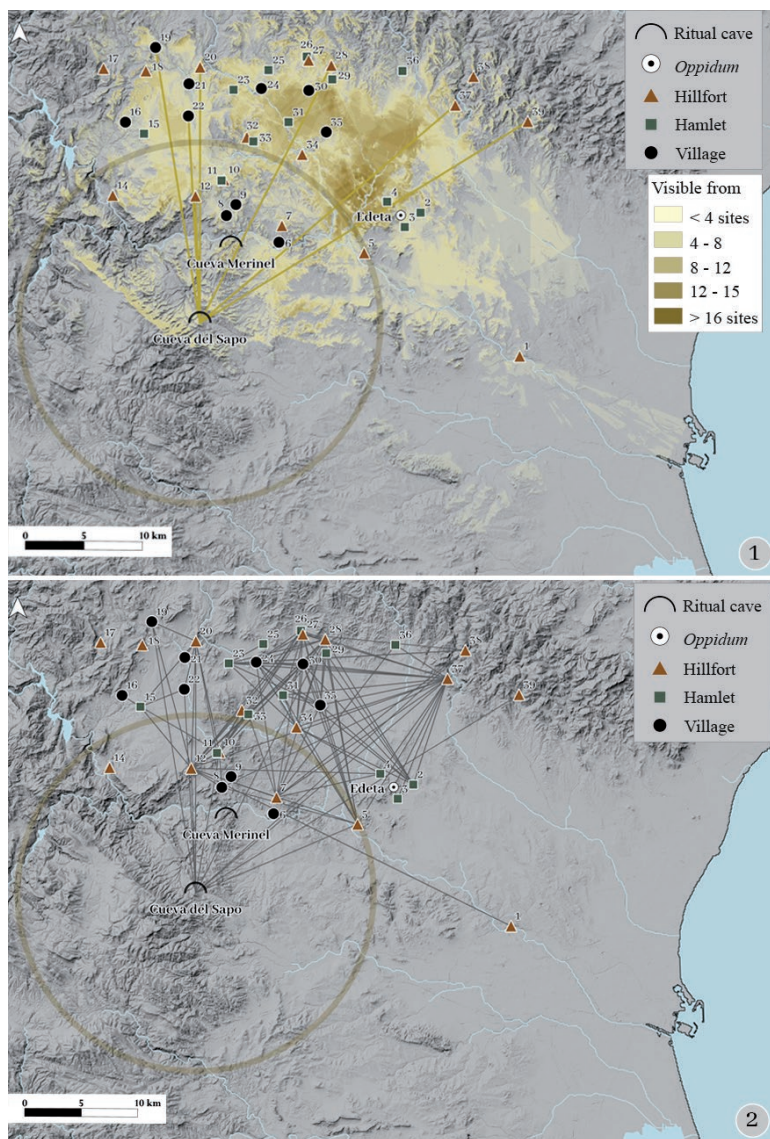As expected, the result of this second calculation shows greater visibility compared to the visual area from the hidden location of the cave (Fig. 6, n. 1). It is important to note here that an intervisibility connection exists between the prominent areas around Cueva Merinel and the *oppidum* of *Edeta* and its territory –also as far as the coastline and beyond, even though is located 40 km from the cave–.

In the case of Cueva del Sapo, its visibility is much better that Merinel's, but is limited to the north and east quadrants (Fig. 6, n. 2), also extending to the coast. It is interesting to highlight here that the location of the cave on the northeast side of the Atalaya hill, with its visibility oriented towards *Edeta*, can reassert its connection to that territory instead of to the territory of La Carència –to the south–. However, we cannot dismiss the possibility that both caves could be visited from both territories and used in different ritual activities. As more data become available, it may be possible to establish the nature of the link between these caves and the territory of La Carència.

Finally, to confirm our direct observations from the caves and their surrounding landscape we undertook different viewshed analysis. Regarding Cueva Merinel, the visibility from the location of the cave entrance is almost non-existent. Only the closest landscape, inside the ravine, is visible from the cave. Considering the importance of the access to that liminal location and the surrounding

3.2. Mobility

Finally, we focus on access between the settlements and the caves. Applying Uriarte's formula, Cueva Merinel and Cueva del Sapo are respectively in the range of three hours –3h 08'– and five hours away from the *oppidum* of *Edeta* –4h 06'–. Using Alberti's (2019) formula, after Conolly
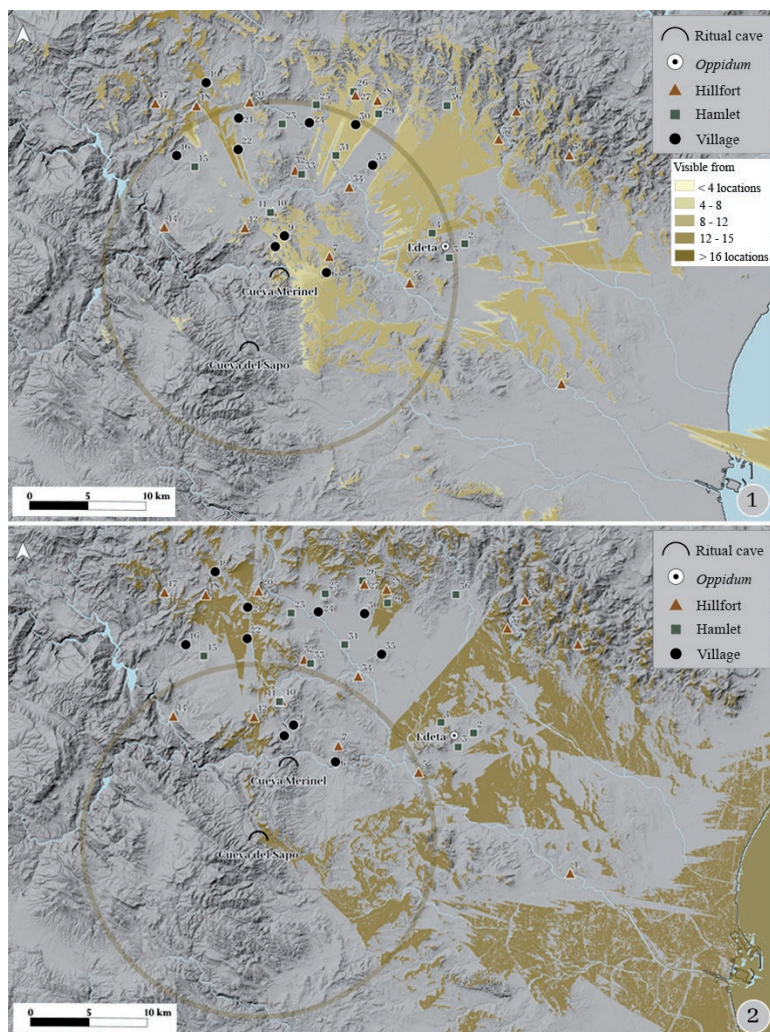
Fig. 6. *1) Cumulative viewshed from Cueva Merinel, considering 20 prominent points close to the cave: 300 m; 2) Visibility from Cueva del Sapo; buffer of 15 km around the caves.*

results become more than 15 hours away in the case of Merinel, and 21 in the case of El Sapo. This implies that the trip to the caves would take at least two days –considering the time to go back to *Edeta* and the northern settlements–, without counting the length of the ceremony at the caves (see Figs. 7 and 8).

As shown in Figs. 9 and 10, our LCPs from the whole area of *Edeta* clearly point out four main roads coming from the north to the southernmost tip of *Edeta*'s land, where the ritual caves are located. With the exception of some small differences, the results are quite similar in both caves[12]. The western road links the three hillforts in the northwest corner –16, 19 and 31, amongst other settlements–, gathering people from all the villages and hamlets in this western area. Before crossing the Turia river, it is possible that people coming from the hillfort of Castellar de Tabaira –13–, on the southwest boundary, could join the last part of this road. This merging path is particularly noticeable in the case of Cueva del Sapo, being one of the few paths that would follow the course of the main river. The second main road goes from the hillforts located in the north central areas –27 and 26–, directly to the south up to the point of merging with the road coming from the northeast area hillforts –36 and 37–, gathering people coming from the Cova Foradà –33– and Llometa del Tio Figuetes –5– hillforts area. This main road merges first with the little branches coming from the *oppidum* and, southwards, with

and Lake (2006), these values increase: 5h 33' to Cueva Merinel and 6h 25' to Cueva del Sapo –see Supplementary Materials 1 and 2: tables–. This means that people coming from the *oppidum* needed a whole day for a round trip to the cave. Using other formulas (Pandolf *et al.*, 1997), the journey would be twice as long –5h 51' and 8h 02', respectively–. When taking into consideration the speed of animals when grazing (Alberti, 2019) as well as the high values of energy needed to move across long distances, these values increase. The

[12] This is based on a *cumulative* vision of the territory of *Edeta*, based on its more important period –fourth-third centuries BC–. However, the use of some paths and the occupation of some settlements would be variable, especially with the changes produced under Roman influence.

ID	Name	Type	To Cueva Merinel		To Cueva del Sapo	
			Distance (km)	Time (h:min:sec)	Distance (km)	Time (h:min:sec)
0	*Edeta*	*Oppidum*	27.80	5:33:36	32.10	6:25:12
1	Despeñaperros	Hillfort	40.80	8:09:36	43.44	8:41:17
2	Rascanya	Rural hamlet	31.80	6:21:36	36.18	7:14:10
3	El Cabèçol	Rural hamlet	23.80	4:45:36	31.35	6:16:12
4	La Foia	Rural hamlet	24.90	4:58:48	32.52	6:30:14
5	Llometa del Tio Figuetes	Hillfort	17.80	3:33:36	26.50	5:18:00
6	El Remolino	Village	5.80	1:09:36	19.43	3:53:10
7	Cerro Partido	Hillfort	8.40	1:40:48	23.42	4:41:02
8	Lloma de la Tia Soldá	Village	4.30	0:51:36	16.72	3:20:38
9	Torralba	Village	5.20	1:02:24	17.64	3:31:41
10	El Castillejo	Hillfort	8.30	1:39:36	18.84	3:46:05
11	Corral Quemado	Rural hamlet	8.10	1:37:12	18.44	3:41:17
12	Pico de los Serranos	Hillfort	11.40	2:16:48	16.07	3:12:50
13	Castellar de Tabaira	Hillfort	22.50	4:30:00	26.39	5:16:41
14	Cerro Agudo	Rural hamlet	17.30	3:27:36	25.05	5:00:36
15	Cerrito Gijón	Village	21.40	4:16:48	30.83	6:09:58
16	Castellar de Losa del Obispo	Hillfort	33.10	6:37:12	41.34	8:16:02
17	Castellar de Villar del Arzobispo	Hillfort	27.70	5:32:24	36.01	7:12:11
18	Loma Plano de Don Jaime	Village	27.30	5:27:36	36.07	7:12:48
19	Penya Roja	Hillfort	25.30	5:03:36	33.84	6:46:01
20	Monteolivé	Village	22.60	4:31:12	31.22	6:14:42
21	La Seña	Village	19.30	3:51:36	27.92	5:35:05
22	Corral de Pomer	Rural hamlet	27.20	5:26:24	34.31	6:51:45
23	Torre Seca	Village	25.60	5:07:12	40.57	8:06:52
24	Corral del Sec	Rural hamlet	27.90	5:34:48	34.84	6:58:08
25	Castellet de Bernabé	Rural hamlet	27.50	5:30:00	42.11	8:25:22
26	Tres Pics	Hillfort	27.90	5:34:48	42.33	8:28:01
27	Bardinal	Hillfort	26.60	5:19:12	42.14	8:25:42
28	Caballó	Rural hamlet	24.80	4:57:36	40.36	8:04:18
29	Partida de Diago	Village	22.60	4:31:12	38.02	7:36:14
30	Ermita de San Roc	Rural hamlet	18.70	3:44:24	34.17	6:49:59
31	Castellar de Casinos	Hillfort	17.60	3:31:12	25.34	5:04:08
32	La Cua	Rural hamlet	16.60	3:19:12	24.66	4:55:56
33	Cova Foradada	Hillfort	17.30	3:27:36	44.86	8:58:21
34	La Monravana	Village	21.10	4:13:12	46.91	9:22:58
35	Mas de Moya II	Rural hamlet	33.00	6:36:00	57.73	11:32:45
36	Puntal dels Llops	Hillfort	37.60	7:31:12	52.66	10:31:58
37	Castillo del Real	Hillfort	44.30	8:51:36	59.40	11:52:51
38	Aqüeducte de Portacoeli	Hillfort	52.10	10:25:12	55.62	11:07:23

Fig. 7. *Data of the cost paths based on Alberti's formula (2019), after Conolly and Lake (2006).*
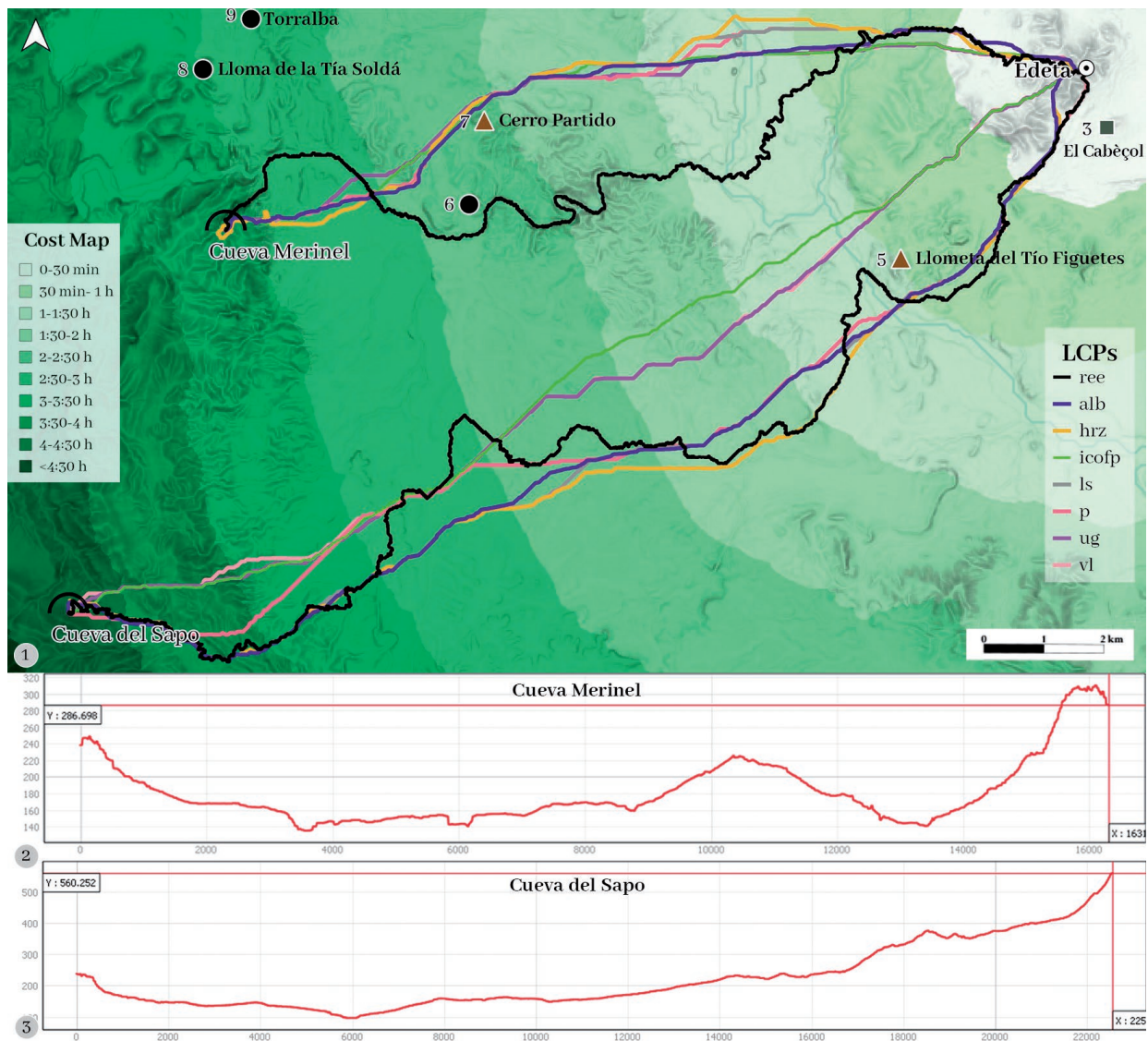
Fig. 8. *1) Paths from the* oppidum *to the caves (for the acronyms in the* LCP *legend see Alberti, 2019: 4); Profile lines following* LCP-*Alb; 2) Cueva Merinel; 3) Cueva del Sapo. Cost Map based on Uriarte's formula (2005): the darker the color, the longer the distance.*

the path coming from the two most isolated hillforts in the eastern area –38 and 1– after independently crossing the Turia river.

The constrained mobility in *Edeta*'s land show a dense network of roads that, as stated, define the territory along north-south axes. The roads have been calculated site by site, so the merging of paths is somehow expected. As we discuss in the next section, it is interesting to point out here that in the majority of the cases, the last part of the path –around 1 hour in the case of Cueva Merinel and around 2 hours in the case of Cueva del Sapo– could be shared by different people converging on shared paths until they reached their final destination.

4. Discussion

Following approaches undertaken for similar cases in the Iberian Iron Age (Grau and Amorós, 2013; Rueda, 2011; González Reyero *et al.*, 2014; Machause and Quixal, 2018), as well as general studies of extra-urban ritual evidence and ritual journeys, we discuss the results presented above for ritual caves in the territory of *Edeta*. In order to do so, we focus on three main elements: liminal location, a notable presence in the landscape, and ritual mobility.

4.1. Liminal location

Extra-urban ritual locations, such as caves, played an important structuring role in ancient landscapes. Therefore, symbolic aspects must be seen as inherent factors in the physical construction of a territory, since they consecrate their limits with rituality (Grau, 2012b). In the case of Iberian landscapes, it has been proposed that the ritualisation of the boundaries, through the ritual use of some caves, would be part of a broader political and ideological strategy (Grau, 2010; Rueda, 2011).

Ancient communities that lived and experienced the landscape, identified the limits between the known and the unknown, even if those limits were not always physically visible. The sacred meaning of natural spaces, such as caves, was clearly increased by their location in remote and peripheral places, involving a sense of secrecy. Ritual caves, as other natural locations in the unknown landscape, might be in fact perceived as liminal and cosmological boundaries that must be transgressed following a ritual formalism, performing a powerful but also dangerous act (Fontijn, 2002: 266).

In our case study, both caves are located on the southern edge of the Edetan territory, far from the *oppidum* –between 5 and 8 hours, depending on the selected formula– (Fig. 7) and more than 1 hour from the closer known settlements (Fig. 3). Liminality is, thus, a key factor in understanding the ritual, political and social use of these caves: a

liminal location of the caves and a liminal phase and state of the people that visited them (Van Gennep, 1909). Like other Iberian examples, caves helped to sacralise the limits of *Edeta* and the territory of La Carència (south). The northern limit of the territory would also have witnessed ritual activities, collective and private, particularly since the third century BC (Bonet, 2010; Bonet and Mata, 1997). In fact, compared to other territories nearby, such as *Kelin*, with five ritual caves (Machause and Quixal, 2018), the city of *Edeta* might have been the hub of most of the ritual activities in the territory. This may explain the presence of only two extra-urban sanctuaries identified for the time being (Bonet and Mata, 1997).

Even if the ritual density of these caves does not suggest these were huge pilgrimage centres, as proposed by earlier studies (Gil-Mascarell, 1975), they would still be important landmarks with symbolic meaning, perhaps shared by diverse communities coming from elsewhere (Machause, 2019). Therefore, we must consider the physical experience of walking across the landscape. It is highly probable that one of the starting points was *Edeta*, since it was where the main political power and the most important demographics were gathered (Bonet, 1995). Ritual activities, starting with the ritual journey across the landscape, arriving at the unknown, performing diverse rituals inside the underground spaces and culminating in the ritual deposits in the darkest spaces of the caves, were a way to reinforce social and political networks (Rueda, 2011; Grau, 2016). But also, other less common rituals of lower magnitude and audience could be undertaken by people coming from rural settlements located nearby, from both territories –*Edeta* and La Carència–, since the more common offerings are quotidian vessels and metal objects (Machause, 2019). However, either scenario imply a first step: a ritual journey to the caves.

The changes and evolution of ritual practices, as well as the location of sacred spaces, are closely linked to urban development in the communities, related to political, economic, and cultural variables (Grau, 2016). Therefore, as in other areas, these

caves changed significance when Iberian territorial structures came under Roman influence. During this period, some ritual spaces were located in rock-shelters and, perhaps, became ritual markers in a different way. This might be true in the case of Tarrangon rockshelter in the west boundary of *Edeta*, in Villar del Arzobispo, Valencia, with Iberian letters carved into the rock (Ferrer i Jané, 2018).

4.2. A notable presence in the landscape

Most landscape studies focus on constructed elements that are clearly identified. However, the results of this study show that the exact location of these ritual caves can barely be seen (Figs. 4 and 5). In fact, its relative invisibility could have given them part of their ritual power, improving their magnetism (Preston, 1992). However, as the visibility analysis show, the prominent hills around the caves were perceivable, helping the visitors find their way (Fig. 4, n. 1). Besides, regarding the political landscape of *Edeta*, those hills were the most visible elements of the southern limit. In any case, both caves are relatively close to both traditional transhumant roads and likely Iberian roads reconstructed by us –see Supplementary Material 4: map–.

The voluntary concealment or monumentalisation of ritual places is very important when analysing the sacred landscape (Criado, 1991). In other cases, caves are real visual markers, as some in Murcia (Gónzalez Reyero *et al.*, 2014) or in the Upper Guadalquivir (Rueda, 2011); in *Edeta*, however, as in other neighbour examples (Grau and Olmos, 2005; Grau, 2010; Machause and Quixal, 2018), it cannot be ascertained that caves were chosen for their visibility. However, the silhouette of the mountain would be a landmark easily recognisable at great distances. This constant reference, as a notable presence in the landscape, would help to define the southern limit of *Edeta*'s territory. Although the caves were not visible when approaching them, their notable presence

in the landscape would have been identified and recognised by the local communities (Grau, 2010).

The landscape has visible memory, thanks to the physical structures that remain on it, but it also evokes invisible memories that lie on the social imaginary, and this can be embodied through paths and social relationships (Holtorf and Williams, 2006; Gibson, 2007). In fact, "… invisible places could have been just as important in ritual landscapes as the visible monuments" (Fontijn, 2007: 70). The specific location of those caves might be only known by some members of the community. As Fontijn (2002: 270) suggested for ritual depositions in natural places, the knowledge of its location could be a powerful and authoritarian resource that served to define membership of a particular community or age group. The selection of remote and 'invisible' places might be related to an ancestral use, created, or remembered. The knowledge of the location of these caves, as well as the specific offerings to do and where to do them inside the cave, might define outsiders from insiders of a community/group, playing an important role in social strategies and constructing the identity of depositional places and groups (Fontijn, 2007).

Regarding their notable presence, it is also important to consider the visual significance that the landscape would acquire when the visitors started the ascent to the hills where the caves are located (Machause and Skeates, 2022). The area surrounding the ritual places would be imprinted on the memory and this sacred geography would be reinforced with every visit (Gosden and Lock, 1998; Parisi, 2014). The landscape is then modified not only through physical means, but also through social, ideological, and ritual actions (Deetz, 1990). At the same time, the visual control from the caves' areas to the settlements and the seacoast, as limit and as a contact, would have a strong symbolism (Grau, 2012b).

4.3. Ritual Mobility

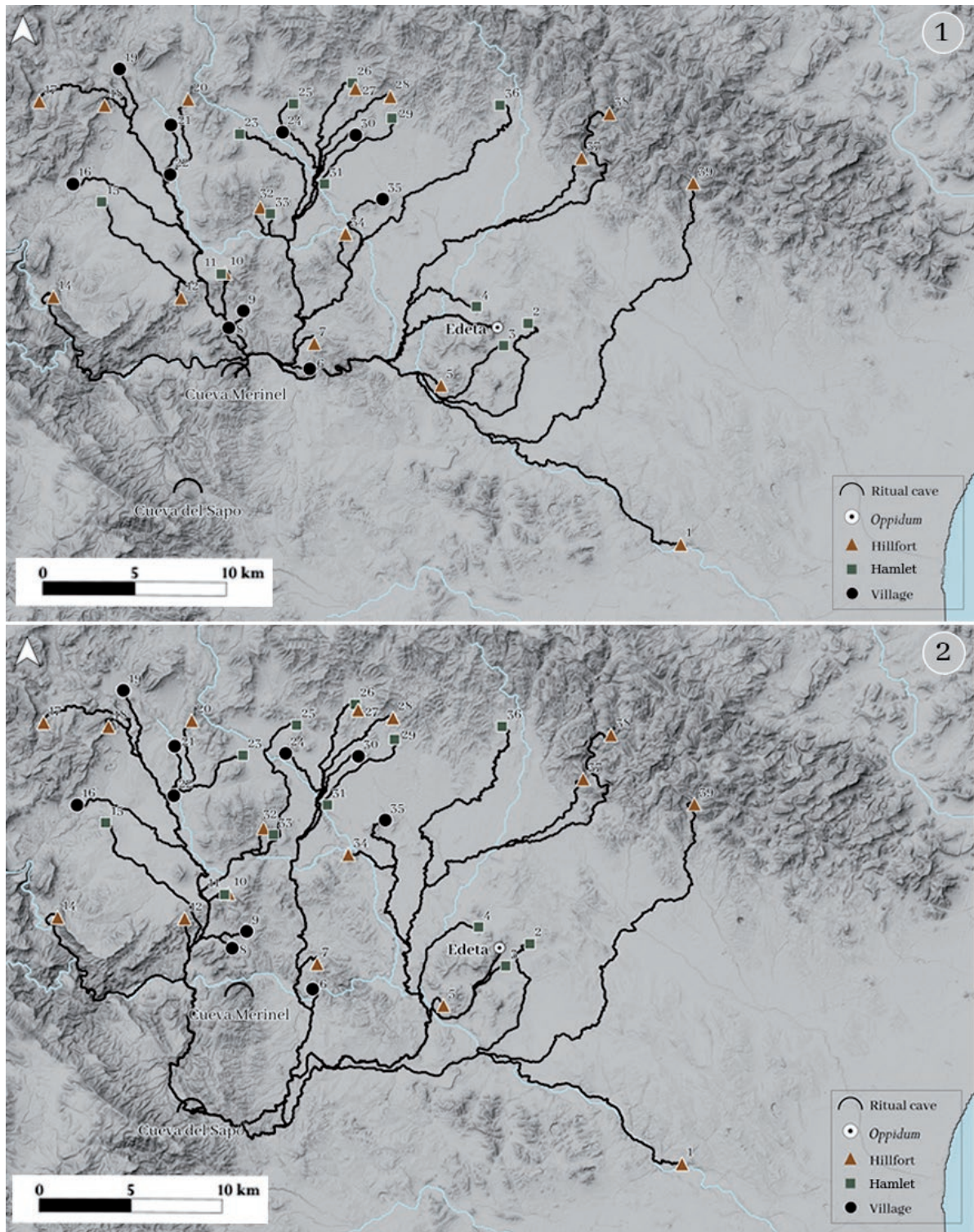Ritual mobility would always change depending on the scale. Bearing in mind the mobility results

FIG. 9. *Proposed paths from the dwelling areas to: 1) Cueva Merinel and 2) Cueva del Sapo, following Alberti's formula (2019), after Conolly and Lake (2006).*
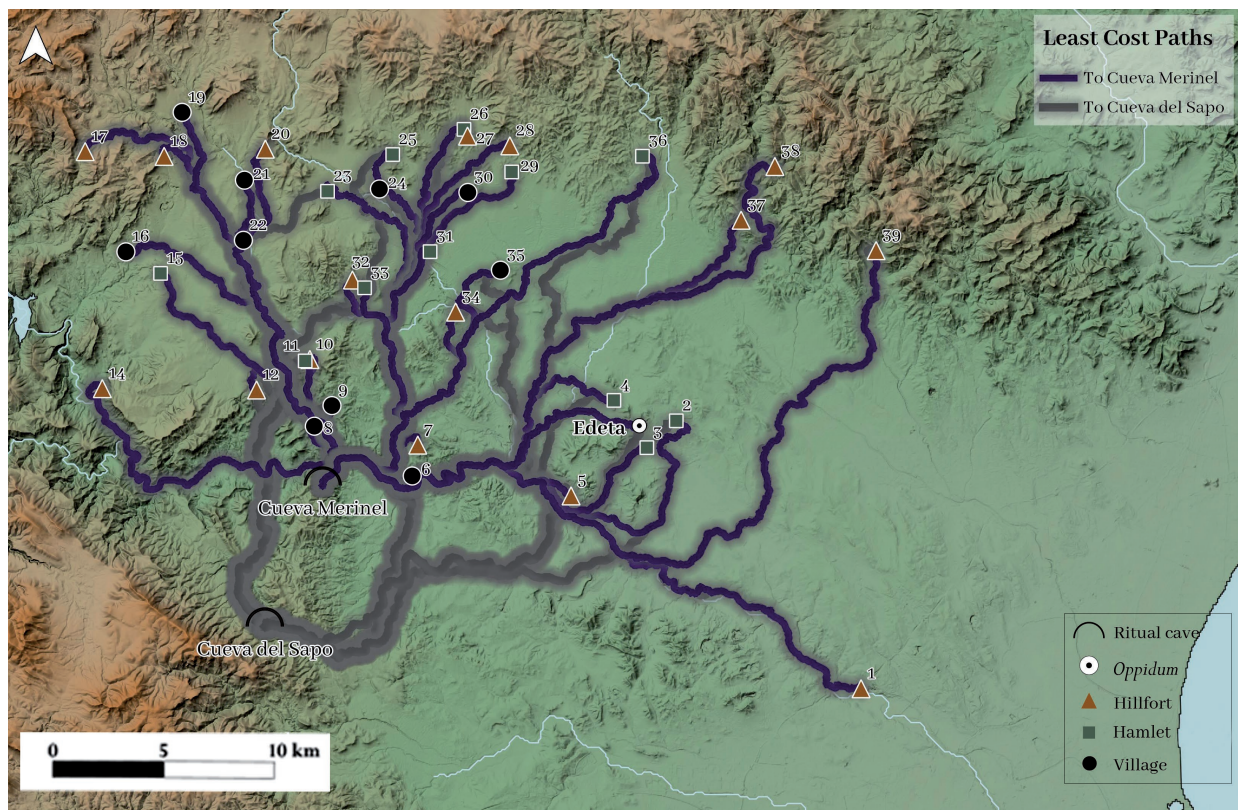
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Fig. 10. *Hierarchical network from the dwelling areas to Cueva Merinel and Cueva del Sapo, following Alberti's formula (2019), after Conolly and Lake (2006). The hierarchical network is the result of merging the* LCPs *towards both caves.*

presented earlier, we would argue that even if the caves were not easily accessible from the *oppidum*, the costs and the distances would be feasible. The journeys from the main city would be over five to eight hours (Fig. 7). Therefore, to visit either of the two caves from *Edeta* or the northern settlements, a two-days' round trip would be necessary. This assertion does not mean that the caves were just visited from the central *oppidum*, but if this starting point was the most common, the trips would be quite long, and they would surely have great value. In fact, this mobility, understood as a mental process that gives meaning to the journey (Elsner, 2017: 269), and the effort of transporting physical burdens could be part of the offering. The trip would be less costly if we consider its accessibility from the closer dwelling places, since the distance would be lower; however, it would imply a

considerable effort, since there are no settlements in their immediate surroundings (Fig. 3). The cost linked to crossing the Turia river and the ascent to the hills where the caves are located would be shared by every origin settlement in *Edeta*. In fact, it is during this last part of the journey when the paths coming from the different dwelling places would merge (Figs. 9 and 10).

There are other time calculations that we cannot easily suggest, but that must not be forgotten. When considering the time spent during the ritual performance linked to Iberian caves, we need to have in mind different periods or stages: the preparation for the journey, the trip to the caves with several stops, the time spent outside and inside the caves to perform diverse ritual practices, as well as the time to come back to the settlements (Machause and Skeates, 2022). In fact, it is interesting to

remark that, considering the long duration of these journeys, pilgrims would make several stops that might be ritually marked –before arriving to the caves as well as during the return trip– (Nordin, 2009: 197), but it is not easy to find material footprints of these ephemeral phenomena. Recent studies have identified very interesting cyclical deposits, linked to a watery context, as the wetland of Haza del Rayo, in Sabiote, Jaén. This location was a key point of the ritual itinerary between the city of *Baecula* and the ritual cave of La Lobera, between the fourth and the third centuries BC (Rueda *et al.*, 2021), showing the important role that natural landmarks played during ritual dynamics. In our study area, there are still no archaeological deposits of this kind of ritual performance. However, we could assume that crossing the river Turia was also a key point during the journey to these two ritual caves.

Regarding the accessibility as a variable, at the present time, we lack a complete catalogue of caves in the study area. Therefore, we cannot completely value the accessibility or inaccessibility variable that determines the choice of some caves to become ritual spaces rather than others in the area. Following the most up to date catalogue (Fernández *et al.*, 1982; FECV), however, the area of the ancient *Edeta* have at least 296 caves, some of them close to Iberian settlements. Therefore, why were only Cueva del Sapo and Cueva Merinel frequented for ritual purposes? We propose that they became scenarios for ritual performances not only because of their natural features, ancestral power, oral tradition, and ritual memory (Machause, 2019), but also because of their location, which implies a sacred and physical separation from the dwelling places to the unknown, as suggested in other areas.

Bearing in mind the data available, it is interesting to consider further this physical separation and the ritual journey undertaken to the sanctuaries[13]. The shared routes and experiences would increase the sense of belonging to a community, forging,

[13]   For a more complete analysis on the ritual journeys and pilgrimage experience linked to these caves see Machause and Skeates, 2022.

and reinforcing community links (Bender, 2001; Nordin, 2009; Alfayé, 2010; López-Bertrán, 2011; Grau, 2012a) and maybe also connecting with border territories. In fact, we are tempted to think that the people from La Carència, could be doing similar journeys, but we lack any evidence to prove this for the moment. It could be argued that the general landscape orientation towards the North implies a better connexion with the territory of *Edeta*.

5. Final Remarks

As seen in other Iberian Iron Age examples, the selection of these ritual caves –isolated from settlements– seems to be connected to territorial patterns. Furthermore, their liminality and relative invisibility helped them to increase their ritual magnetism and create community links. Although traditional studies have prioritised the material evidence found inside these caves, in this paper we have highlighted the importance of the context of these natural spaces as well as the sacred meaning of the journeys undertaken from different locations to visit them, having in mind diverse scales such as temporary, spatial and social.

These last decades, new methods and approaches are being developed to study ritual mobility (e.g. Preston, 1992; Stoddard, 1997; Coleman and Eade, 2004; Nordin, 2009; Alfayé, 2010; López-Bertran, 2011; Friese and Kristensen, 2017; Friese *et al.*, 2019; Rueda *et al.,* 2021). GIS is one of them, since it can play a dynamic role in the understanding of ritual process linked to natural spaces, by analysing the potential mobility within a well-known territory. We are aware that there are multiple limitations and that these are just the first steps of an ongoing research. Consequently, our data would be enhanced by future archaeological and speleological data, also taking into account other ritual locations, some potential stops during the journey, optimal transit zones, ritualised paths, and other territories such as La Carència; also comparing our data with other Mediterranean contexts. Nonetheless, our

results show, once again, the importance of context in archaeological studies focused on sacred spaces. In this case, the sacred cave is the focus of the ritual process but to have a more complete understanding of the ritual scenario, we need to connect it with the daily life of the performers that give the cave its ritual meaning through their visits, offerings and memories experienced across different landscapes.

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